Employment in Poland 2013

# LABOUR IN THE AGE OF STRUCTURAL CHANGE

edited by Piotr Lewandowski and Iga Magda

HUMAN CAPITAL
NATIONAL COHESION STRATEGY

Human Resources Development Center

Ministry of Labour and Social Policy

EUROPEAN UNION
EUROPEAN SOCIAL FUND

Warsaw 2014

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# INTRODUCTION

It is with great pleasure that we present the ninth edition of „Employment in Poland". The publication has been prepared by the Institute for Structural Research in cooperation with the Warsaw Institute for Economic Studies, for the Human Resources Development Center on the initiative of the Ministry of Labour and Social Policy as part of the systemic project named *Analysis of the Labour Market Processes and Social Integration in Poland in the Context of Economic Policy*.

This edition, entitled *Labour in The Age of Structural Change*, is devoted to the assessment of structural changes in Poland and other EU and OECD countries, and their impact on the labour markets. The report is divided into four parts. The first part of the report entitled *Labour Demand and the Challenges of Restructuring* focuses on the changes of the volume and composition of the demand for labour as a result of restructuring processes in the economy in the long term. Apart from the analysis of trends observed so far, we present a projection of labour demand in Poland and other EU countries. In the second part (*Labour Supply in the Face of Population Ageing*) the analysis of the impact of demographic changes on the changes in the structure of the labour supply in Poland and other EU and OECD countries has been conducted, highlighting the transformations of the labour supply structure with respect to education and including the labour supply forecasts in the future. The third part (*Labour in The Green Economy*) focuses on the influence that may be exerted on the labour markets in Europe and in Poland by the reconstruction of the economic growth model into more environment-friendly one. The fourth part (*The Time of Technology – Labour and Labour Market Institutions in the 21st Century*) analyses the challenges resulting from the ICT progress for the labour markets, including the institutional perspective concerning the role that could be played by the labour market institutions, educational policy and the innovation support policy. Recommendations for public policy are the last part of the report.

Employment in Poland 2013 Part I

# Labour demand and the challenges of restructuring

Piotr Lewandowski, Jan Baran, Paweł Chrostek

# INTRODUCTION

The first two parts of *Employment in Poland 2013* describe medium and long-term trends in the labour market in Poland and the European Union. Together, they constitute an extension of the previous edition which focused on short-term changes in the labour markets, especially those since the outbreak of the Great Recession.

The first chapter discusses the evolution of labour demand in an historical perspective and presents possible developments in the demand for occupations and qualifications over the next few decades. It presents the most important long-term trends in structural change affecting the composition of labour demand in Poland and other EU and OECD countries. The analysis of the Polish labour market covers the period from the early 1980s to provide a broad perspective of the transformation from a centrally planned economy to a capitalist economy. For those highly developed economies with richer data sources, it was possible to carry out detailed analyses covering the period from the mid-twentieth century.

In the second chapter we look at similarities and differences to the EU15 in the structure of labour demand in sectors and industries in Poland and other countries in the region. We also analyse how structural change and technological progress have been affecting the demand for occupations and qualifications, with special attention paid to the impact of technological progress, globalisation processes, and changes in consumer preferences as a result of increases in income.

In the third chapter we present and compare scenarios of projections of the evolution of labour demand in Poland and other European Union member states.

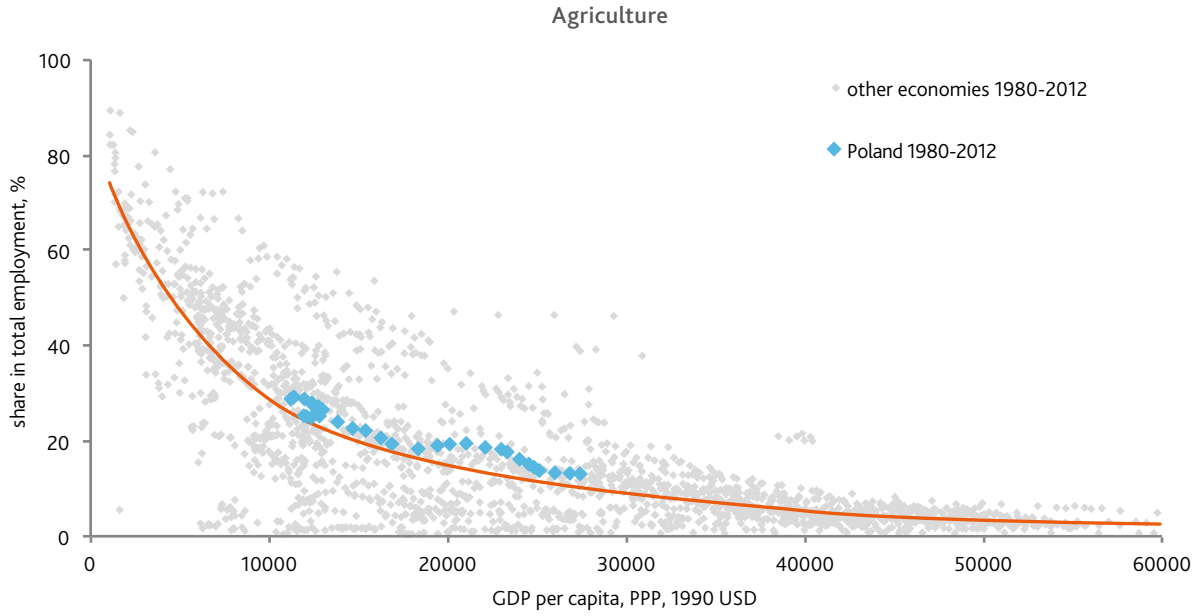
Part 1 concludes with a summary.

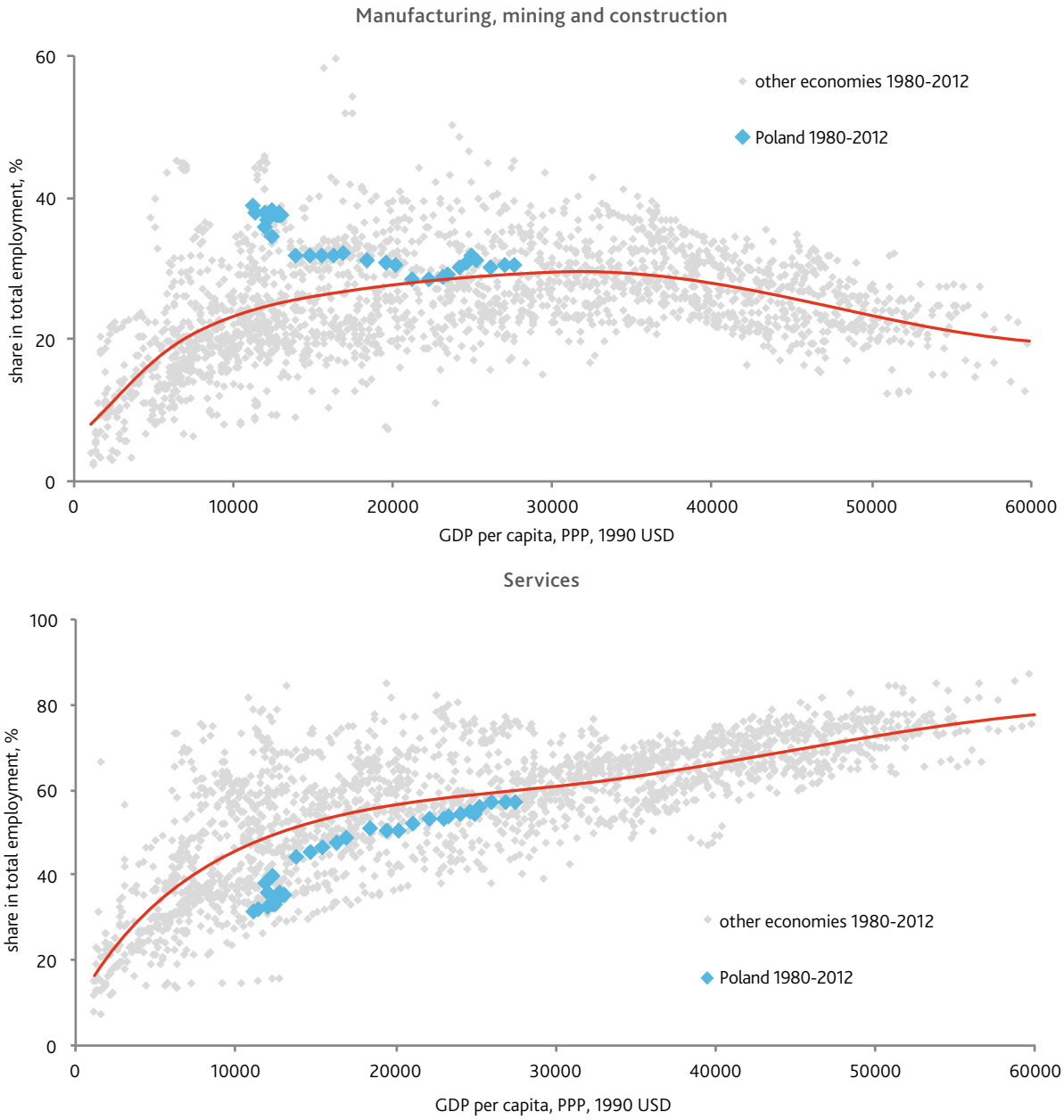
# 1 EVOLUTION OF THE LABOUR DEMAND VS. CHANGES IN THE ECONOMIC STRUCTURE

Labour is one of the factors used by companies in the production of goods and provision of services. It is inextricably linked with the individual characteristics of a worker. Decisions whether and how much to work depend on individual preferences and social norms. The type and intensity of work are influenced by a number of socio-demographic characteristics, such as age, gender, health, education, work experience, skills, etc. The labour demand reported by companies is also highly diversified. Employers desire to hire individuals with traits that best suit the nature of the job, so that the work performed is most productive and maximises profit. Therefore employers search for workers with specific qualifications, areas of expertise, skills, etc. The heterogeneity of labour plays an increasingly significant role due to technological progress and structural changes in the economy. Along with technological progress certain activities are being replaced by machines, which decreases the demand for human labour in some areas, but at the same time it necessitates new skills and is followed by a growing labour demand in other areas. As a result, the structure of labour demand by qualification evolves; a decline in labour demand in some occupations is accompanied by an increase in labour demand elsewhere.

The main factor influencing the structure of labour demand in the long run is the nature of economic activity. In the early stages of economic development, economic activity is dominated by agriculture (currently sub-Saharan Africa, South and South-Eastern Asia), but with economic development it is quickly followed by an outflow of labour to other sectors. The next stage of economic development is marked by the increasing importance of industry in employment and the structure of value added. On average, the highest share of industry in total employment is around 30% (see Figure I.1), although this value has often been significantly exceeded in many countries at various stages of development. Following this, along with further income growth, the services sector starts to dominate at the expense of agriculture and industry. In most of the developed economies in the early 1990s, employment in services exceeded 70% of total employment. Figure I.1 presents the relationship between income per capita and the share of each of three sectors in the employment structure for different countries of the world.

Figure I.1. **Sectoral structures of economies vs. income per capita (1990 USD, PPP), 1980-2012.**





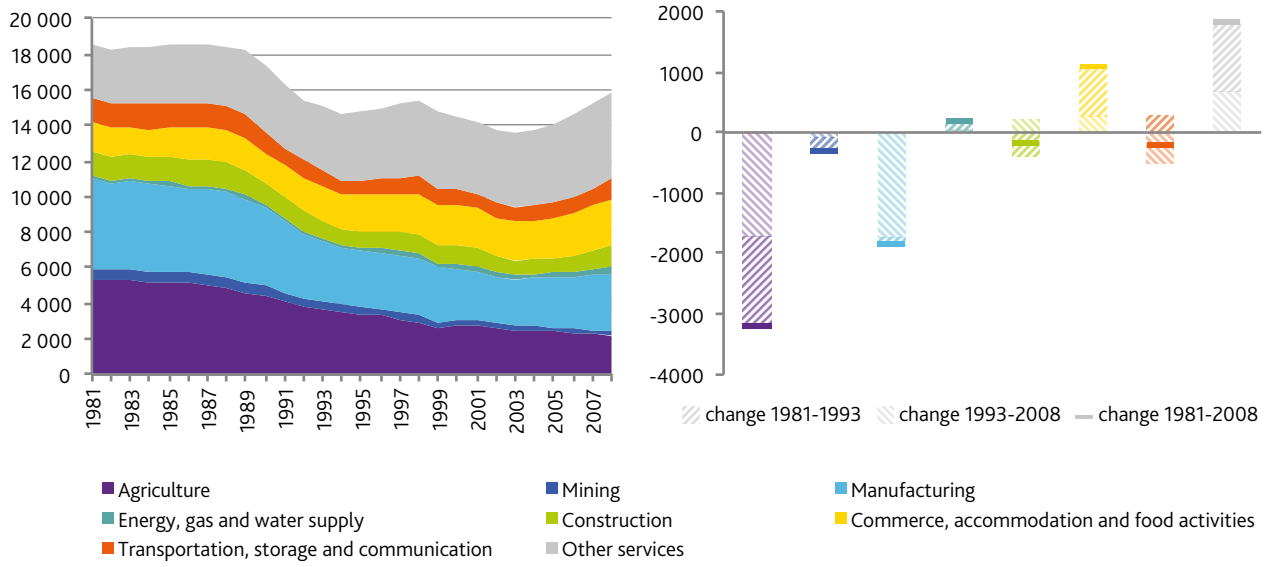

*Notes: Points on the graph represent the share of the sector in the structure of total employment for 116 economies available in the WB WDI database over the period 1980-2012*

*Source: Compiled based on data from the WB WDI.*

As shown in Figure I.1, Poland is characterised by a slightly higher share of both agriculture and industry in the employment structure than the expected evolution of the level of income per capita. Figure I.2 presents the changes in sectoral structure of employment since the early 1980s. At the beginning of the analysed period, employment in Poland was characterised by the significant share of manufacturing, mining and construction (so-called secondary sector), well above the values observed in countries at a similar level of development. At the same time, the service sector was relatively under-developed with a low share in employment. The over-representation of industry at the expense of services was typical of centrally planned economies.

The transition to a capitalist economy put the Polish economy on a path of rapid economic growth and intensified changes in the structure of labour demand. In the first phase of the transition, enterprises began to lay off workers, no longer trying to maintain the excessive employment levels characteristic of communist countries. Opening up to international trade caused additional pressure, resulting in closures of the least competitive companies. As a result, in the short period between 1988 and 1992, employment in Poland fell from 18.5 million to 15.5 million (according to ILO). Labour demand shrank the most in the previously excessively large sectors of manufacturing, mining and construction, altogether by 1.62 million people. Employment in agriculture also significantly decreased (the downward trend still continues), while labour demand in services changed the least.

Figure I.2. **Evolution of sectoral structure of employment in Poland 1981-2008 (thousands of people).**




*Notes: Some differences in the number of employees in the sectors may result from changes in classification. Until 1993, employment in sectors was reported according to ISIC Rev. 2. In 1994 classification was changed to ISIC Rev. 3 and in 2008 to ISIC Rev. 4. In addition, in 2002 the data was adjusted for National Census results.*

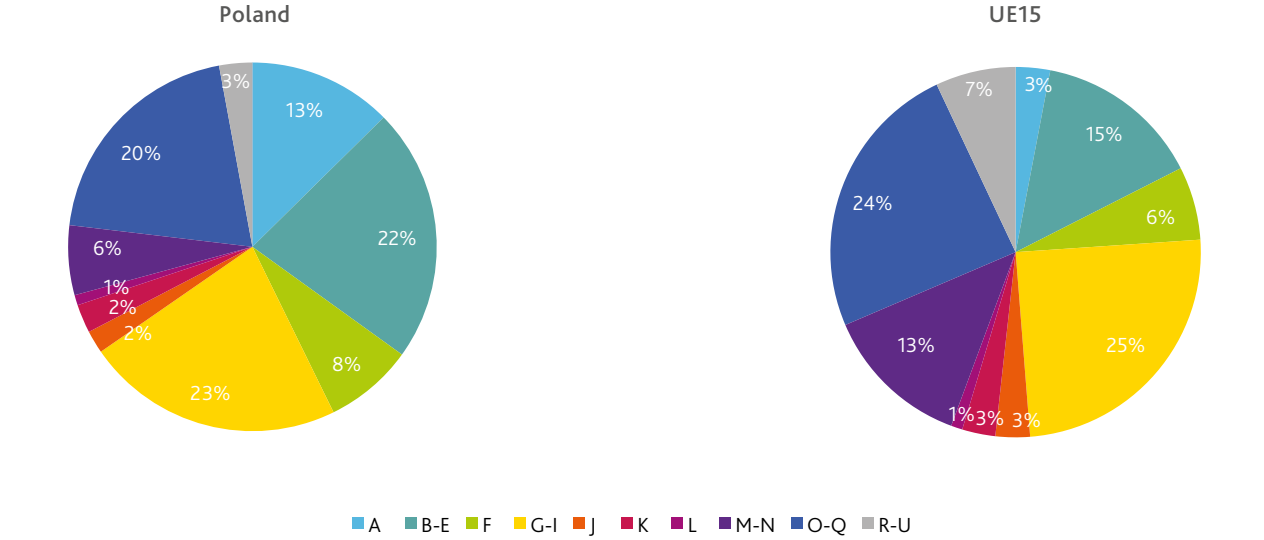
*Source: Own elaboration based on data from LABOURSTA, ILO.*

The next two decades (1993-2012) saw further changes in the structure of labour demand. Employment in agriculture was still decreasing. Labour demand in manufacturing and construction had been to a greater extent influenced by medium-term factors and business cycle fluctuations. In that period, employment in manufacturing fell by a further 460 thousand people, two thirds of which were laid off during and following the Great Recession. A good economic situation, investment in infrastructure and a high demand for new buildings resulted in an increase in employment in construction by 230 thousand. An exceptionally strong rise in labour demand occurred in the services sector, where employment increased by 2.4 million people.

In the following sections, those changes will be discussed in detail.

Although the aforementioned trends contributed to an increasing similarity of the sectoral structure of labour demand in Poland to the more developed EU countries, differences in the structure of labour demand have not disappeared completely. The Polish and EU 15 employment structures differ especially in terms of the size of employment in the agriculture and industry sectors, being much higher in Poland than in the EU15. Some service industries play a much less important role in Poland, particularly those relating to professional, scientific, technical, administrative

Figure I.3. **Employment structure by sector in Poland and the EU15 in 2012 (%).**




*Source: Own elaboration based on Eurostat data.*

and support services. The assumption of a further convergence of the sectoral structure of labour demand to Western Europe is one of the main assumptions of the labour demand projections presented in Chapter 3.

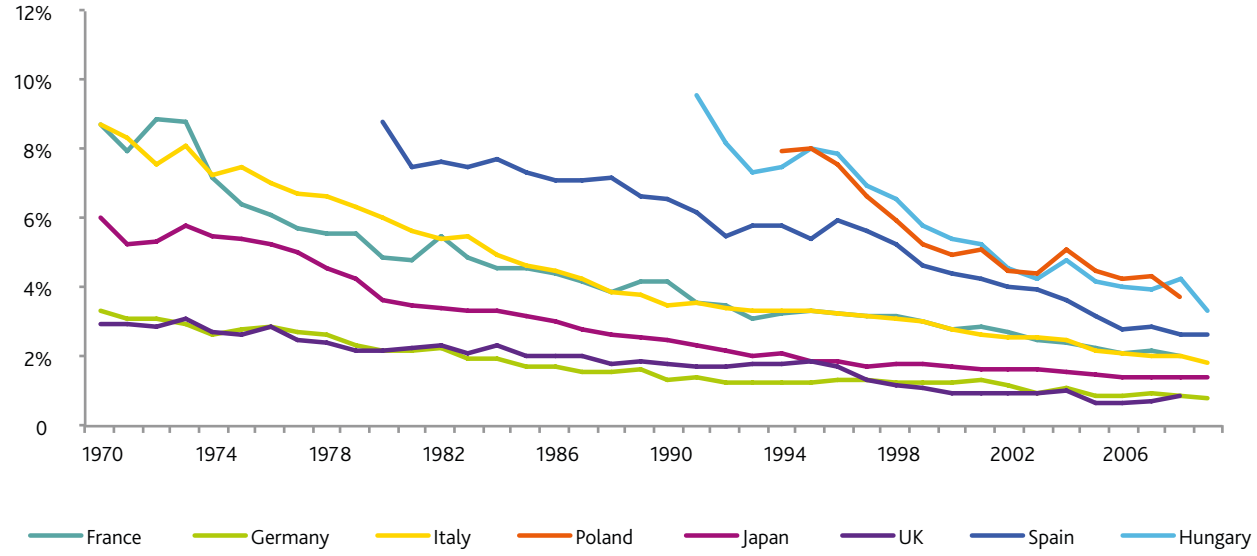
## 1.1 AGRICULTURE AND DEAGRARIZATION

Despite the systematic outflow of employment from agriculture, Poland still has a relatively high share of employment in this sector compared to other EU states. In 2012, the proportion of people working in agriculture in Poland was 12.6%, compared to the EU27 average of 5%. In the EU15 the share of agriculture in employment was even lower, at 3%. Also above the European average are the new member states as well as Greece and Portugal.

An especially large number of people work in agriculture in Romania and Bulgaria (31% and 19%). Nevertheless, in all EU countries agriculture has a reducing share in total employment (see Figure I.5). There has been a noticeable convergence in this regard, with the reduction faster in countries that had started with a higher share of agriculture, with the notable exceptions of Portugal, Greece and Romania. The share of agriculture in total employment has declined by 5 pp in Poland since joining the EU in 2004. Lithuania and Latvia were the only other EU countries that experienced the same pace of deagrarization.

Changes in the employment structure occur with a certain delay with respect to changes in the structure of value added. In less developed EU countries, the share of agriculture in total employment is several times bigger than the corresponding share in the

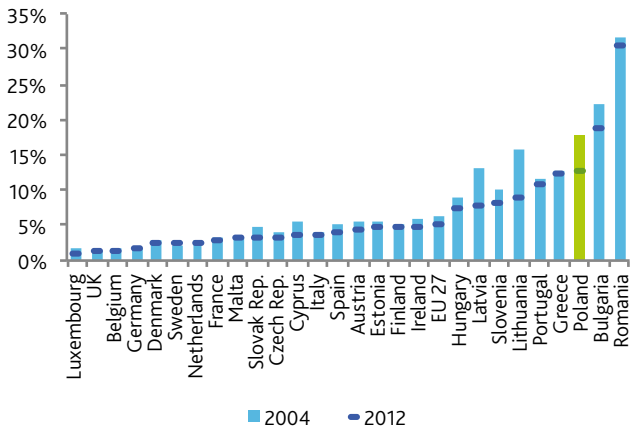
Figure I.4. **Share of agriculture in value added structure in selected OECD countries, 1970-2010 (%).**




*Notes: Until 1991 data for Germany refer solely to West Germany.*

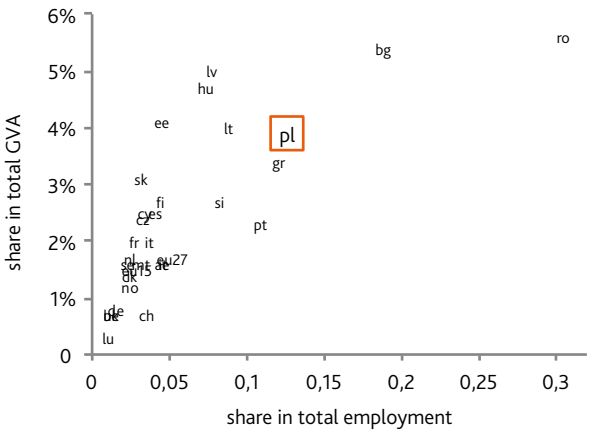
*Sources: Own elaboration based on OECD data.*

Figure I.5. **The employment share of agriculture 2004-2012 (%).**




*Source: Own elaboration based on Eurostat data.*

Figure I.6. **The share of agriculture in employment and value added structure in 2012 (%).**



value added. In Romania and Portugal it is about five times higher, while in Poland, Greece, and Bulgaria it is about three times higher. A similar employment time lag was observed in the 1970s in Italy and Spain.

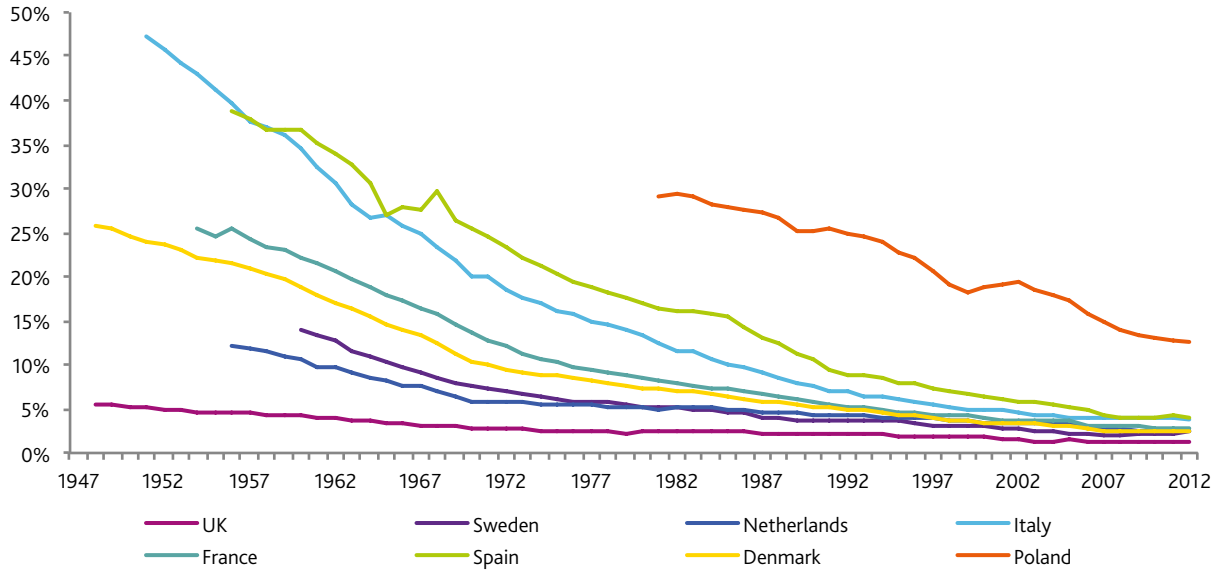
In certain countries for which a long time series is available, the evolution of employment in agriculture since 1950 has been traced, as shown in Figure I.7. Western European countries experienced a strong convergence of size of employment in agriculture, despite initially significant differences. For instance, in the middle of the 20th century, the share of employment in agriculture in Spain and Italy was about 40 pp higher than in the UK, while recently the difference between these countries has not exceeded 5 pp. Figure I.7 also presents data for Poland for the last three decades. In the early 1980s, as many as 30% of Poles worked in agriculture. It is worth noting that Sweden and West Germany both reached the current proportion of employment in agriculture of Poland (i.e. about 12%) in the 1960s, France in the early 1970s and Spain in the late 1980s. This means that deagrarization in Poland is 50 years behind Germany, 40 years behind France and 25 years behind Spain.

In the coming years the downward trend for employment change in Polish agriculture is expected to continue. Although Poland has good natural conditions for agriculture, ultimately the share of employment in agriculture should not differ from the European average by more than a few percentage points. Poland may be compared to France which has a similar acreage of arable land per capita (approx. 0.3 hectares per capita), while the share of agriculture in total employment is 3%.

The main factor behind the decline in agricultural employment is the labour demand expansion in other sectors of the economy and the wage premium by moving to non-agricultural sectors. Low incomes in agriculture are associated with low productivity in this sector. In all EU countries, agriculture is less productive than other sectors of the economy. In Poland, the ratio of productivity in agriculture to average productivity in the economy is 3:10. Value added per worker in agriculture in Poland is around 7,000 euro per year, compared to 42,000 in the Netherlands and 48,000 euro in France (see Figure I.8). This means that there is significant productivity improvement possible in Polish agriculture, although it has to tackle the significant fragmentation of farms and the high share of family farms with low commercialisation (see IBS / CRZL, 2010, p. 51). The consolidation of farms, necessary to increase farmer income, would mean a further decline in agricultural employment. At the same time a qualitative change may be expected in the structure of labour demand, because intensive agriculture requires advanced agrotechnical knowledge and competence in management.

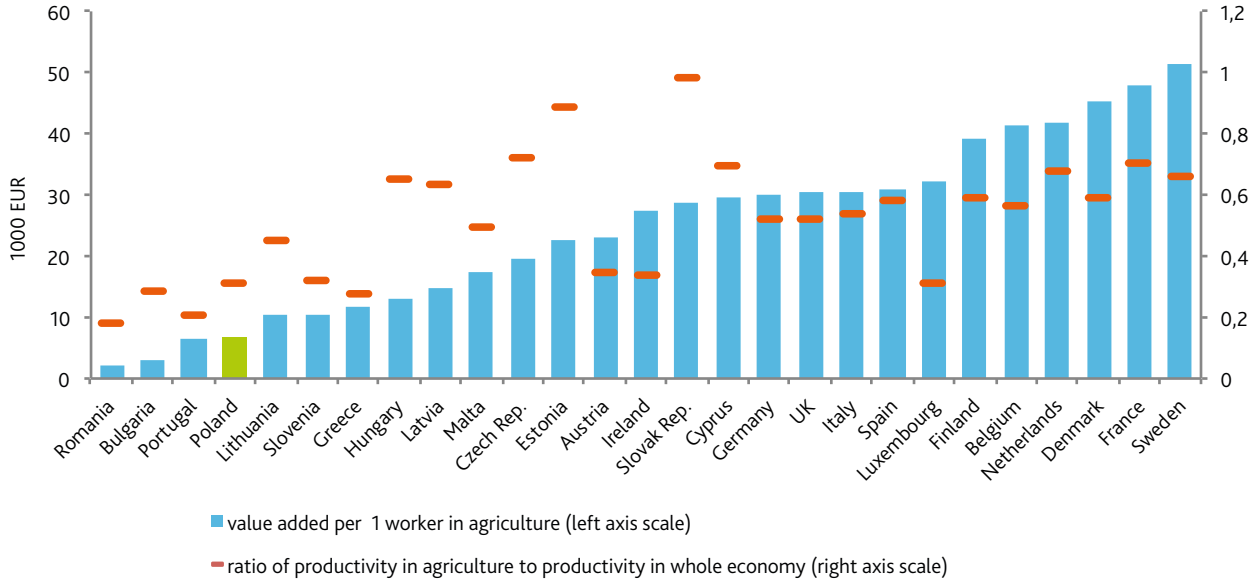
A qualification mismatch impedes reallocation of the agricultural labour force from to more productive sectors. Industry, which used to absorb the excess employment from agriculture, is exhibiting an increase in demand for skilled workers (to be discussed later in this report), while farmers are one of the least educated occupational groups (see with Part II of the report). Demand for low skilled workers in industry is lower than it was in the 20th century, and so this sector is not able to absorb all of the surplus labour from the agriculture sector. Other activities that would absorb surplus farmers include construction, and certain services such as commerce and transportation (Magda et al., 2012). As shown by Tocco, Bailey and Davidov (2013), who analysed a larger group of EU countries, outflows from agriculture are fostered by the advantageous characteristics of local labour markets, such as low unemployment and high wages outside agriculture. The same authors observed that the low skills of farmers in Poland are one of the major obstacles in finding jobs outside agriculture.

Figure I.7. **The share of agriculture in employment in Poland and selected European countries – historical perspective (%).**




*Source: Own elaboration based on Groningen Growth and Development Centre 10-Sector Database data, ILO, Eurostat.*

Figure I.8. **Productivity in agriculture in EU countries in 2012.**




*Source: Own elaboration based on Eurostat data.*

Outflows from agriculture are also influenced by institutional conditions. Remaining in agriculture is encouraged by money transfers, i.e. subsidies to farmers under the EU Common Agricultural Policy which reduces the income gap between agriculture and non-agricultural sectors. The pace of labour reallocation in Poland is also slowed by preferential regulations concerning social security and taxation of agricultural activity. Another reason is the legal ban on combining the preferential social insurance for farmers in the *Agricultural Social Insurance Fund* (*Kasa Rolniczego Ubezpieczenia Społecznego*) with other forms of employment, which is a clear disincentive for work in other industries. The ASIF insurance contributions are much lower than regular non-farmer contributions and the ASIF pension eligibility is conditional on 25 years of contribution to ASIF, which implies at least 25 years of not being employed on regular contracts. Therefore, institutional factors (CAP and preferential social insurance for farmers) result in any permanent or additional work outside agriculture being less profitable than it could be if farmers were included in the public pension system and taxed on general principles.

## 1.2 INDUSTRY AND DEINDUSTRIALISATION

### 1.2.1 EVOLUTION OF THE SIGNIFICANCE OF INDUSTRY IN EUROPEAN ECONOMIES

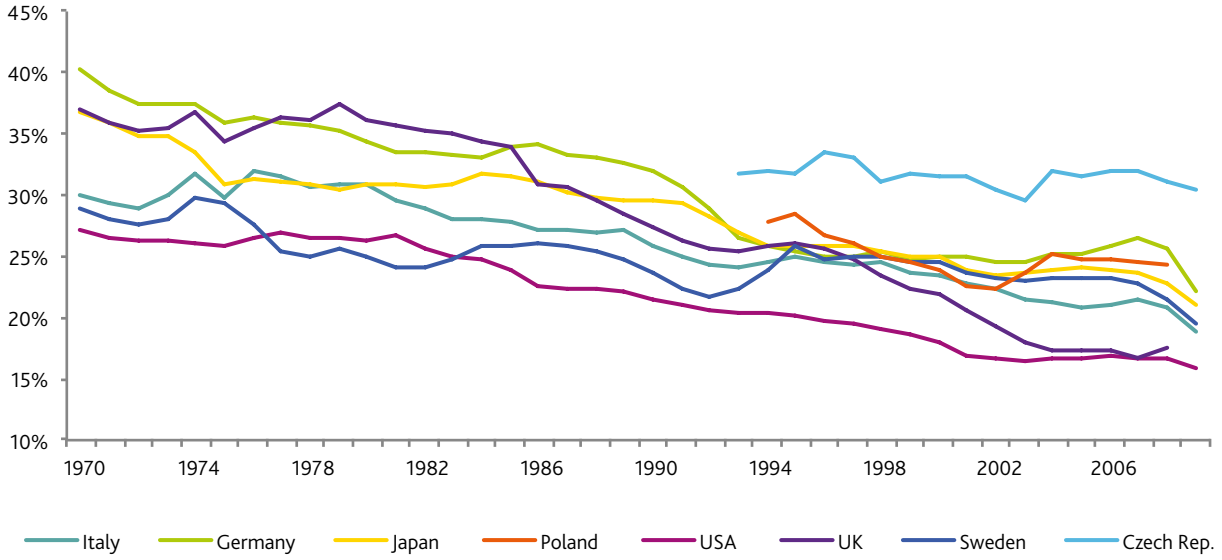
For several decades, the decreasing importance of industry has been a key structural trend in developed countries. This has been observed both in the share of industry in employment and in value added. The main cause of the declining significance of this sector is technological progress. Automation has made it possible to increase the volume of industrial production with a lower labour input. Technological progress reduces production costs, but it also contributes to a decline or stagnation of prices for industrial goods. While this is obviously beneficial for consumers, it also causes a slower growth of value added in industry than in services.

The second key reason for the decline of industry in most developed countries is offshoring, consisting of fragmentation of production processes and their transfer or parts thereof to countries with a low labour cost (Grossman & Rossi-Hansberg, 2008). Offshoring especially concerns products that can easily be transported over long distances. A similar effect is from trade intensification and exposure to foreign competition. Hence the least efficient domestic producers are crowded out by more cost efficient foreign competitors. Development of trade and offshoring is stimulated by technological progress, especially the reduction of transportation costs, and by information and communication technologies that enable efficient management of fragmented supply chains. Significantly lower labour costs in developing countries have caused labour intensive industries in most developed countries to almost disappear.[1]

Contrary to the popular belief that Asian countries benefit most from this process, offshored production in Western Europe is reallocated mainly to other EU countries, especially the new member states. Data collected by the European Restructuring Monitor (ERM) show that in 2003-2013 about half the jobs offshored from EU countries remained within the European Union. One-third went to new member states, and a further 13% found a new location in the EU15 (Eurofound, 2013). After 2008, offshoring intensity diminished, which means that its effect on the destruction of jobs in Western Europe also weakened (Eurofound, 2013).

1 Apart from industrial goods, offshoring is used also for some services. An example of such service offshoring are famous IT centres in India providing services for highly developed countries.

Figure I.9. **The share of industry (manufacturing + mining + energy, water and gas supply) in the structure of value added in selected OECD countries 1970-2010 (%).**



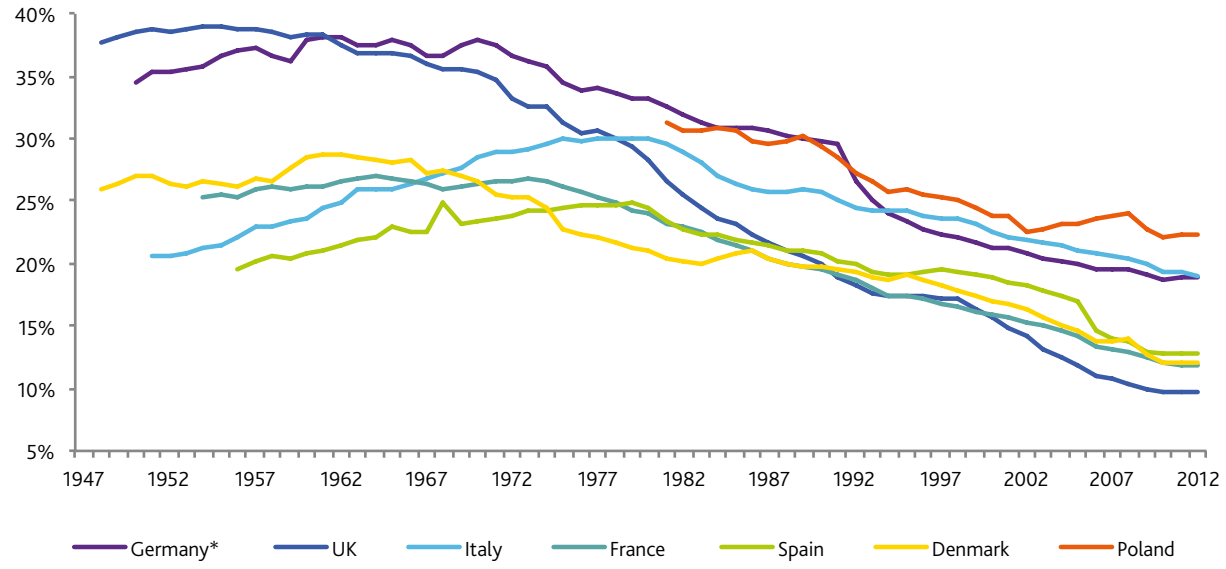

*Notes: Until 1991, data for Germany refers solely to West Germany.*

*Source: Own elaboration based on OECD data.*

Deindustrialisation, defined as a fall in the share of industry in the structure of employment, began in Western Europe in the late 1960s and 1970s. The relatively less developed countries of Southern Europe, with initially high employment in agriculture, intensively increased employment in industry up to the late 1970s, while some (Spain and Italy) entered this path of decline in employment in industry in the 1980s (Figure I.10).

Deindustrialisation was also reflected in a decline in the share of industry in the structure of value added. In contrast to agriculture discussed previously, it is difficult to speak of a clear convergence of the share of industry across the EU countries. Despite the downward trend observed in the share of industry in total employment and value added, the differences between countries have remained distinct.

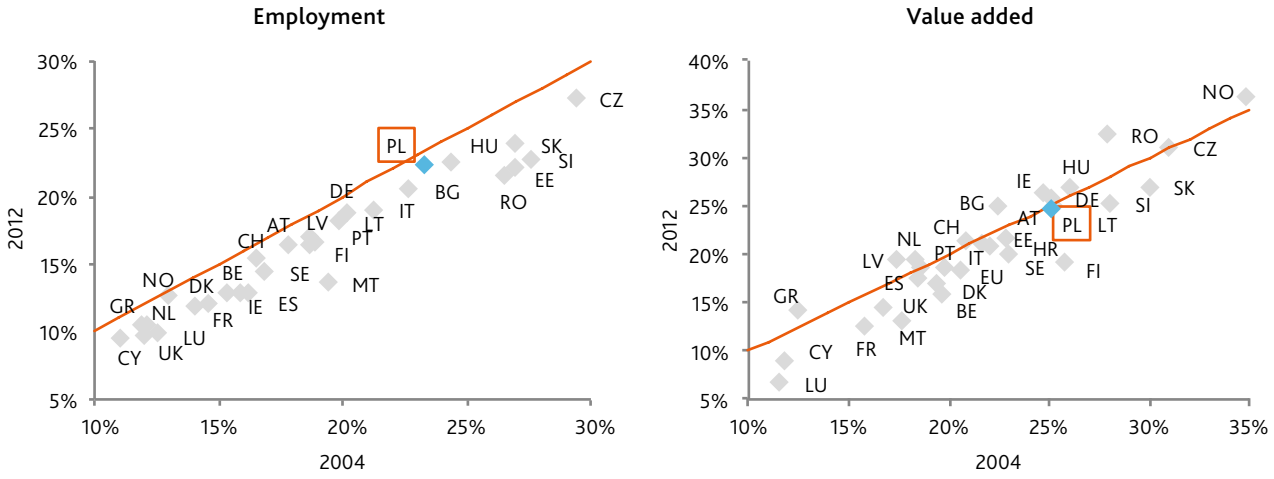
Figure I.10. **The share of industry (manufacturing + mining + energy, water and gas supply) in employment in Poland and selected European countries – historical perspective.**




*Notes: Until 1991 data for Germany refers solely for West Germany.*

*Source: Own elaboration based on Groningen Growth and Development Centre 10-Sector Database data, ILO, Eurostat.*

Figure I.11. **The share of industry in the structure of employment and value added in Poland and selected European countries 2004-2012 (%).**



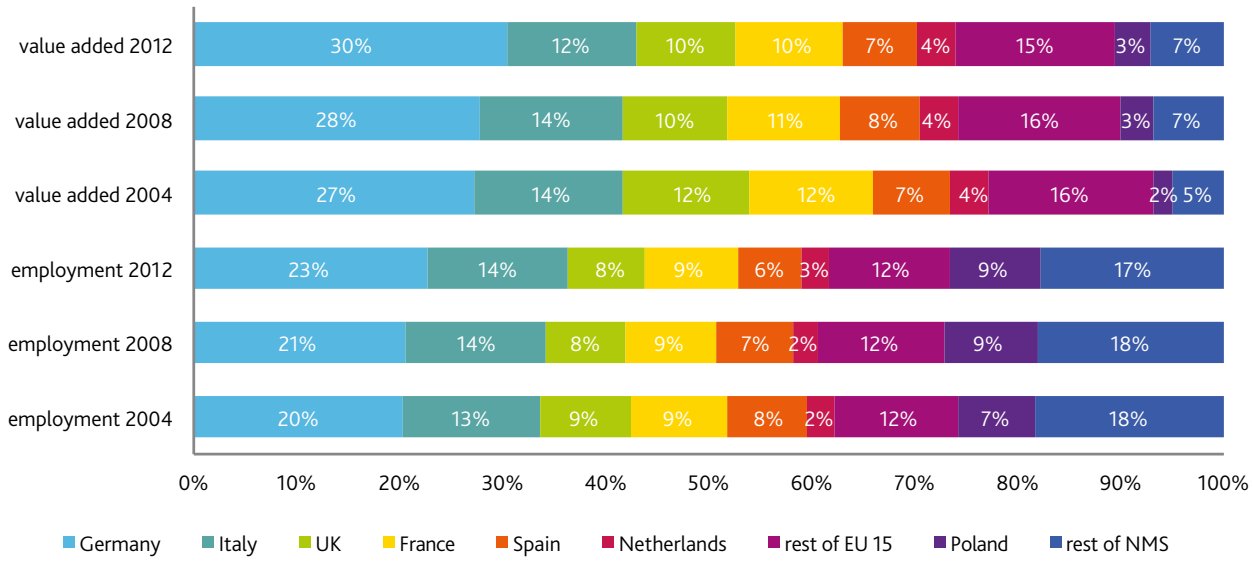

*Source: Own elaboration based on Eurostat data.*

Germany and the United Kingdom are examples of the substantially different deindustrialisation paths. In the 1960s, both countries had nearly identical shares of industry in the structure of employment (approx. 38%). In 2012, the share in Germany was 18.8% while in the UK it was half that (9.7%). The rapid pace of deindustrialisation in the UK was due to the economic policy pursued by Margaret Thatcher, promoting the development of the services sector, while closing unprofitable mines. The strong position of German industry is the result of its strong export orientation, amongst other factors. The ratio of the value of German exports of industrial goods to GDP is 34%, twice that of the UK.

In Poland, the outflow of workers from manufacturing intensified during the transition period. Later, declines in employment in manufacturing resulted from economic slowdowns in the late 1990s and early 2000s, as well as the Great Recession. In 2012, the share of employment in manufacturing in Poland stood at 22%. Although Polish levels are clearly above the EU average, other countries of the region, i.e. Czech Republic, Slovakia and Hungary, also experienced above average levels.

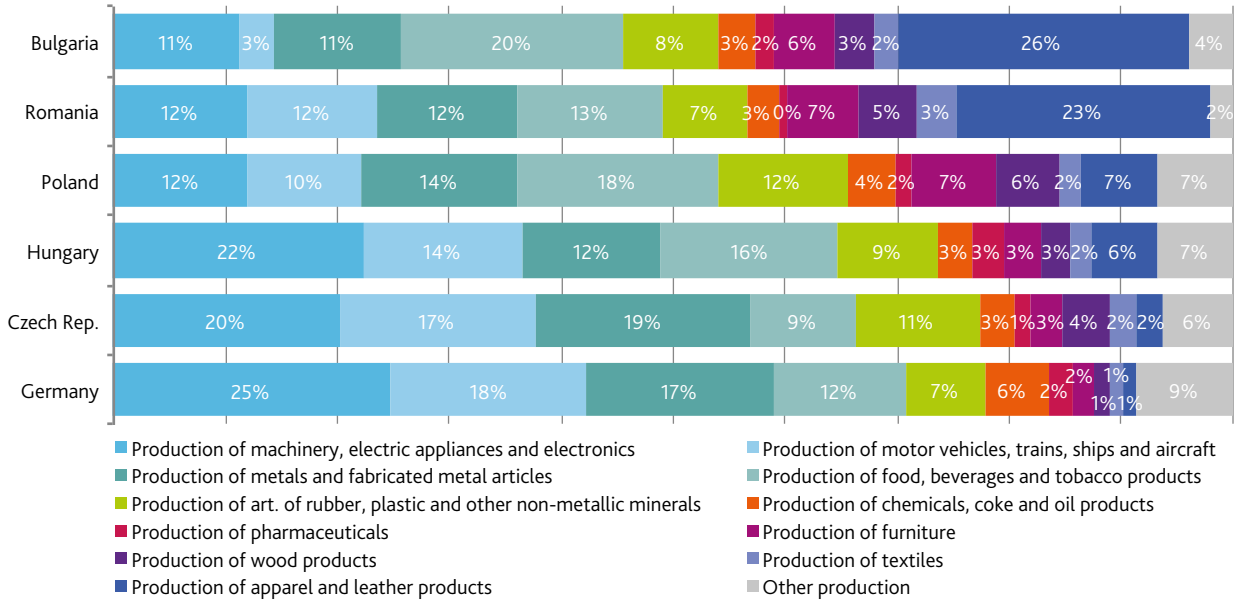
Among the EU15 countries, a share of manufacturing in the structure of employment close to 20% can only be found in two economies: Germany and Italy. Although in 2004-2012 the share of manufacturing decreased in all EU countries, the relative hierarchy of countries hardly changed. This means that countries with a large industrial base in 2004 remained the same up to 2012. There were no cases in which a country rebuilt its production potential, or moved from a relatively low to relatively high share of industry in employment or value added during this period.

Figure I.12. **Geographical structure of manufacturing in industry in the EU 2004-2012 (%).**




*Source: Own elaboration based on Eurostat data.*

Figure I.13. **Comparison of employment structure in manufacturing in selected New Member States and Germany in 2012 (%).**

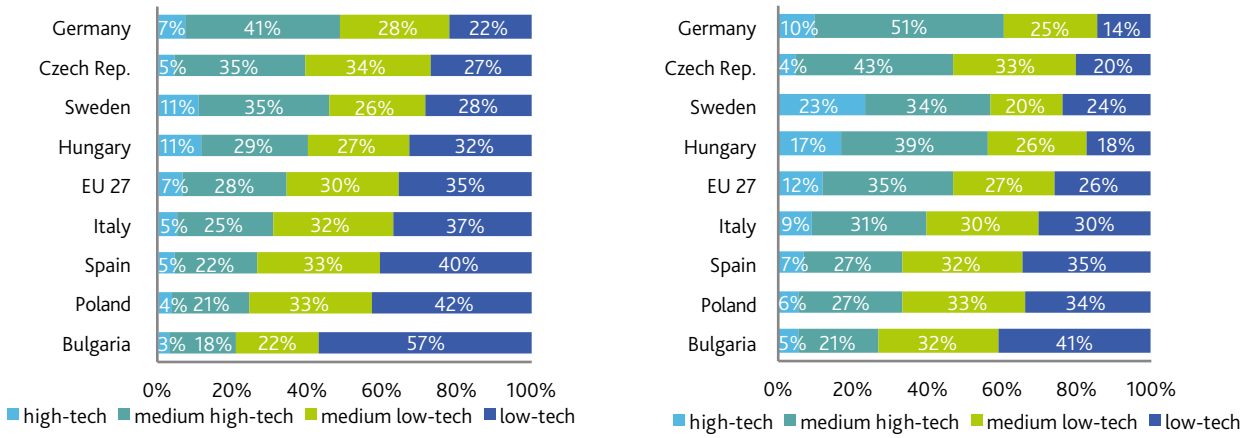



*Notes: Countries are ordered by similarity of their branch composition of employment in manufacturing to Germany (measure of dissimilarity is the sum of squared differences). Hence, Bulgarian manufacturing is the least similar to Germany, whilst Czech manufacturing is the most similar.*

*Source: Own elaboration based on Eurostat.*

The strong position of industry in Central and Eastern Europe has several sources. Firstly, it stemmed from the extensive industrial base inherited from the communist era, and secondly from relatively low labour costs, proximity and a barrier-less access to the markets of Western Europe, which increased the competitiveness of CEE producers as well as encouraged foreign companies to transfer their production there. CEE countries have experienced the largest growth of value added in the manufacturing sector among all the EU member states in recent years. Nevertheless, most of the industrial base of the European Union is still located in the old member states (see Figure I.12). The EU15 countries account for 90% of the EU value added in manufacturing and they employ 73% of all EU workers in in this sector. European industry is dominated by Germany. After 2008 its position was further strengthened by the relative resilience of German industry to the shock of the Great Recession (see *Employment in Poland 2012 – the labour market during the recovery from the crisis* (IBS/CRZL, 2013)). In 2012, Germany accounted for 30% of the value added generated

Figure I.14. **Structure of employment and value added in manufacturing by the technological level of industries, in selected EU countries in 2011 (%).**



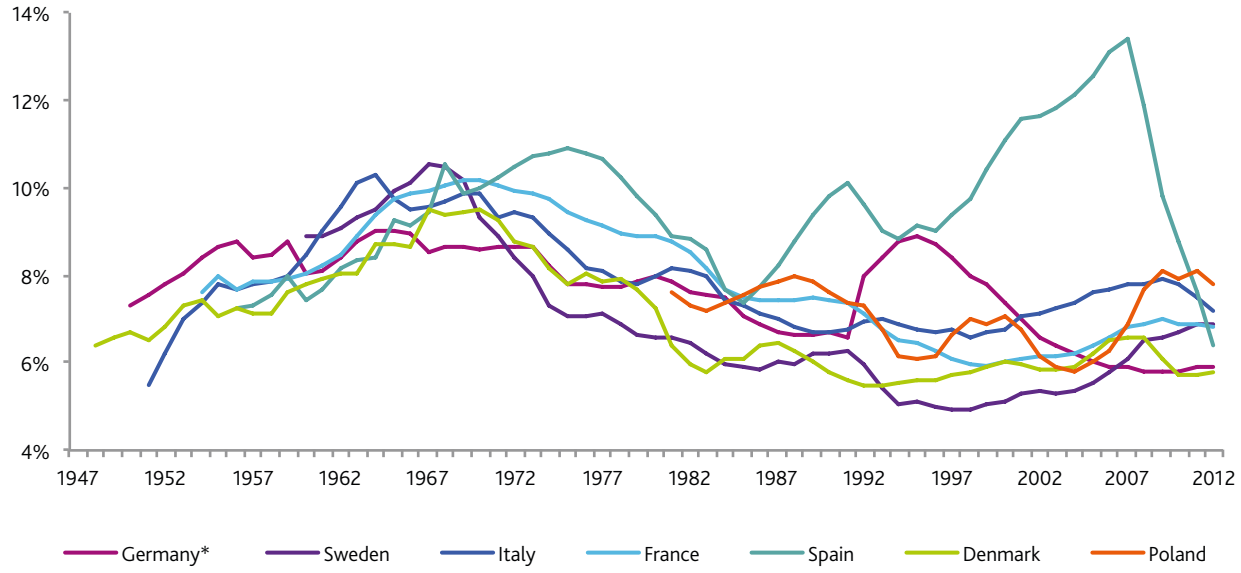

*Notes: For Italy, EU27 and Sweden – data for 2010. Grouping of industries to Eurostat methodology (2014).*

*Source: Own elaboration based on Eurostat data.*

**Box I. 1. Construction**

The share of the construction sector in total employment has shown no long-term trend, as opposed to agriculture and manufacturing. What is more, the share is similar across EU countries. In Poland, employment in the construction sector in relative terms does not differ from the countries of Western Europe. However, fluctuations observed in construction employment are cyclical and associated with changes in economic conditions. Figure I.15 clearly depicts two major cases of expansion of the construction sector in the last 25 years in the EU. The first is Spain, where joining the EU in 1986, introduction of the euro and reforms by the Aznar government contributed to an unprecedented growth in the construction sector that was not sustainable in the long term. In 2008 the construction bubble burst resulting in a deep slump in labour demand in this sector (cf. Part I of *Employment in Poland 2012 - the labour market in the recovery from the crisis* (IBS / CRZL, 2013)). A construction boom, although on a smaller scale, also occurred in Germany after unification in the 1990s, but in that case the share of the construction sector began to decline slowly in the second half of the decade, avoiding the bubble bursting. However, both cases clearly show that an expansion of labour demand in the construction sector is temporary by nature.

Figure I.15. **The share of construction in total employment in Poland and selected EU countries – historical perspective.**




*Notes: Until 1991 data for Germany refers solely to West Germany.*

*Source: Own elaboration based on data from; GroningenGrowth and Development Centre 10-Sector Database, ILO, Eurostat.*

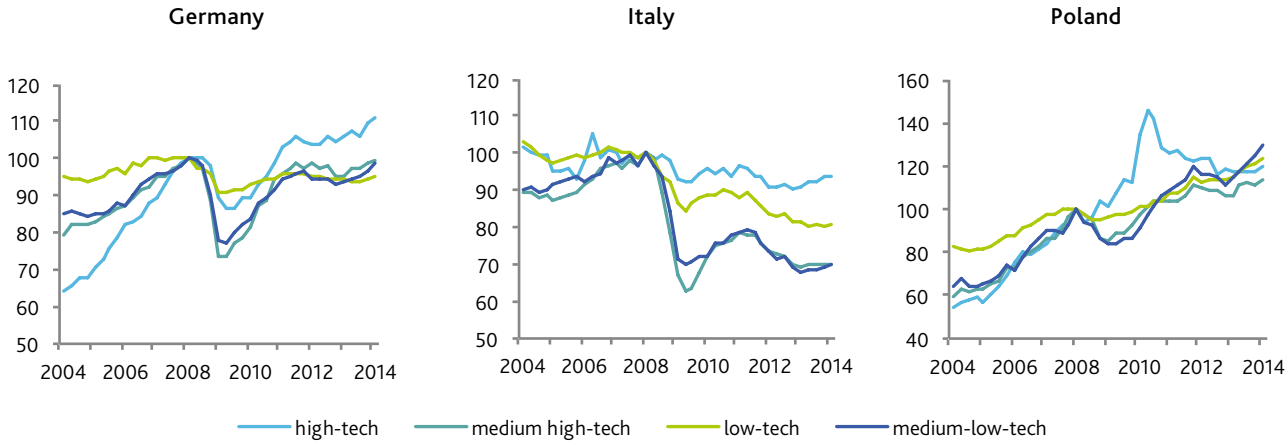
*Source: Own elaboration.*

by European manufacturing and 23% of employment in the sector. The significance of Polish industry is rather low as it contributes only 3% of total value added and 9% of total employment.

The branch composition of manufacturing shapes the characteristics of the labour demand because different branches require different competences. The four main branches of Polish manufacturing with the highest share in employment are: food and beverages (17.7%), basic metals and fabricated metal products (13.9%), motor vehicles (7.8%) and furniture (7.5%). Compared with Germany, Poland has a relatively higher employment share in the food, furniture and textile industries, and in the production of wood and wood products. Generally, work in these industries is rather manual and repetitive or requires the use of unsophisticated machines and equipment. At the same time, the machinery, electronics, transportation and chemical industries are less developed in Poland than in Germany. Therefore in Poland low-technology industries are predominant, in contrast to Germany where the dominant industries use more advanced technologies.

Other countries in the region, i.e. the Czech Republic, Slovakia and Hungary, have a relatively more modern structure of manufacturing than Poland. In terms of the branch composition of employment in manufacturing, the Czech Republic is most similar to Germany among the EU countries. In Romania and Bulgaria where labour costs are the lowest in the European Union, the textile and apparel industries still play a very important role in employing 20-25% of all workers in manufacturing. In Poland, the Czech Republic and Hungary, production of textiles and apparel is losing in importance due to the higher labour cost, with the share of employment of those branches between 4% and 8%. The branch composition of employment in manufacturing also implies a different sensitivity in response to shocks. The

Figure I.16. **Industrial production by the technological level of industries in selected countries, 1st quarter of 2008 = 100, 2004-2014.**




*Notes: Grouping of industries according to the Eurostat methodology (2014).*

*Source: Own elaboration based on Eurostat data.*

Great Recession revealed that *medium-technology* industries (see Eurostat industry grouping (Eurostat, 2014)) are the most sensitive to business cycle fluctuations (cf. Fig. I.16). Industries of high and low technologies, in particular industries related to the production of food and beverages, showed relative resistance to the shock (OECD, 2012; European Commission, 2014). Figure I.16 shows that, despite some fluctuations, the volume of industrial production in all four groups of industries in Poland have had a long-term upward trend.

### 1.2.2 GLOBALISATION AND LABOUR DEMAND

The increase in volume of international trade, the main symptom of the on-going process of globalisation, has had an ambivalent impact on labour markets.[2] According to the traditional approach, international trade promotes growth in the labour demand in export sectors in which the country has a comparative advantage (see Box I.2).[3] At the same time the country experiences a destruction of jobs in import industries in which the country is less competitive than foreign suppliers. The net effect for the labour market is not definite - the number of jobs lost in import-competing sectors may exceed the number of created jobs in export sectors. In addition, the shift in demand between sectors may cause a problem of structural unemployment when workers from declining industries do not have the skills required for the growth sectors. Regardless, trade between well-developed countries is actually dominated by intra-industry trade, i.e. two-way exchange within the same product group, that cannot be explained by the traditional approach of comparative advantage. The intra-industry trade rather increases competitive pressures within sectors, so that competition from foreign suppliers will drive the least efficient domestic producers out of the market. This means that trade also causes displacement of labour between companies *within* sectors.

An assessment of the impact of trade on the number of jobs in individual EU countries can be found in the study by Sousse et al. (2012), prepared for the European Commission. Unfortunately, the study covers only the impact of exports on markets outside the EU, with no mention of intra-EU trade. We see from the study that exports outside the EU are of utmost importance to the level of employment in the small economies of the „old" EU (Luxembourg, Ireland, and Finland) and in Germany. Every tenth job in the German economy depends on exports to markets outside Europe. In Poland, other new Member States and Southern European countries, trade with countries outside the EU plays a much smaller role. According to estimates by Soussa et al. (2012), in Poland only 5% of jobs depend on exports outside the EU (760 thousand workers).

An analysis of the impact of trade on the EU economies has also been carried out in *Employment in Poland 2010 Integration and globalisation* (IBS/CRZL, 2011). The strongest impact of trade on the labour market was identified in the smallest countries and those most strongly integrated into the European economy. The biggest beneficiaries of trade openness are Ireland, Sweden and Germany, where gains in net employment related to international trade were estimated at approx. 10% of total employment. In Greece, Estonia and Portugal trade caused a significant decrease in employment by about 15%. Poland was close to the EU average and the net impact of trade on the level of employment in Poland turned out to be close to zero.

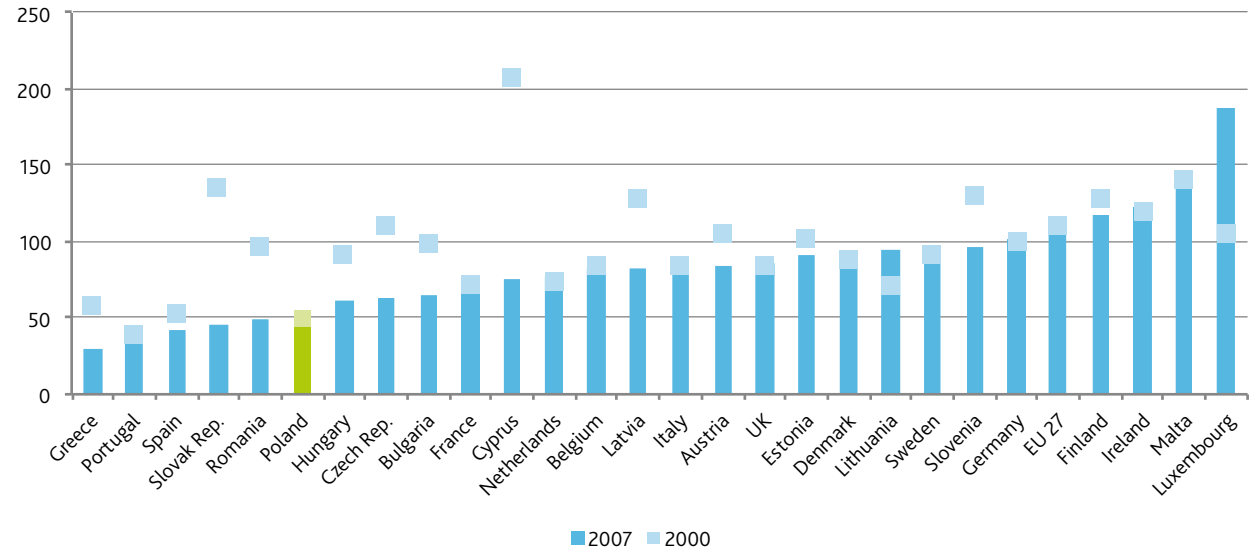
International trade is a major factor that shapes the structure of production. In order to determine products in which Poland specialises, we performed an analysis of revealed comparative advantage (for the method see Box I.2). To capture the

2 Detailed discussion of relationship between trade and employment can be found in Jensen & Lee (2007).

3 Comparative advantage depends on relative prices of production factors and technologies.

dynamic nature of comparative advantage, we compared the current results (2013) with those for 1994. The procedure was repeated for the other countries of the region: Czech Republic, Slovakia and Hungary. The results are shown in Table I.1. For the sake of readability we only included products in which the country had a significant comparative advantage (SRCA above 0.2) in 1994 or 2013, having a share above 0.5%in the export structure of the country.

Figure I.17. **Employment dependent on exports outside the EU per 1000 jobs.**




*Source: Own elaboration based on Soussa et al. (2012).*

## Box I.2. How to determine comparative advantage?

The theory of comparative advantage by David Ricardo is a basic explanation of why and how countries trade with each other. According to the theory, country A exports manufactured goods for which it has a comparative advantage, i.e. which produces them relatively cheaper than other goods and sells them to countries where the cost is relatively higher. Country A reduces or completely stops the production of goods that do not have a comparative advantage, and the demand is then satisfied by imports. As a result, international trade leads to the production and export specialisation of countries.

Analysis of revealed comparative advantage (RCA) uses the Balassa index (1965), which takes the following form:

$$RCA_i = \frac{\frac{X_i}{X}}{\frac{X_i^*}{X^*}}$$

Where  is the value of exports in product group *i* from the country analysed; X is the total value of exports from the country analysed, is the value of exports in product group *i* in the country or region of reference; and  is the total value of exports of all products from the country or region of reference. The reference can be a selected economy (e.g. Germany), region (e.g. EU) or the entire world economy. In our analysis, the results of which are presented below, the entire world economy serves as a reference. The Balassa index compares the share of product groups in the exports from the country against the share of the same products in the reference region. The Balassa index can take any value from zero to infinity. For the sake of convenience, the Balassa index is converted to a symmetrical form:

$$SRCA = \frac{RCA_i - 1}{RCA_i + 1}$$

This transformation is monotonic, and so does not change the order of products in terms of intensity of revealed comparative advantage. The SRCA index takes values from the interval (-1, 1). Values above zero indicate that the country has a revealed comparative advantage in trade, and the higher the index value, the greater the advantage. For values below zero the country has no advantage (i.e. revealed comparative disadvantage).

*Source: Own elaboration.*

## Table I.1. Revealed comparative advantage of Poland, Czech Republic, Slovakia and Hungary 1994 and 2013.

| Code | Description of product groups | SRCA 1994 | SRCA 2013 | Share in exports 1994 | Share in exports 2013 |
|---|---|---|---|---|---|
| **Poland – declining export sectors** | | | | | |
| 22 | Beverages | 0,20 | -0,29 | 1% | 0% |
| 25 | Salt, sulphur, earth, stone, plaster, cement | 0,68 | -0,24 | 2% | 0% |
| 61 | Apparel knitted or crocheted | 0,20 | -0,22 | 2% | 1% |
| 28 | Inorganic chemicals | 0,26 | -0,14 | 1% | 0% |
| 62 | Apparel not knitted | 0,63 | -0,02 | 9% | 1% |
| 1 | Live animals | 0,63 | 0 | 1% | 0% |
| 72 | Steal | 0,44 | 0 | 6% | 2% |
| 31 | Fertilizers | 0,56 | 0,03 | 1% | 0% |
| 63 | Other made up textile articles | 0,54 | 0,05 | 1% | 0% |
| 17 | Sugar and sugar confectionery | 0,43 | 0,14 | 1% | 0% |
| 8 | Fruits | 0,50 | 0,17 | 2% | 1% |
| **Poland – established export products** | | | | | |
| 73 | Articles of iron and steal | 0,45 | 0,27 | 4% | 3% |
| 7 | Vegetables | 0,36 | 0,29 | 1% | 1% |
| 70 | Glass and glassware | 0,34 | 0,33 | 1% | 1% |
| 20 | Preparations of vegetables and fruit | 0,36 | 0,35 | 1% | 1% |
| 16 | Preparations of meat and fish | 0,48 | 0,36 | 1% | 1% |
| 74 | Copper and articles of copper | 0,75 | 0,40 | 5% | 2% |
| 4 | Dairy products | 0,31 | 0,41 | 1% | 1% |
| 44 | Wood and articles of wood | 0,49 | 0,42 | 4% | 2% |
| 89 | Ships and boats | 0,68 | 0,50 | 5% | 3% |
| 94 | Furniture | 0,65 | 0,58 | 6% | 5% |
| **Poland – new export gains** | | | | | |
| 69 | Ceramic products | 0,04 | 0,26 | 0% | 1% |
| 83 | Misc. articles of base metals | -0,29 | 0,3 | 0% | 1% |
| 19 | Preparations of cereal and flour, pastry products | -0,12 | 0,34 | 0% | 1% |
| 82 | Tools and cutlery | -0,30 | 0,35 | 0% | 1% |
| 40 | Rubber and articles of rubber | -0,04 | 0,35 | 1% | 3% |
| 33 | Cosmetics | -0,48 | 0,35 | 0% | 1% |
| 21 | Misc. edible preparations | 0,11 | 0,40 | 0% | 1% |
| 48 | Paper and paperboard | -0,23 | 0,42 | 1% | 3% |
| 34 | Soaps, scouring products, waxes, lubricates | -0,13 | 0,46 | 0% | 1% |
| 2 | Meat | -0,11 | 0,50 | 1% | 2% |
| 18 | Cocoa and cocoa preparations | -0,01 | 0,51 | 0% | 1% |
| 24 | Tobacco | -0,25 | 0,64 | 0% | 1% |
| **Czech Republic – declining export sectors** | | | | | |
| 52 | Cotton | 0,34 | -0,45 | 1% | 0% |
| 55 | Man-made staple fibres | 0,23 | -0,38 | 1% | 0% |
| 12 | Oil seeds | 0,25 | -0,35 | 1% | 0% |
| 64 | Footware | 0,30 | -0,19 | 2% | 1% |
| 25 | Salt, sulphur, earth, stone, lime, cement | 0,57 | -0,18 | 1% | 0% |
| 63 | Other made up textile articles | 0,39 | -0,16 | 1% | 0% |
| 69 | Ceramic products | 0,55 | 0,07 | 2% | 0% |
| 72 | Steal | 0,57 | 0,08 | 8% | 3% |
| 4 | Dairy products | 0,34 | 0,09 | 1% | 1% |
| 34 | Soaps, scouring products, waxes, lubricates | 0,45 | 0,09 | 1% | 0% |
| 68 | Articles of stone, plaster and cement | 0,39 | 0,12 | 1% | 0% |
| **Czech Republic – established export products** | | | | | |
| 94 | Furniture | 0,47 | 0,26 | 3% | 2% |
| 44 | Wood and articles of wood | 0,46 | 0,27 | 4% | 1% |
| 40 | Rubber and articles of rubber | 0,21 | 0,32 | 2% | 2% |
| 73 | Articles of iron and steal | 0,54 | 0,39 | 6% | 4% |
| 86 | Trains and parts thereof | 0,60 | 0,41 | 1% | 1% |
| 70 | Glass and glassware | 0,72 | 0,46 | 3% | 1% |

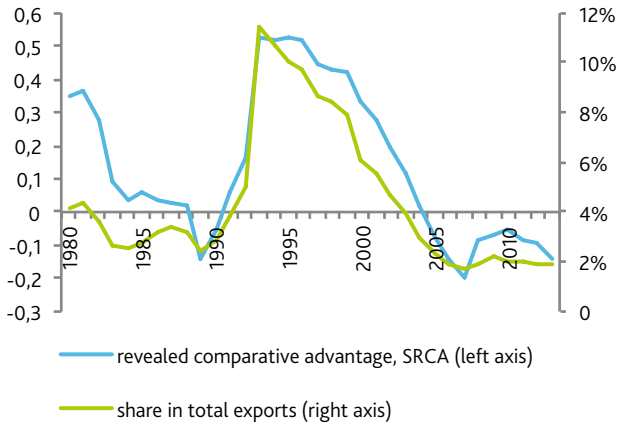
| Code | Description of product groups | SRCA 1994 | SRCA 2013 | Share in exports 1994 | Share in exports 2013 |
|---|---|---|---|---|---|
| **Czech Republic – new export gains** | | | | | |
| 84 | Machinery and mechanical appliances, parts thereof | -0,21 | 0,24 | 10% | 19% |
| 32 | Dyes, pigments, paints, inks | 0,17 | 0,25 | 1% | 1% |
| 87 | Motor vehicles, parts thereof | -0,10 | 0,37 | 8% | 18% |
| 49 | Printed books and newspapers | -0,15 | 0,40 | 0% | 1% |
| 83 | Misc. articles of base metals | 0,13 | 0,44 | 1% | 1% |
| 95 | Toys, games and sport requisites | 0,09 | 0,60 | 1% | 2% |
| **Slovakia – declining export sectors** | | | | | |
| 7 | Vegetables | 0,21 | -0,75 | 1% | 0% |
| 69 | Ceramic products | 0,37 | -0,67 | 1% | 0% |
| 54 | Sewing thread of man-made filaments | 0,67 | -0,32 | 3% | 0% |
| 74 | Copper and articles of copper | 0,32 | -0,15 | 1% | 1% |
| 39 | Plastics and articles of plastics | 0,27 | -0,08 | 5% | 3% |
| 49 | Printed books and newspapers | 0,32 | 0 | 1% | 0% |
| 68 | Articles of stone, plaster and cement | 0,25 | 0,05 | 1% | 0% |
| 31 | Fertilizers | 0,61 | 0,06 | 1% | 0% |
| 73 | Articles of iron and steal | 0,43 | 0,12 | 4% | 2% |
| 94 | Furniture | 0,40 | 0,15 | 3% | 2% |
| 48 | Paper and paperboard | 0,29 | 0,15 | 3% | 1% |
| 44 | Wood and articles of wood | 0,40 | 0,19 | 3% | 1% |
| **Slovakia – established export products** | | | | | |
| 70 | Glass and glassware | 0,51 | 0,21 | 2% | 1% |
| 64 | Footware | 0,32 | 0,26 | 2% | 1% |
| 40 | Rubber and articles of rubber | 0,44 | 0,34 | 3% | 3% |
| 72 | Steel | 0,75 | 0,35 | 16% | 5% |
| **Slovakia – new export gains** | | | | | |
| 85 | Electrical appliances and equiptment | -0,49 | 0,28 | 4% | 21% |
| 17 | Sugar and sugar confectionery | -0,13 | 0,36 | 0% | 1% |
| 83 | Misc. articles of base metals | -0,32 | 0,41 | 0% | 1% |
| 87 | Motor vehicles, parts thereof | -0,31 | 0,50 | 5% | 25% |
| **Hungary – declining export sectors** | | | | | |
| 61 | Apparel knitted or crocheted | 0,34 | -0,62 | 2% | 0% |
| 8 | Fruits | 0,23 | -0,57 | 1% | 0% |
| 62 | Apparel not knitted | 0,54 | -0,54 | 6% | 0% |
| 63 | Other made up textile articles | 0,39 | -0,37 | 1% | 0% |
| 64 | Footware | 0,48 | -0,26 | 3% | 0% |
| 7 | Vegetables | 0,48 | -0,12 | 1% | 0% |
| 16 | Preparations of meat and fish | 0,60 | -0,11 | 1% | 0% |
| 22 | Beverages | 0,39 | -0,05 | 2% | 1% |
| 12 | Oil seeds | 0,43 | -0,01 | 1% | 1% |
| 94 | Furniture | 0,29 | 0,06 | 2% | 2% |
| 39 | Plastics and articles of plastics | 0,22 | 0,10 | 5% | 4% |
| 76 | Aluminium | 0,46 | 0,14 | 3% | 1% |
| 30 | Pharmaceutical products | 0,28 | 0,17 | 2% | 4% |
| 69 | Ceramic products | 0,24 | 0,17 | 1% | 0% |
| **Hungary – established export products** | | | | | |
| 2 | Meat | 0,65 | 0,23 | 4% | 1% |
| 70 | Glass and glassware | 0,28 | 0,23 | 1% | 1% |
| 20 | Preparations of vegetables and fruit | 0,76 | 0,28 | 3% | 1% |
| 10 | Cereals | 0,30 | 0,33 | 2% | 1% |
| 1 | Live animals | 0,68 | 0,54 | 1% | 0% |
| **Hungary – new export gains** | | | | | |
| 84 | Machinery and mechanical appliances, parts thereof | -0,41 | 0,20 | 6% | 18% |
| 85 | Electrical appliances and equiptment | -0,07 | 0,30 | 11% | 22% |
| 40 | Rubber and articles of rubber | -0,04 | 0,31 | 1% | 2% |
| 23 | Prepared animal fodder | -0,27 | 0,37 | 0% | 1% |

*Source: Own calculations based on Comtrade data.*

## Box I.3. The apparel industry in Poland – the success and fall.

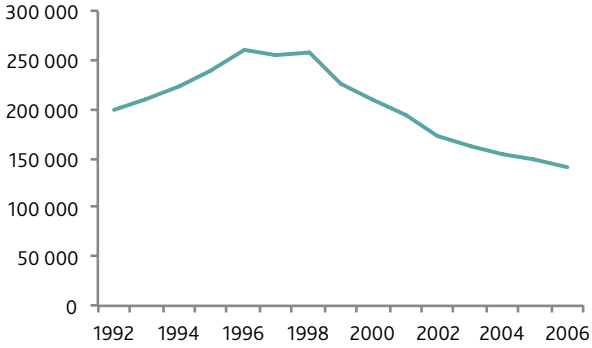
The situation of the textile and apparel industries during the transition period in Poland is an interesting example of the impact of opening up to international trade. Employment in the textile industry fell dramatically after forsaking the centrally planned economy and adjustment of the zloty exchange rate. Textile production in Poland became too expensive compared to cheap imports from developing countries. On the other hand, due to the relatively cheaper labour than in the EU and no-barrier access to EU market thanks to the European Agreement signed in 1991, Poland in the 1990s had a comparative advantage in the production of apparel, resulting in employment expansion of this industry. However, the gradual closing of the income gap between Poland and Western Europe has meant that since the early 2000s the manufacturing of apparel started to lose competitiveness and employment declined. Thus Polish apparel industry is an example of the fast growth and fall of an industry in a very short time span, implying significant flows of workforce between industries.

Figure I.18. **Position of apparel exports in Polish trade 1980-2013.**




*Source: Own elaboration based on Comtrade data.*

Figure I.19. **Employment in the apparel industry in Poland 1992-2006.**




*Source: Own elaboration based on ILO data.*

*Source: Own elaboration.*

The results indicate that Poland has a strong revealed comparative advantage in the production of furniture, wood, boats and yachts, copper mining, and in many branches of agricultural and food production. These results coincide with the identification of major branches of Polish manufacturing. These industries are not technologically advanced, are moderately labour-intensive and moderately capital-intensive. Over two decades, Poland and other countries in the region have experienced strong changes in comparative advantage. In comparison with 1994, Poland and Hungary have lost a strong comparative advantage in the production of apparel and certain textile articles, Slovakia lost advantage in the production of fibres, and the Czech Republic in textiles and footwear. At the same time, Polish exporters managed to gain a strong position in trade in certain food products, paper and consumer chemicals. An exceptionally strong improvement in revealed comparative advantage related to the production of cosmetics. In the Czech Republic and Slovakia, a significant improvement of advantage was achieved by automotive manufacturing. In Hungary and Slovakia the expansion of exports concerned home appliances. Therefore, Poland lags behind the countries of the region, as it specialises in industries that do not require high technology, while Poland's southern neighbours began to specialise in the production of vehicles, machinery, equipment and electronics.

The openness of the economy to trade, favours reallocation of jobs between countries. However, for some time now offshoring has been accompanied by an opposite phenomenon, so-called reshoring. Reshoring usually refers to American companies which had moved production to East Asia years ago and now have decided to resume production in the United States (The Economist, 2013). In the European Union reshoring applies mainly to German and Italian companies, and has also indirectly affected the Polish economy. In 2012, Fiat Group decided to move production of the Fiat Panda from the Tychy factory back to Italy, which resulted in an outflow of 1400 jobs. Another example of reshoring was the 2007 decision by Volkswagen to close its factory in Belgium, resulting in the dismissal of more than 3,000 employees and the transfer of most of the production to Wolfsburg in Germany. Reshoring results, *inter alia*, from higher than initially expected production costs abroad, problems with product quality, problems in supply chain management, and the closing of the cost gap between developed and developing countries. One factor that has improved the competitiveness of American manufacturing was the launch of shale gas extraction, which has caused a significant drop in energy prices in the United States. The examples of Fiat and Volkswagen suggest that decisions about relocating production back to the home country may also be caused by non-economic factors. In order to promote reshoring,

the representatives of industry in the United States established the *Reshoring Initiative*. The French government launched the web portal *Colbert 2.0* to help employers assess the cost of relocating production back to France (Eurofound, 2013).

Reshoring can be seen as part of a broader phenomenon of re-industrialisation in the EU. The Great Recession in the economies with a strong position in industry was milder than in service-based economies, as seen in the cases of Germany and the UK, which drew the attention of European policy makers to the need of supporting the industrial sector. One of the effects of a more favourable climate for manufacturing is the strategy of re-industrialisation of the European Union (Box I.4).

### Box I.4. Strategy of reindustrialisation in the European Union

The European Union plays an important role in stimulating industrial development in member countries. One of the seven flagship initiatives of the Europe 2020 growth strategy is „An industrial policy for the globalisation era". Assumptions of the initiative were presented in 2010. The initiative highlighted the need for an industrial policy coordinated at European level and integrated with other Community policies (competition, trade, energy). The EU industrial policy is meant to create the best environment for the development of a strong, competitive and diversified industrial base in Europe (in particular through regulations concerning SMEs), and to promote a more efficient use of energy and resources.

At the end of 2012, the European Commission presented a second Communication on industrial policy which emphasised the need for re-industrialisation of the European economy. It was noted that since the start of the Great Recession in Europe, more than 3 million jobs had disappeared in manufacturing, while industrial production in 2012 had remained 10% lower than before the crisis. At the same time it was stressed that industry plays an important role in creating economic growth, accounting for 80% of exports and as much in private investment in research and innovation in the EU. Re-industrialisation is believed to be a way of rebuilding the competitiveness of the EU economies after the Great Recession. The measurable objective set by the European Commission is to increase the share of industry in the EU GDP from around 16% in 2012 to 20% in 2020. It is worth noting that countries differ significantly in this area – e.g. in the Czech Republic, Germany and Hungary, the share of manufacturing in the structure of value added exceeds 20%, while in France and the UK it is about 10%. Thus, it seems that the adopted target is very ambitious and achieving that by 2020 is not very realistic. Nevertheless, it is a strong signal that the European Commission wants to reverse the declining trend in manufacturing. In the document from 2012, the European Commission proposes four main pillars of industrial policy:

1. Stimulating investment and innovation, and improving the efficiency of use of raw materials.
2. Improving the functioning of the EU internal market, and greater openness to foreign exchange markets, in particular through the promotion of exports by small and medium-sized businesses.
3. Improve company access to finance investment.
4. Investment in human capital and skills; anticipating required skills as well as mismatches between skills and the needs of industry.

The document highlights the importance of energy and raw materials for the competitiveness of European manufacturing. In this respect, the European Union is clearly losing ground to the main foreign competitors, including the United States. The Commission proposes the appointment of an efficient internal energy market, investments in energy infrastructure, diversification of energy sources and improvements in energy efficiency. As the Commission notes, the impact on energy prices should be taken into account when designing other policies.

The Commission also established six priority areas: 1) advanced manufacturing - greater efficiency in consuming energy and raw materials; 2) key development-oriented technologies; improvements in technological infrastructure in small and medium-sized enterprises; 3) bioproducts; 4) sustainable construction and raw materials derived in a sustainable way - to improve energy efficiency in residential construction and improvement of recycling; 5) clean vehicles and ships, including the creation of an infrastructure for alternative fuels; 6) smart grids and digital infrastructure.

*Source: Elaboration based on the European Commission (2010), Communication from the Commission. Europe 2020. A strategy for smart, sustainable and inclusive growth. European Commission (2012), Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Stronger European manufacturing for growth and economic recovery. Update Communication on industrial policy. European Commission (2014), Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Measures for the revival of European manufacturing*

## 1.3 SERVICES

### 1.3.1 EVOLUTION OF THE SIGNIFICANCE OF SERVICES IN EUROPEAN ECONOMIES

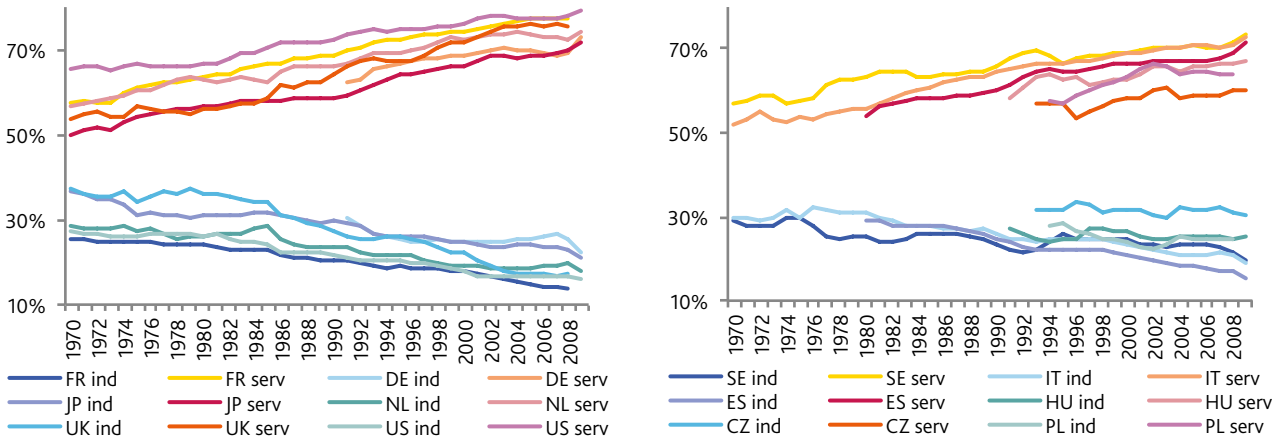
The growing share of the service sector in the structure of employment and value added, a mirror image of de-industrialisation, is another trend taking place in all EU countries. A continuous rise in the importance of the service sector has been observed since, at least, the early 1960s. These days, the German service sector employs 73% of all employed, while in the UK it is 83%, compared to 40% and 50% in 1960. Despite the large share of services in the employment structure, employment growth in this sector has not yet halted, and in some countries this process has even accelerated as a result of strong job destruction in other sectors of the economy during the Great Recession (e.g. in Spain).

At the beginning of the 1980s the Polish service sector employed 5.9 million people, which constituted one third of the working population. In 2012, the Polish service sector employed 8.76 million people, which represents 57% of the working population. Hence, employment in services increased by more than 2.8 million people over three decades, and its share in employment increased by 25 pp. Although the importance of the service sector is still far below the levels observed in Western European countries, – the gap between Poland and Germany is currently 16 percentage points (cf. Figure I.21) – the difference has gradually decreased throughout the transition period (in 1994 it was 22 percentage points) with the fastest rate in the 1990s. Assuming that the current pace of growth in the services sector is maintained, Poland will have reached the current level of (though strongly industrialised) Germany by the end of the 2030s. In terms of the structure of value added, the differences between Poland and Western European countries are much smaller. In 2012 services in Poland accounted for 65% of gross domestic product, while in Germany it was 69%, and in the whole EU27 it was 78%.

There are several reasons behind the service sector expansion (see Handel 2011, Wölfl 2005):

- With the growth of incomes, the demand for services is growing faster than the demand for food and industrial goods, i.e. demand for services exhibits high income elasticity. The expansion of demand applies especially to education, health care, as well as entertainment and recreation.
- Countries with high income levels also guarantee broader access to welfare state institutions. Public health services and education are available to people who would not be able to afford these services on a commercial basis. This means that the welfare state subsidises some forms of services, thus generating additional employment (OECD, 2000).
- Development of the various functions of government requires an efficient public administration to manage the public sector and to ensure proper tax collection, thus increasing employment in public administration.
- Extended working life periods and increasing female participation entail an increase in market demand for services previously satisfied within households, such as preparing meals and caring for children and the elderly.
- More companies, including manufacturing companies, outsource business support services. As a result, certain elements of value added chains are no longer performed by production companies themselves, but instead are provided by external specialised service companies.
- Growth of the service sector can be driven by positive external demand. Traditionally, services were considered to be non-tradables. However, the development of information

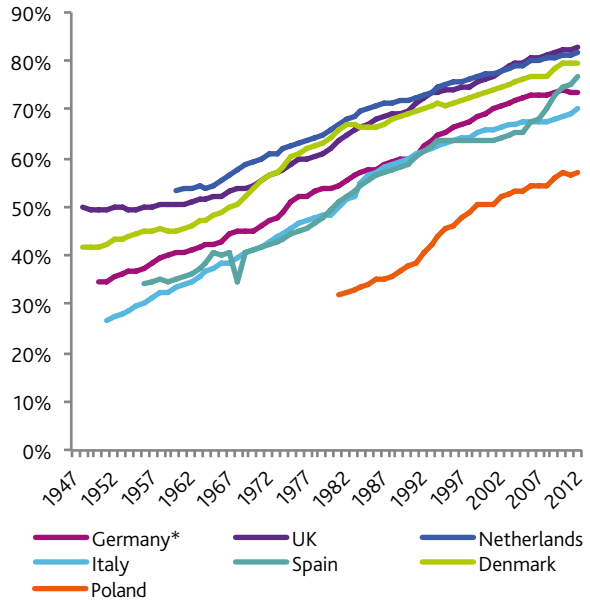
Figure I.20. **The share of services and industry in the structure of value added in selected OECD countries 1947-2010 (%).**




*Notes: Until 1991, data for Germany refers solely to West Germany.*

*Source: Own elaboration based on OECD data.*

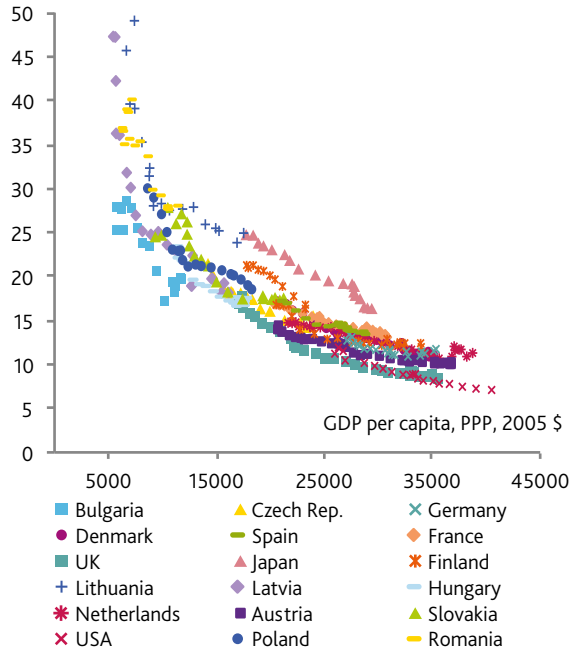
Figure I.21. **The share of services in employment in Poland and selected European countries – historical perspective.**




*Notes: Until 1991, data for Germany refers solely to West Germany.*

*Source: Own elaboration based on data from: Groningen Growth and Development Centre 10-Sector Database, ILO, Eurostat.*

Figure I.22. **Share of spending on food and beverages in the total expenditure of households 1980-2012 (%).**




*Source: Own elaboration based on Eurostat and WDI WB data.*

technology has enabled the provision of certain services across borders.

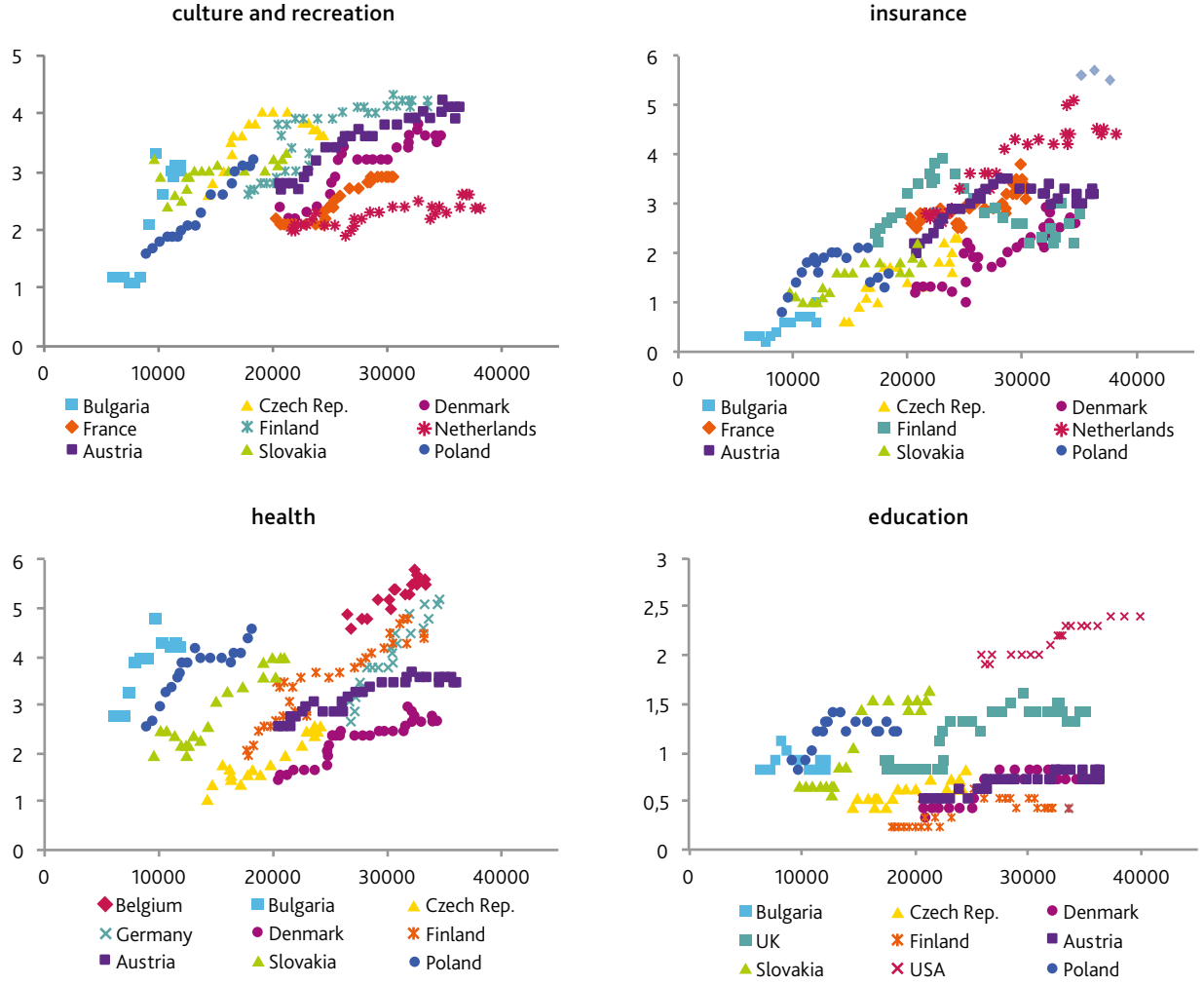
- Growth of the service sector can be explained by the slower pace of technological progress in the service sector than in the manufacturing sector. Baumol (1967) and Ngai and Pissarides (2007) show that differences in the rate of growth of total factor productivity (TFP) across sectors result in a structural change and movement of workers from industries with a high rate of TFP growth, to industries with a low rate of growth.

An increase in income levels is followed by changes in the structure of the demand for goods and services reported by households, due to different income elasticities of demand for individual goods. The share of goods with lower income elasticity decreases in total expenditures, in contrast to goods with a relatively higher income elasticity. The former group of products includes food, which means that food consumption grows more slowly than income and the share of food in the total household expenditure gradually decreases. This regularity is known as the Engel law, clearly illustrated in Figure I.22 which presents data for selected European countries, the USA and Japan. A decrease in relative demand for food has also been observed in Poland - in the mid-1990s, spending on food and beverages accounted for 30% of total household expenditure, and by 2012 it had dropped to 19%. In addition to food, households spent relatively less on clothing and footwear - in 1995 it was 6.1% while in 2012 it was 4.4%.

On the other hand, an income increase also results in a growing share of expenditure related to recreation in the structure of household budgets. In Poland, this has doubled over the past two decades from 1.6% in 1995 to the current share of 3.2%. An upward trend can also be found in household spending on health, education and financial services. Figure I.23 shows that this relationship applies to most of the analysed countries, where an increase in national income provided a disproportionate increase in demand for various services, thereby stimulating growth in the service sector.

Another reason for the increased demand for services is external demand. In contrast to trade in goods, Poland is a net exporter of services. In 2012, the value of exported services exceeded imports by 20 billion zlotys. The structure of Polish exports of services is dominated by transport services (mainly road transportation) and travel-related services. A significant share of exported services are construction and IT services. Significantly, in 2000, IT exports from Poland were growing by an average of 33% per year in nominal terms, compared to the average of 8% for other categories of services. Although as late as 2010 Poland was still a net importer of IT services, in 2012 the trade surplus in IT services amounted to 1.5 billion zlotys.

Figure I.23. The share of selected expenses in household budgets in selected countries 1980-2012 (%).

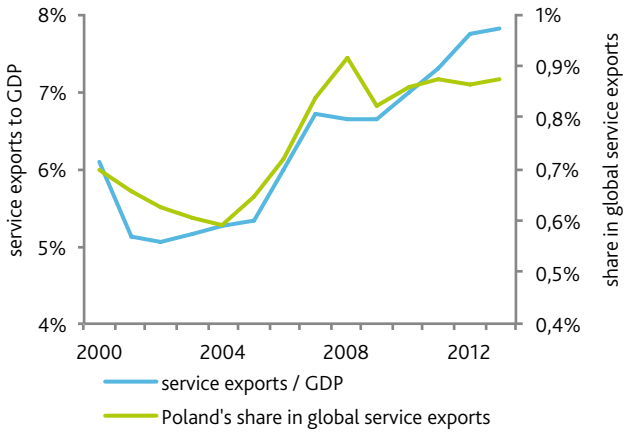



*Source: Own elaboration based on Eurostat and WDI WB data.*

Figure I.24. Trade balance in Poland 2000-2012, in billions of zloty.


*Source: Own elaboration based on NBP data.*

Figure I.25. Exports of services in Poland 2000-2013.




*Source: Own elaboration based on WTO and WDI WB data.*

Table I.2. **Trade in services in Poland in 2012 in billions of zloty.**

| | exports | | imports | | balance |
|---|---|---|---|---|---|
| | PLN | % | PLN | % | PLN |
| Transportation | 36,4 | 29% | 22,9 | 22% | 13,4 |
| Travel | 35,7 | 29% | 28,6 | 28% | 7,1 |
| Construction | 5,2 | 4% | 2,6 | 3% | 2,5 |
| IT | 7,9 | 6% | 6,4 | 6% | 1,5 |
| Insurance and finances | 2,6 | 2% | 4,4 | 4% | -1,8 |
| Personal, cultural and recreation | 1,3 | 1% | 3,4 | 3% | -2,2 |
| Post and telecommunication | 1,8 | 1% | 2,1 | 2% | -0,3 |
| Patents and license fees | 0,7 | 1% | 7,6 | 7% | -6,8 |
| Other services | 31,9 | 26% | 25,9 | 25% | 6,0 |
| **Totals** | **123,4** | **100%** | **104,0** | **100%** | **19,5** |

*Source: Own elaboration based on NBP data.*

### 1.3.2 STRUCTURE OF EMPLOYMENT IN SERVICES IN EUROPEAN COUNTRIES

As services have dominated the structure of most developed economies, the traditional division into three sectors is no longer relevant. Instead, more attention should be paid to the branch composition in services sector. Differences between the branches result from many factors, such as the type of service, the recipient (services for individuals vs. companies), who renders the services (private vs. public), whether the services may be rendered abroad and what qualifications they require.

The simplest division differentiates between market and non-market services, the latter being traditionally associated with the public sector, i.e. education, health care, security and administration. The development of the public sector is related to the growth of national income; Figure I.23 shows a positive relationship between income per capita and the share of expenditures on education and health in the structure of household budgets. In most EU countries, employment in education, health care, security and administration is between one fifth and one fourth of total employment. Much higher proportions can be found in countries with well-developed welfare states: Scandinavian countries (Sweden 31%, Norway 33%), France and Belgium. In Poland this sector is one of the smallest in the EU, with one fourth of all employed.

A quick glance at Figure I.26 reveals that the structure of the service sector in Poland is generally similar to that in other countries in the region: the Czech Republic, Slovakia and Hungary. The largest individual sectors in the NACE classification are wholesale, retail trade, and repairs. In all the countries, this sector has a very similar share in total employment. Moreover, its importance does not change significantly in the long run. This suggests that regardless of the size of employment in the production of goods, economies always need a similar level of redistribution of goods.

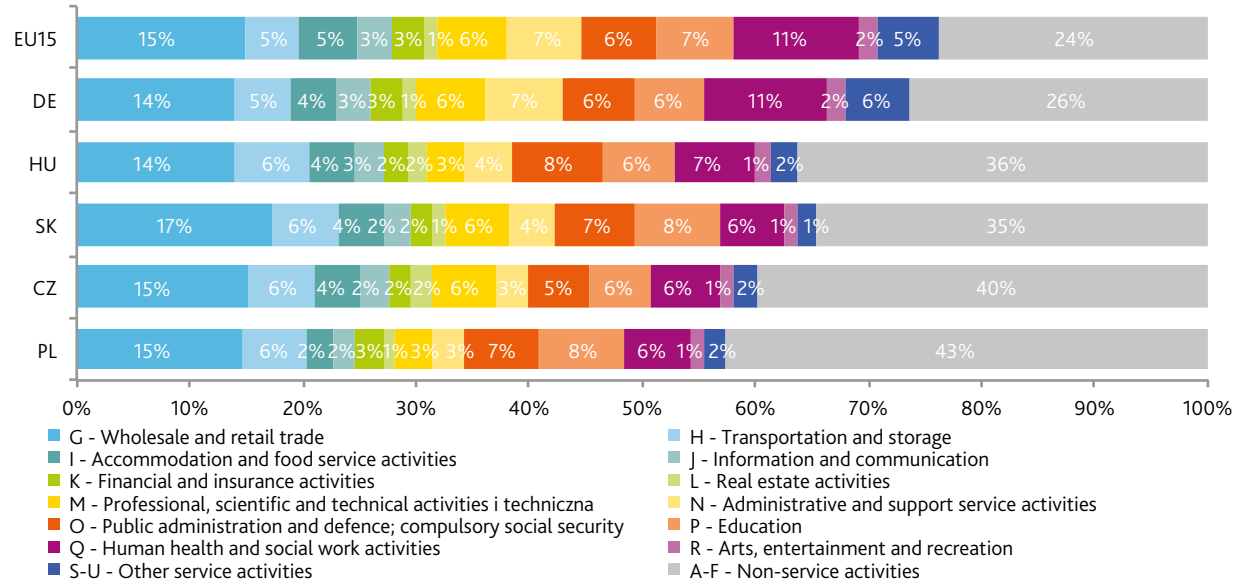
The same Figure shows that considerable discrepancies exist between the Polish and German (or EU15) sectoral structure in services. Poland has much lower employment in services associated with public health, social work and support service activities; this gap can also be observed in the Czech Republic, Slovakia and Hungary. Poland also has distinctly less developed professional and scientific activities, as well as accommodation and food service activities.

Over the last decade employment has grown fastest in the following sections: M - professional, scientific and technical activities; N - administration and support service activities; I - accommodation and food service activities, J - information and communication, K - finance and insurance. Because these sections are under-represented in Poland compared to the EU15, their increase has resulted in a convergence of employment structures. It is worth noting that these branches are not homogenous. The group consists of services considered modern, requiring a high level of qualification, such as information, communication, professional and scientific activities, as well as the traditional services where the required level of education is relatively low (accommodation and food service activities). Also, the nature of the recipients of those services is mixed. There are services to individuals (accommodation and food) and to business (administration and support service activities). It is expected that the gap between Poland and the EU15 will continue to decrease due to the expected increase in demand for health services, entertainment and recreation, as well as outsourcing services for businesses.

It is worth noting that in OECD countries, convergence of the branch structure of the service sector is much weaker than convergence of the share of the service sector (as a whole) in total employment (OECD, 2000). Differences in the service sector structure occur regardless of the level of economic development of a country and are relatively persistent over

time. The differences arise either from a different model of welfare state, or different specialisation pattern in tradable services, e.g. in tourism, transportation, education and research, professional and financial activities. There are many examples of such specialisations. The Luxembourg economy is based on specialisation in financial services. Southern Europe specialises in tourism, which increases employment in accommodation, food services and entertainment activities. The Netherlands and Denmark specialise in transport. In Poland, it is still an open question whether the observed rapid growth of exports of IT services can become such an area of specialisation for the country.

Figure I.26. **Structure of employment in the service sector by branches in Poland and selected countries in 2012.**




*Source: Own elaboration based on Eurostat data.*

Figure I.27. **Change in employment in service sectors in Poland 2004-2012.**


*Source: Own elaboration based on Eurostat data.*

# 2 CHANGE IN THE DEMAND FOR SKILLS AND OCCUPATIONS

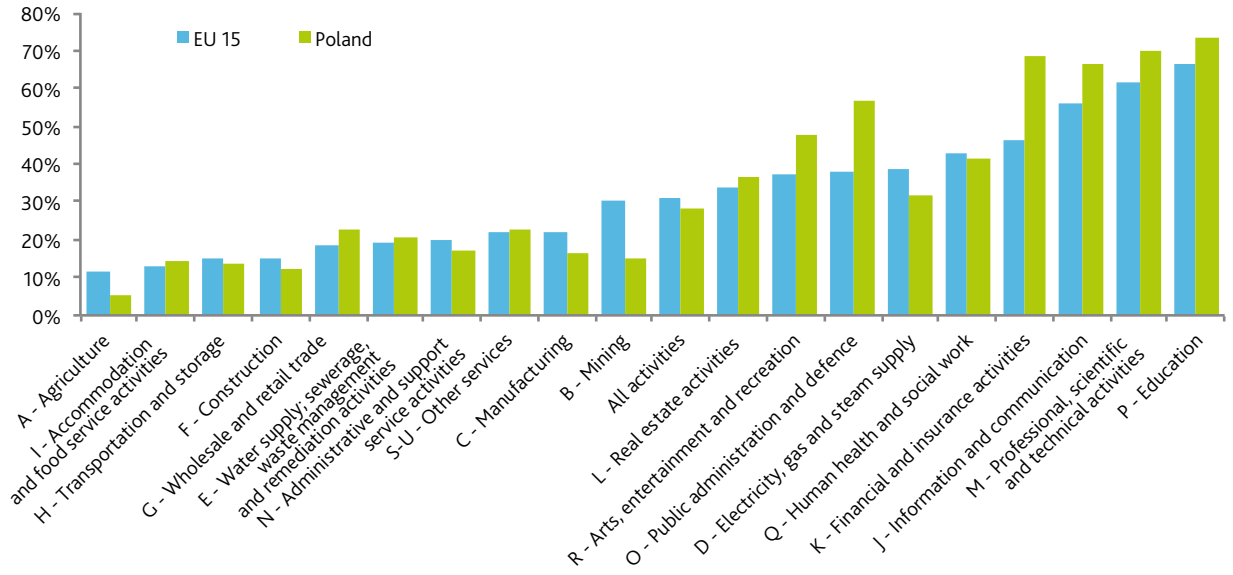
## 2.1 SECTORAL DEMAND AND THE CHARACTERISTICS OF WORKFORCE

Demand for skills and occupations is largely determined by the branch structure of the economy. This is due to different job characteristics in the various branches and hence different labour demands of branches. As a result, structural change of the economy that is observed in the long run, translates into a change of labour demand for certain levels and types of education. Figure I.28 presents shares of tertiary educated workers among all workers for all sections of economic activity in 2011 (there are 19 sections according to the NACE classification). The highest proportion of workers with a tertiary diploma, both in Poland and the EU15, was in education, with almost three quarters of the workers in this section. A slightly lower rate was found in professional, scientific and technical activities. Persons with a university degree constituted more than two thirds of those employed in finance and insurance, as well as information and communication. In all those sectors the proportion of people with university education is higher in Poland than in the EU15.

The differences in educational structures, in particular the share of people with tertiary education, between Poland and the EU15 in various industries are small, with just a few exceptions. The lowest relative demand for high qualifications, both in Poland and the EU15, is found in agriculture, construction and some service industries: accommodation and food services, transport and storage. Wholesale and repairs, responsible for approx. 15% of entire employment in the economy, uses high qualifications to a lesser extent than the average. Furthermore, in the EU15, people with tertiary education constitute a greater proportion of workers in manufacturing than in trade and repairs. Therefore the process of the growing importance of services in the structure of economic activity does not necessarily mean an increase in demand for higher qualifications. Nevertheless, almost all sections of the economy which employ relatively more people with high qualifications belong to the service sector (except energy supply).

A significant gap in the use of high qualifications between Poland and EU15 can be observed in industry, especially in mining and – to a lesser extent – energy and manufacturing. In the case of mining and energy, the gap results from the high average age of workers in those branches in Poland and lower formal qualifications of the older workers who started working before the beginning of the educational boom. However, among newly hired workers the percentage of people with high qualifications is higher than among older workers. Also, manufacturing in Poland employs relatively fewer people with higher education than in the EU15. This difference is partly due to the lower importance of modern industries in Poland, i.e. those with a relatively high demand for highly qualified workers (cf. Figures I.14 and I.31).

Figure I.28. **The share of employees with university education in the employment structure in Poland and EU15 in 2011 (%).**




*Notes: The names of sections have been abridged.*

*Source: Own calculations based on EU LFS data.*

### Table I.3. Decomposition of differences in educational structure between Poland and the EU15 in 2013 (percentage points).

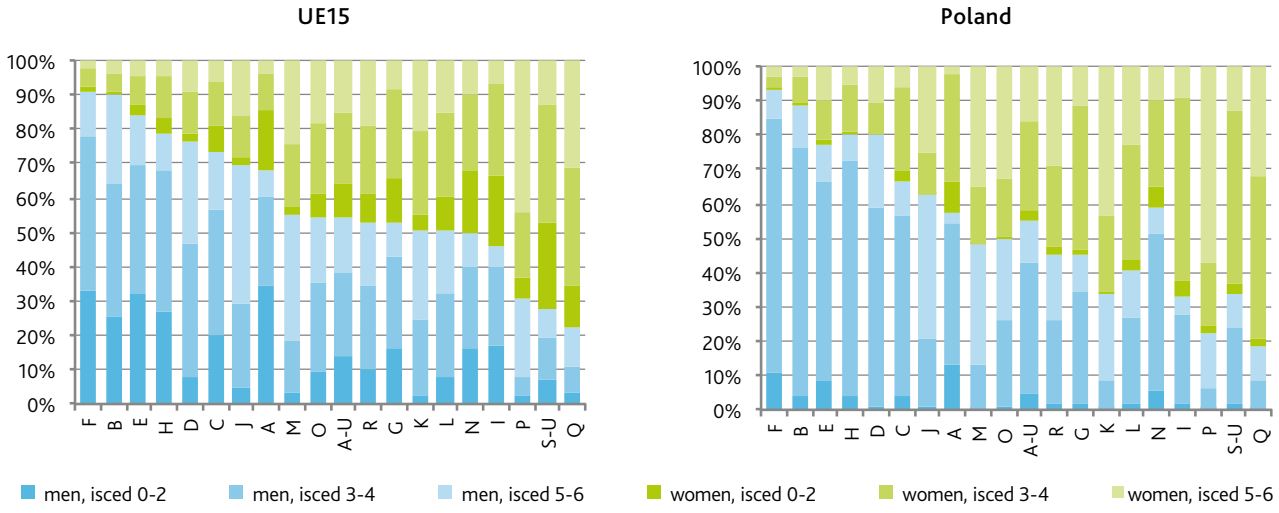
| | | education ISCED 0-2 | education ISCED 3-4 | education ISCED 5-6 |
|---|---|---|---|---|
| The share of workers with a given level of education in the structure of employment in Poland | | 7 | 64 | 29 |
| The share of workers with a given level of education in the structure of employment in the EU15 | | 24 | 45 | 31 |
| Difference between Poland and the EU15 | | -16,7 | 19,4 | -2,7 |
| decomposition | The effect of differences in educational structure within individual sectors | -18,7 | 16,0 | 2,7 |
| | The effect of differences in sectoral structure in total employment | 3,6 | 0,1 | -3,7 |
| | Residual | -1,6 | 3,3 | -1,7 |

*Source: Own calculations.*

As we have already shown, Poland in comparison to Europe's main industrial nation, Germany, has well developed industries producing food and beverages, furniture, clothing, and wood products. Jobs in those industries are generally manual and repetitive, only sometimes requiring the use of simple machines. They do not require university level knowledge and skills. Hence there is a lower proportion of highly educated workers in those industries than in the entire economy (see Figure I.31). Of all the sections of manufacturing, the highest proportion of university graduates is found in the production of pharmaceuticals, which in this regard is similar to most advanced service industries. In other industries, an above-average use of high qualifications can be found in the production of transport, electronics, machinery and in the chemical industry, i.e. industries in which Poland's southern neighbours have a much stronger comparative advantage than Poland.

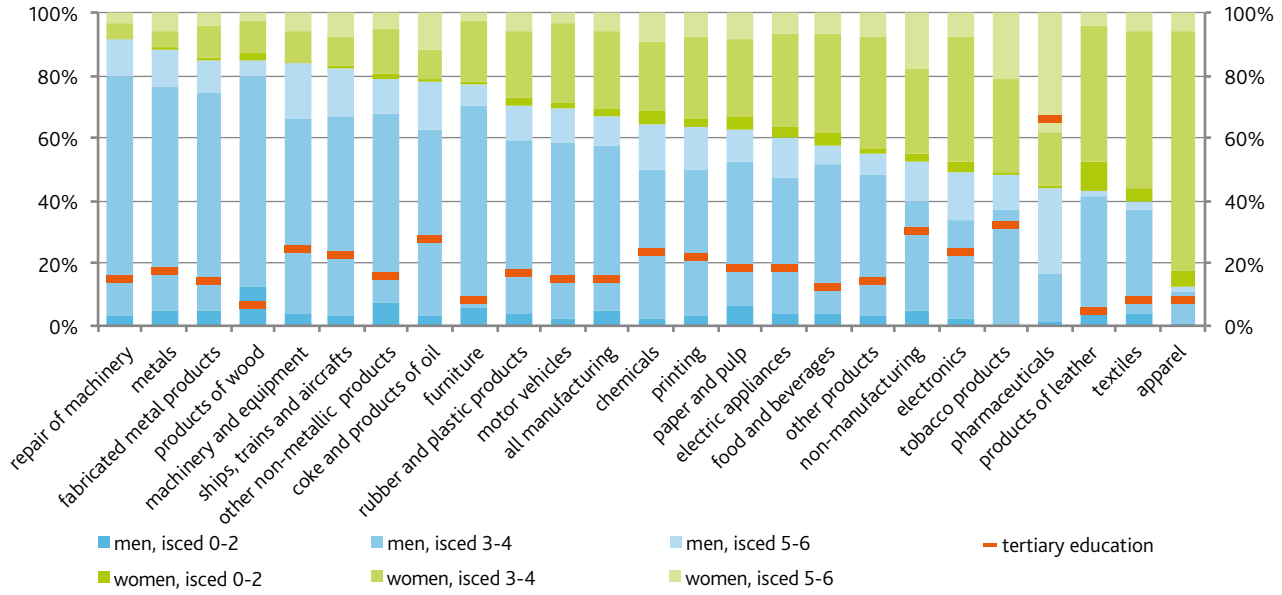
The decomposition results shown in Table I.3 shed more light on differences in educational structures of the workforce in Poland and the EU15. A difference in the share of a given educational level between Poland and the EU15 can be decomposed into the effect of a different educational structure *within* sectors in Poland and the EU15, and the effect of a different sectoral structure of total employment. The decomposition reveals that in the case of tertiary education (ISCED 5-6) Poland has relatively more university graduates *within* individual sectors, but relatively fewer people working in sectors with a high proportion of highly-qualified workers. This means that the structure of economic activity in Poland does not promote the use of high qualifications as much as the EU15 economies do. However, it can be expected that if the sectoral structure of the Polish economy converges to the EU15 economic structure, the demand for high qualifications will grow. For the other levels of education, the decomposition shows the key role of the supply of qualifications *within* industries. In addition, employment in industries characterised by a higher share of low-qualified workers is relatively higher in Poland than in the EU15.

### Figure I.29. Feminisation and educational structure of employment in NACE sections in Poland and EU15 in 2011.




*Source: Own elaboration based on EU LFS data.*

Figure I.30. **Feminisation and educational structure of employment in manufacturing sections in Poland in 2010 (%).**

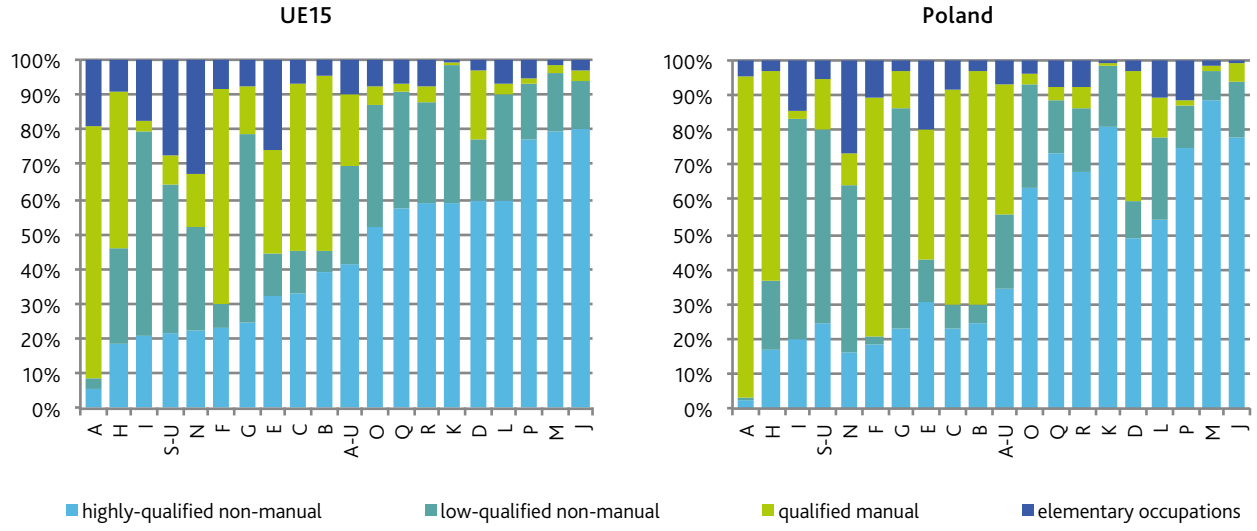



*Source: Own calculations based on Polish Labour Force Survey data.*

The type of job influences, to some extent, the gender structure of labour demand. Employment of men clearly dominates in sectors where work requires physical strength or endurance. The highest masculinisation, approx. 90%, can be found in construction and mining. Other industries with high masculinisation are transportation and storage, energy and water supply, and waste management. Also manufacturing, both in Poland and the EU15, exhibits above-average masculinisation, especially in heavy industry: metallurgy and machinery. On the other hand, the highest share of women among workers can be found in the textiles and apparel industries, as well as in the production of pharmaceuticals. In the service sector, the highly feminised branches are primarily education, health care and social work, and to a lesser extent accommodation and food service.

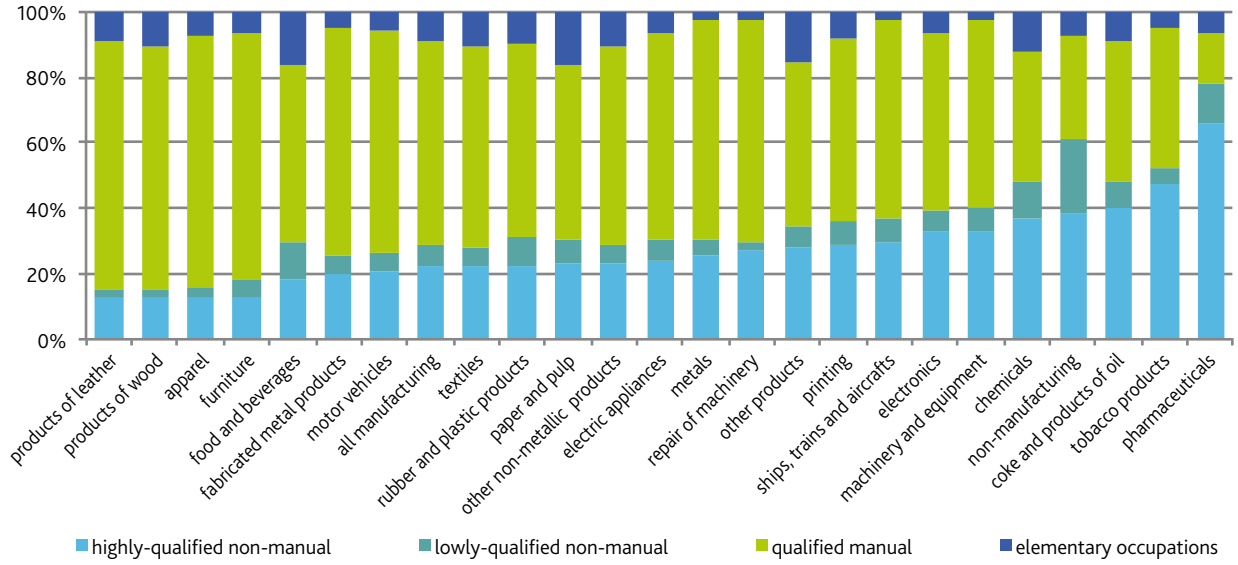
The highest demand for highly qualified professions is found in sectors requiring non-manual labour: information and communication, professional, scientific and technical activities, and education. In these industries approx. 80% of jobs are skilled non-manual. In Poland, this group also includes finance and insurance. The same industries have the highest share of employees with university education. This is due to the fact that

Figure I.31. **Occupational structure of employment in NACE sections in Poland and the EU15 in 2011 (%).**




*Source: Own elaboration based on EU LFS data.*

Figure I.32. **Occupational structure of employment in sections of manufacturing in Poland in 2010 (%).**




*Source: Own calculations based on Polish Labour Force Survey data.*

requirements regarding the education of the candidate for the job are highly correlated with the type of occupation.[4] Demand for non-manual low-skilled labour is dominant in some services, especially those relying on direct contact with customers, such as accommodation, food service and wholesale. Manual occupations are concentrated in agriculture, manufacturing, construction, and also in transport and storage – part of the services sector. Elementary occupations do not play a dominant role in any of the sectors, although a relatively high proportion can be observed in water supply and waste management (e.g. refuse workers), and administration and support service activities (e.g. cleaners).

A comparison of Poland and the EU15 reveals a similar age structure of industries. Branches that are characterised by a high share of young workers in the EU15 also have a higher proportion of young workers in Poland. They consist of branches with a high turnover of workers, namely accommodation, food services, and trade and repairs. They also do not require high skills or much experience, and as such they attract young people just entering the labour market or combining education with work. The high share of young workers in information and communication results from the supply of skills; in the labour market, particularly in Poland, there are few older people who graduated from computer science or other faculties required in IT. Agriculture is at the other extreme; the large share of older workers is caused by the outflow of young people who choose work outside agriculture.

4 There is a strong relationship between the official classification of occupations (ISCO standard) and the qualifications sought by employers. The official classification of occupations orders professions according to the level of qualifications needed to perform a job. In ISCO, occupations with low digits (1 – managers and officials, 2 – professionals) are characterised with high qualification requirements for job candidates. The higher the digit, the lower the education requirements (cf. Kocór, Strzebońska, Keler (2012), p. 45, based on the Study of Human Capital, module Research of Job Offers 2011 (in Polish)).

## 2.2 CHANGE IN THE OCCUPATIONAL STRUCTURE IN POLAND AND THE OECD

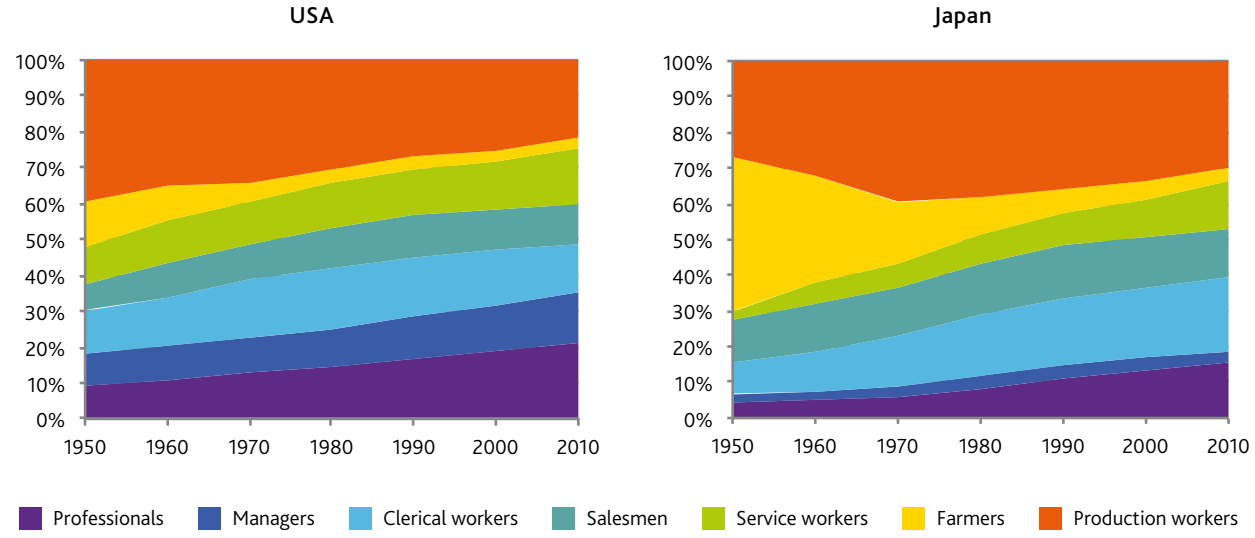
Change in the sectoral structure of the economy is followed by changes in demand for skills. This is because services require qualifications and skills other than those for industry or agriculture. Hence deagrarization, industrialisation and servitization contribute a changing structure of labour demand in terms of qualifications. Furthermore, technological progress contributes to shifts in the structure of skills within sectors. In recent decades, automation and computerisation have been crucial in the demand for qualifications. As shown by Murnane and Levy (2003), the growing use of computers and digital technology in a variety of professions has increased the demand for highly qualified workers. This is especially manifested in the increased share of skilled workers in total employment. A continuous increase in the share of professionals in the employment structure has been observed in all European Union countries over the last decade. Figures I.33 and I.34 show that in the case of some OECD countries (including United States, Germany, Japan) this trend dates back to the 1960s, when the share of professionals was less than 10%. In 2009, it was twice as high as in 1960, and in Japan and Germany as much as three times higher.

A growing share of professionals has also been observed in Poland. The share of this group in total employment has steadily increased from 9% in 1995 to 18% in 2012. This growth was one of the fastest in the European Union and so in 2012 the share of professionals in total employment in Poland did not differ significantly from the EU15 average. In addition to the decline in employment in agriculture-related occupations, the significant increase in the employment of professionals has been a major change in the occupational structure of employment in Poland over the previous ten or so years. Besides specialists, the skilled workers category also consists of managers. Their share in

employment has been stable at around 6%, a typical value for the countries of the European Union. Although historically the share of managers in employment grew in developed countries starting from the 1960s, from 1995 to 2012 the share of workers in managerial positions fell slightly or remained unchanged in most EU countries.

In addition to managers and professionals, technicians are another occupational group that requires a relatively high level of qualifications. Compared to the EU15 or NMS (e.g. Czech Republic, Slovakia or Hungary), Poland has a relatively low employment of technicians at 11% of all employed, and virtually zero dynamics of change from 1995-2012. The same was the case in Portugal. In contrast, those EU15 countries which have a very high share of technicians employed (above 20%) such as France and Germany, have seen a significant increase in the share of this group from 1995-2012, by approx. 3 percentage points. Therefore, one can speak of a divergence of European economies in terms of the demand for technicians over the last ten or so years.

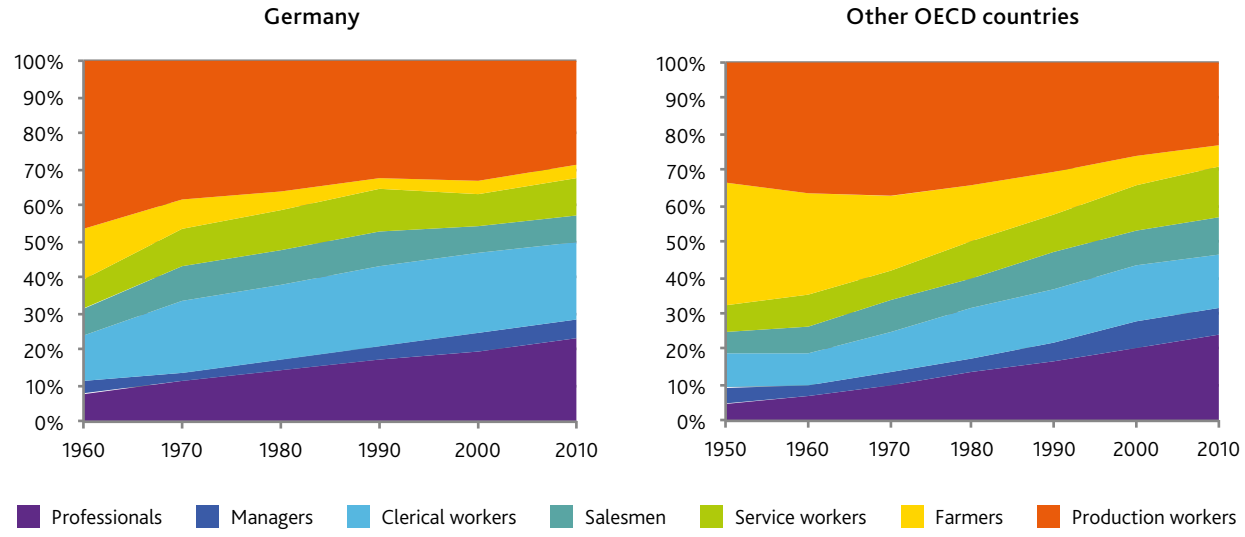
Figure I.33. **Change in the occupational structure of employment in the United States and Japan between the years 1950 and 2009.**




*Notes: Due to the historical character of the presented data, the classification of occupations presented in the Figures is not entirely consistent with the current division of occupations in Europe, based on ISCO standards.*

*Source: Elaboration based on Handel (2012), p. 34.*

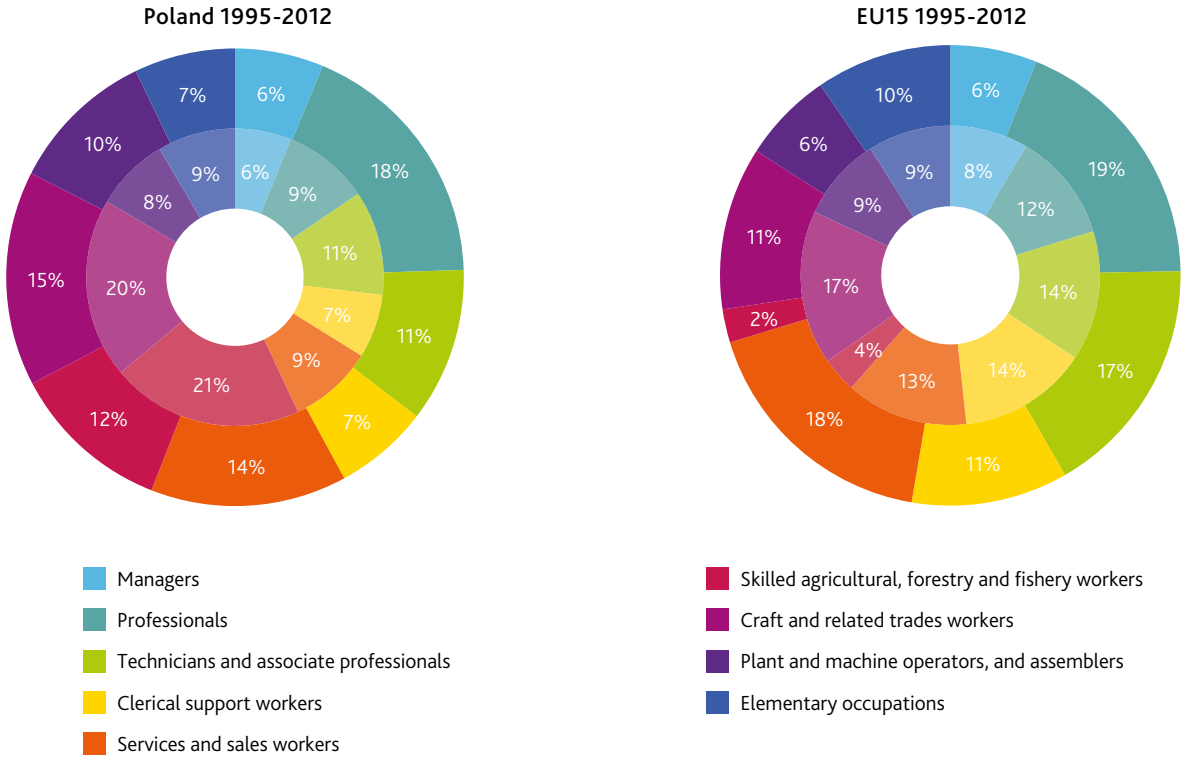
Figure I.34. **Change in the occupational structure of employment in Germany and OECD countries between the years 1960 and 2009.**




*Notes: Due to the historical character of the presented data, the classification of occupations presented in the Figures is not entirely consistent with the current division of occupations in Europe, based on ISCO standards.*

*Source: Elaboration based on Handel (2012), p. 34.*

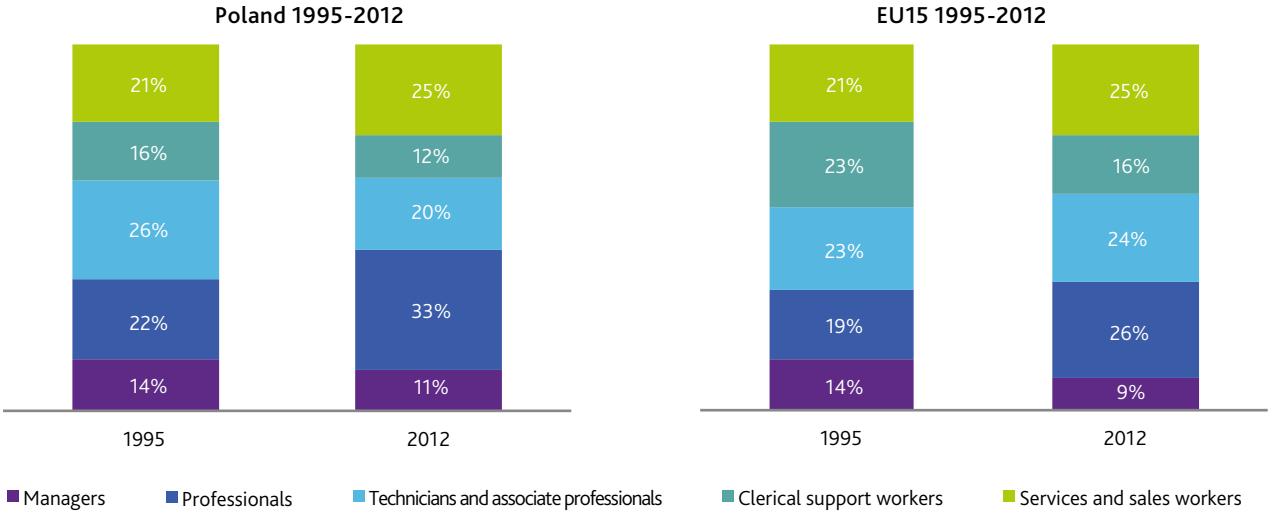
Figure I.35. **Occupational structure of employment in Poland and EU15.**




*Source: Own elaboration based on Eurostat data.*

The group of non-manual occupations also consists of jobs with relatively low qualification requirements, e.g. office clerks and personal service workers. The share of the former in total employment in Poland stood at around 7% from 1995 to 2012. In the EU15, the importance of this occupational group fell from 14% in 1995 to 11% in 2012. It is also worth noting that the proportion of clerks in the 1990s was higher in high-income countries compared to middle-income countries. The arithmetic mean of the 10 NMS countries in 1999 was 8%, while for the EU15 it was 13%. In 2012, the difference was reduced from 5 to 2 percentage points, which was mainly associated with a decline in employment in this group in high-income countries. A different situation occurred in the group of personal service workers. The share of workers in this occupational group has grown steadily in all countries. In Poland it increased from 9% to 14% between 1995 and 2012. The average level in the EU15 has increased by 5 percentage points, from 13% in 1995. A significant increase in the number of personal service workers can be linked to the growing importance of services in the economies of the European Union (see Section 1.3).

Figure I.36. **Occupational structure of non-manual jobs in Poland and EU15.**



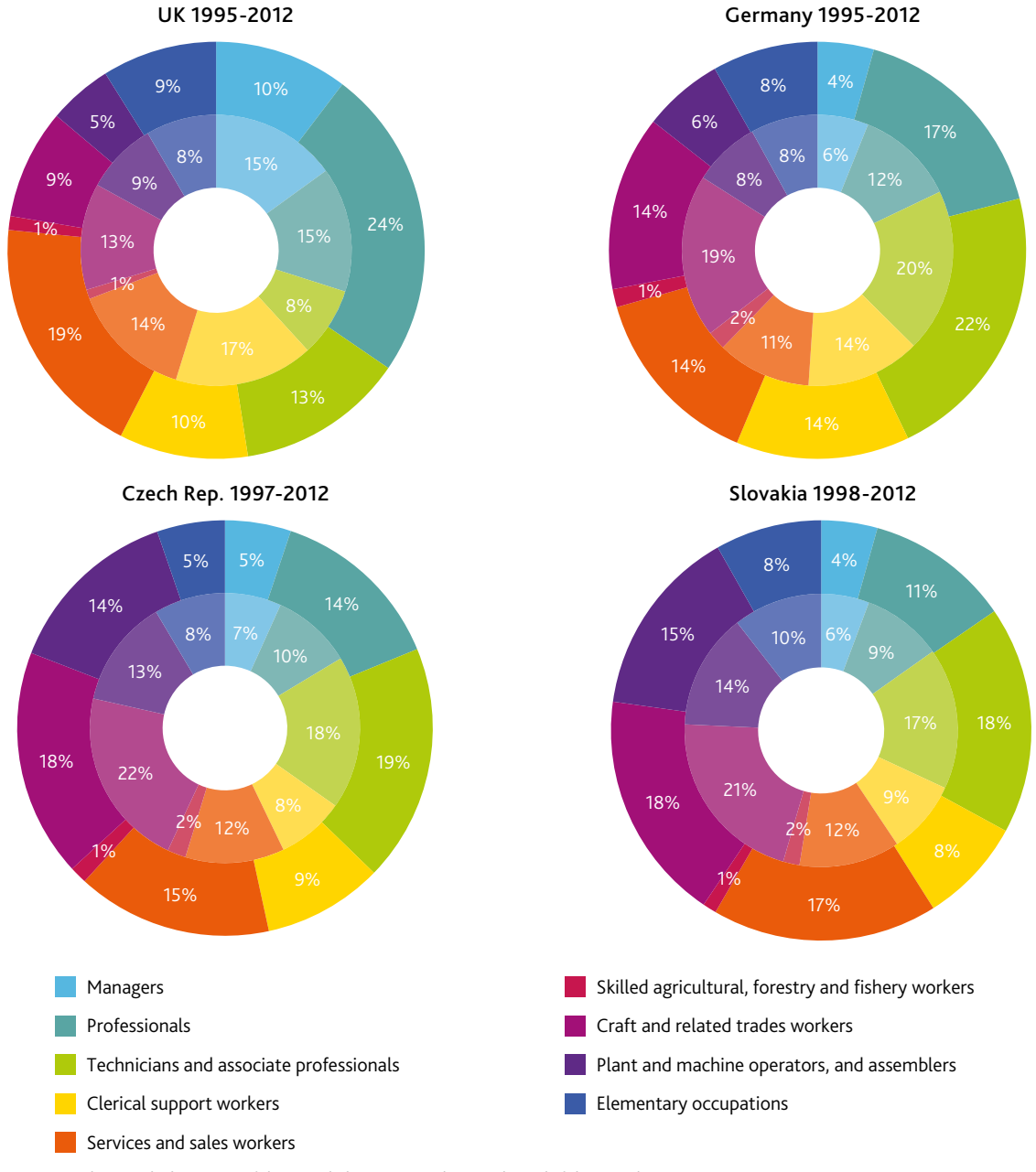

*Source: Own elaboration based on Eurostat data.*

The last group contains the elementary occupations that require a very low level of skills and qualifications. Interestingly, the EU15 countries have seen a growing demand for this kind of work. This phenomenon is explained by the polarisation of employment, to be discussed in greater detail in the next section. However, this was not the case in most of the NMS10 that experienced falling employment in elementary occupations. In Poland the percentage of workers in elementary occupations declined from 9% to 7% of total employment between 1995 and 2012. This is another factor pointing to significant differences in changes in labour demand between the EU15 and the NMS10.

## 2.3 DETERMINANTS OF CHANGE IN THE STRUCTURE OF LABOUR DEMAND

The previous section on historical trends was descriptive, so in the present section we will analyse the determinants of labour demand. Literature mentions two factors which may influence the structure of labour demand. The first relates to technological changes (see Murnane and Levy, 2003). The introduction of new technologies results in an increase of productivity in some

Figure I.37. Occupational structure in selected European countries




*Notes: The inner ring denotes the beginning of the period; the outer ring denotes the end of the period.*

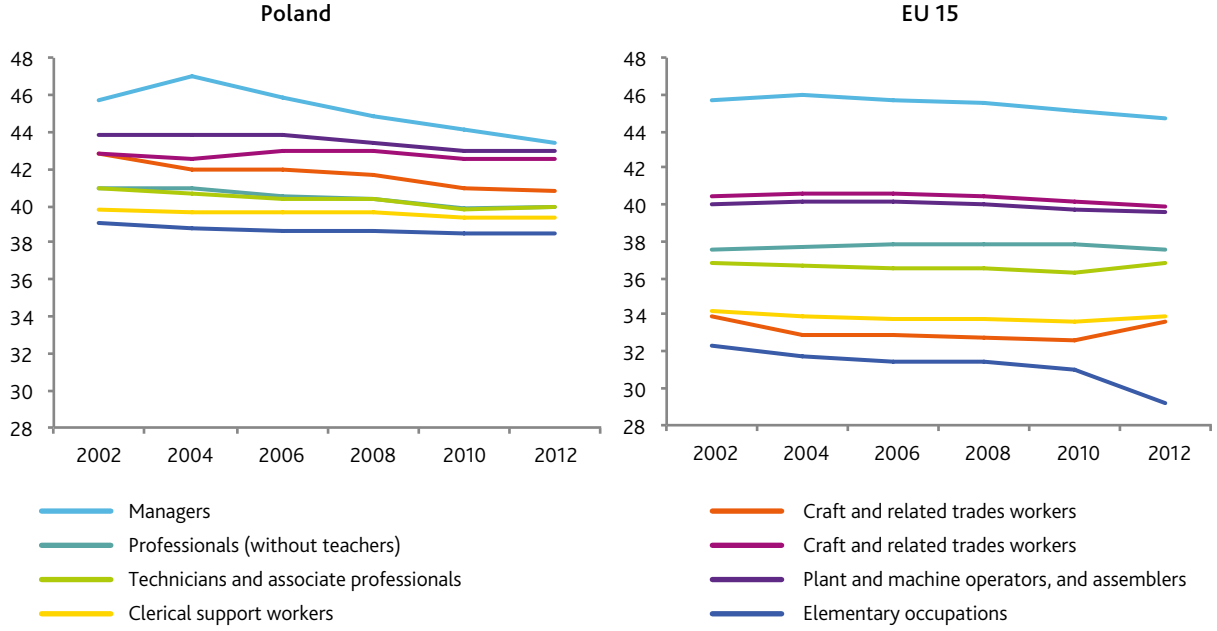
*Source: Own elaboration based on Eurostat data.*

## Box I.5. Hours worked and hourly wages

In 2012, the average number of hours worked per week in Poland was 40.7 hours, one of the highest in the EU. The high position of Poland was due to the low incidence of part-time work. In the Netherlands and Denmark, countries with the highest percentages of people working part-time, average hours worked per week amounted to 30.0 and 30.7 hours. It is worth noting that in both these countries the percentage of employees satisfied with the number of hours worked is the highest in the EU, exceeding 90%, compared to 78% in Poland (Eurobarometer 2014). It should be added here that the availability of employment contracts with a reduced working time, along with access to child care services, is a major institutional instrument for increasing the labour market participation of women.

Both in Poland and the EU15, managers, labourers and operators work much longer than average. In the EU15 the average number of hours worked is strongly diversified across occupational groups, while in Poland it is more centred close to the mean. In Poland, the lowest average number of hours worked is by professionals, mainly teachers. After the exclusion of teachers from the sample, the number of hours worked per week by professionals does not differ significantly from the average. The lowest number of hours worked is shown by office clerks and elementary occupations. It is worth noting that the difference between these two groups and the average for all workers is small, less than two hours. For comparison, the difference in the EU15 amounts to more than 7 hours per week. Similar to Poland, EU15 occupations with the lowest average number of hours worked include office clerks, personal service workers and sales workers (which is associated with the feminisation of those groups), and the elementary occupations.

Figure I.38. **Average number of hours worked per week in Poland and EU15 2002-2010.**

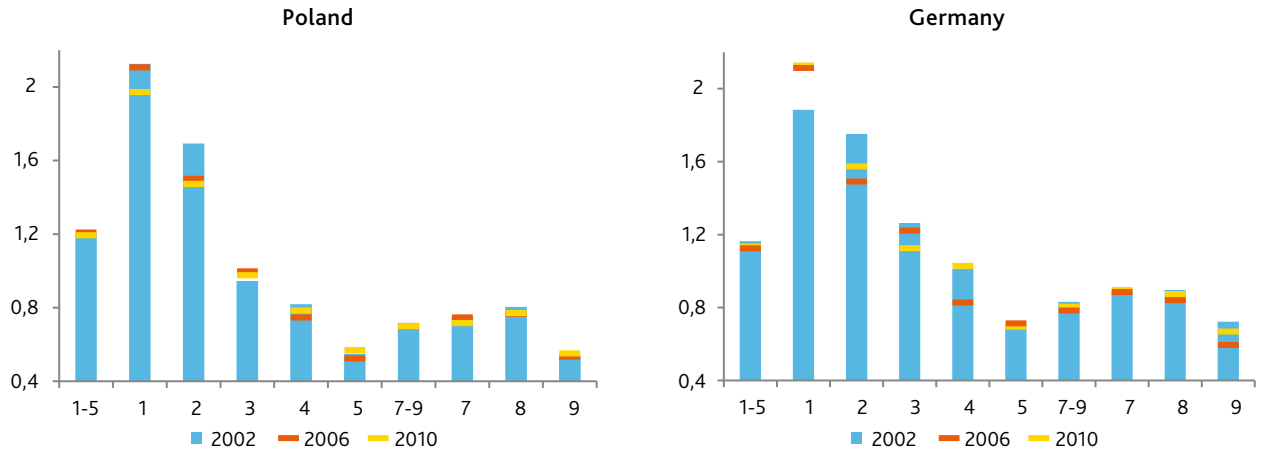



*Source: Own elaboration based on Eurostat data.*

In 2010, the hourly wage of manual workers in the EU27 (ISCO 6-7) was on average 37% lower than the non-manual workers (ISCO 1-5). The difference in pay between these two groups was particularly small in Nordic countries and relatively larger in the new Member States, Portugal and the UK. These differences are due to differences in the productivity of workers in different occupations, scarcity of certain qualifications, and to some extent the social model. The ranking of jobs by hourly wage is roughly the same in all EU countries, which provides indirect information about the relative productivity of jobs. The top-paid, and hence supposedly the most productive, are managers (group 1), closely followed by professionals. In both cases, those occupations generally involve the requirement of university education. The lowest hourly wage applies to sellers, personal service workers and elementary occupations. Analysing Figure I.39, it is worth noting that the relative hourly wage of professionals has decreased in Poland, which seems to be associated with the increasing number of hours worked in this group of occupations (see Figure I.38) and the growing number of well-educated potential employees entering the labour market.

Box I.5. cont. **Hours worked and hourly wages**

Figure I.39. **Average hourly wages against average wages, by occupation, in entities hiring at least 10 people, in Poland and Germany 2002-2010.**




*Note: Numbers on the horizontal axis refer to ISCO occupational group classifications.*

*Source: Own elaboration based on Eurostat data.*

Changes in hourly labour supply depend on the relative strength of substitution and income effects. When the income effect is stronger than the substitution effect, the increase in wages results in a decreased number of hours worked. When the substitution effect predominates, labour supply increases. An especially negative influence on labour supply is exerted by taxation of the income of second earners, mainly women. In effect, labour supply among women has a greater wage elasticity than among men; changes in wages, e.g. due to labour taxation changes, are less significant for men than for women. On the other hand, the number of hours worked, especially among low-skilled workers, significantly depends on the regulations concerning working hours, protection of employment and regulations limiting competition in the product market (Causa, 2008).

From a macroeconomic perspective, we can see a long-term downward trend in the number of hours worked, dating back as early as the late 19th century. In this long horizon, the decrease in average working hours has resulted from technological progress and the introduction of work time regulations. Despite similar initial levels in the 1960s, the average working hours in the US and Western Europe have diverged (Alesina, Glaeser and Sacerdote, 2005). In the case of male workers, this has happened due to a faster decrease in the number of hours worked in Western Europe than in the United States. In the case of women, from 1975 to 2010 Europe experienced a fall in the intensity of labour supply, and the United States experienced an increase (Blundell, Bozio and Laroque, 2011). A number of researchers indicate that changes in working hours in Europe compared to the US can be explained by differences in fiscal policy, especially higher taxation on labour and higher social benefits in Europe (see Berger, Heylen 2011; Langot and Quintero-Rojas, 2008; Ohanian, Raffo and Rogerson, 2006; Prescott, 2004). Alesina, Glaeser and Sacerdote (2005) also emphasise the role of the different number of days off work throughout the year, and the increased popularity of part-time jobs in Europe. Importantly, the EU countries did not seem to converge in terms of working hours – countries which in the early 1990s had relatively long working hours have not changed their position in this regard (Deloitte 2010).

Langot and Quintero-Rojas (2008) show that although most countries experienced a long-term decrease in the total number of hours worked (per year) up to the early 1980s, the total number of hours worked in the economy since has remained at the roughly the same level in Belgium and Italy, and is still decreasing in France, while in Spain, the UK and the US it is growing. The annual number of hours worked per employee has shown a constant decline in Belgium, France, Italy and UK. In Spain this decrease started as late as about 1970, and was especially intensive before 1980. In the US the annual number of hours worked per average employee has been rather constant since the early 1980s. Importantly it is the US (with stable working hours) and the UK (where it has been decreasing) which have experienced growth in the employment rate. In the other countries, employment rates have been stable in the medium term (in some of them the working hours have been getting shorter, while not in others), while previously the employment rates used to decrease together with a decreasing number of hours worked. This lack of systematic connection between the trends in employment rate and average number of hours worked results from the fact that the main factors explaining the decrease in hours worked per employee are different from those that influence the employment rate. The average number of hours worked depends mainly on labour market regulations (the obligatory number of free days) and taxation, while the employment rate is shaped by the availability and level of unemployment benefits, and the model of collective bargaining.

**Box I.5. cont. Hours worked and hourly wages**

Nonetheless, policymakers often seem to believe in the existence of a link between the average number of hours worked and the percentage of employed at working age. It was hoped that a forced reduction in the weekly number of hours worked would mean increased employment and reduced unemployment rates. This argument was used by trade unions in Germany in the 1980s and 1990s (Hunt 1999), and also in connection with the official French cut of weekly working hours from 39 to 35 in 2000 (Aubry reform). However, as argued by Cahuc and Zylberberg, there are no well documented results to confirm that the reduction in number of hours worked results in the creation of jobs (Artus, Cahuc and Zylberberg, 2007, p. 132). In addition, empirical research in this area brings inconsistent results. The decrease in hours worked in German industry, negotiated by trade unions in 1985, resulted in higher hourly wages and a decrease in the number of employed (Hunt 1999). Crépon and Kramarz (2002) estimate that the decrease by one hour in weekly working hours in France in 1982 resulted in the loss of 2%-4% of jobs. On the other hand, Rapose and van Ours (2010) show that the reduction of hours worked in Portugal from 44 to 40 hours a week, increased employment via a lower rate of destruction of jobs.

*Source: Own elaboration.*

groups of occupations, which is followed by increased labour demand in them. In the recent decades, this could be observed for computer professionals. After some occupations are automated, they disappear, for example craftsmen. With the advent of mass production, craftsmen were not able to compete with the increasingly efficient enterprises and were pushed out of the market. It is worth noting that currently machines and computers are able to perform not only physical labour, but also non-manual tasks, e.g. associated with the processing of data.

International trade is another factor of change in the structure of labour demand; liberalisation of trade made it possible for countries to specialise in production. According to the classical theory of trade, countries should specialise in their areas of comparative advantage (see Box I.2). As indicated by Blinder and Krueger (2009) in developed countries, offshoring results in decreasing labour demand in sectors requiring low skills while it contributes to increased employment in occupations which require high skills. This happens due to the fact that countries with high incomes enjoy a comparative advantage in technology and human capital intensive production. This implies the reallocation of part of production from developed countries to developing ones, which indirectly affects the structure of labour demand.

Goos, Manning and Salomons (2010) indicate that in the UE15 the structural change in labour demand has mainly been driven by technology. Some of this role can also be attributed to offshoring, but the quantitative influence of this factor has been much smaller. Furthermore, in Poland offshoring is of a different nature and intensity than in Western Europe (cf. *Employment in Poland 2010*, chapter IV.2). In a further part of this chapter we will focus on the significance of technological progress on the structural evolution of labour demand.

Information and communication technologies are complementary to the demand for workers with high qualification, and to increased worker productivity. This especially relates to occupations with non-routine tasks,[5] requiring specialist knowledge. This, however, is not the only effect of ICT on the structure of employment, where in highly developed countries office clerks (performing repetitive tasks) are being replaced by computers [Goos and Manning (2007), Katz and Kearney (2008), Goos, Manning and Salomons (2010)]. Indeed, in the EU15 the share of office clerks in total employment decreased from 14% in 1995 to 11% in 2012. In Poland this share has been relatively stable, although with a slight downward trend – from 2002 it declined from almost 8% to a little over 7% in 2012.

Besides computerisation, the occupational structure in Poland has also been influenced by the mechanisation and automation of manufacturing. Computerisation concerns mainly non-manual labour, while automation also has a significant effect on manual labour. Some manual tasks which were initially performed by people are now being performed by machines, or with their help. This process leads to a reduction of employment in manual jobs, which is especially visible for industrial labourers and agriculture workers.

As mentioned previously, between 1995 and 2012 Poland saw a decrease in the share of manual workers from 49% to 37%. However, that change was not homogenous for all occupations in this category. In the analysed period, the share of machine operators (ISCO group 8) increased by 2 percentage points, while the employment of labourers (ISCO group 7) dropped by 5 percentage points. This also indicates that manual jobs that are complementary to technology, experience rising demand. Moreover, within the group of manual jobs, one can see a reallocation from labourers to machine operators – Polish Labour Force Survey data shows that more than 40% of employment inflow to machine operators is from labourers.

Another fact showing how technological progress favours highly qualified workers is the growing wage disparity between university graduates and workers with secondary or vocational

5 Non-routine tasks are those which cannot be automated.

## Box I.6. Job polarisation

Highly developed countries experience the disappearance of middle-level jobs. These are, for example, non-manual jobs which are repetitive and require precision – as such, they can be described as routine cognitive jobs. The typical example of such work is office work associated with the registering of information or simple calculations. As indicated by Goos and Manning (2007) for the United Kingdom, Katz and Kearney (2008) for the United States, and Manning and Salomons (2009) for the EU15, the introduction of ICT has resulted in the automation of many tasks which previously were performed by medium-skilled workers.

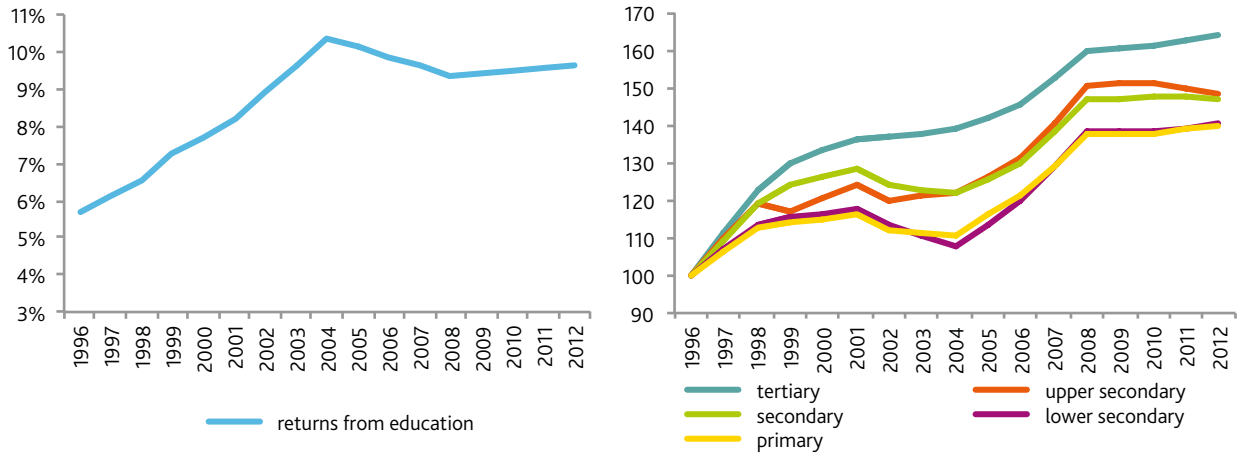
In addition to the disappearance of the middle-level jobs, computerisation resulted in the increased employment in non-routine jobs, where automation is rather difficult. On one hand, these are jobs that require high skills used for solving unconventional problems. On the other hand, these are jobs associated with elementary occupations that does not require qualifications but cannot be presented as an algorithm and be automated. One example of such labour is the preparation of meals in fast food restaurants.

Due to the fact that the type and degree of complexity of required skills is directly associated with remuneration, computerisation results in increased employment in the best and worst paid skills. This is known as the job polarisation, i.e. a growing demand for well-paid jobs requiring high skills and poorly paid jobs not requiring specific skills.

Poland has also seen some signs of the job polarisation. First, there has been an increase in the number of jobs requiring relatively high skills. Secondly, some manual jobs requiring medium skills have started to be pushed from the market, e.g. craftsmen. On the other hand, the share of office clerks did not show any significant decrease in the years 1995-2012 and the employment in elementary occupations decreased. Hence, it seems that the polarisation in the labour market alone cannot be used to explain the change in the occupational structure in Poland.

*Source: Own elaboration.*

Figure I.40. **Returns to education and dynamics of real wages by education in the years 1996-2012.**




*Notes: Returns to education are estimated using the Mincerian wage equation (Mincer 1974).*

*Source: Own elaboration based on data from the Polish Structure of Earnings Survey.*

education. Figure I.40 shows that this difference grew from 1996-2004. At the same time, as we show in Part II, the number of university students doubled and the number of graduates rose rapidly. A rising tertiary education wage premium suggests that the demand for high qualifications expanded at a faster pace than the supply of high qualifications. The trend of a rising tertiary education wage premium partially reversed in 2004 and between 2006 and 2008 the difference decreased; in 2008 it began to grow again, although at a slower pace. The phenomenon of growing returns on education is consistent with the theory that technological progress in the last decades has increased demand for highly qualified workers compared to low-qualified workers (Katz and Murphy, 1992).

Murnane and Levy (2003) argue that analysis based on a division into high and low skilled workers does not fully reflect the effect of technology on the labour market. Each job consists of many tasks which can be grouped according to certain characteristics. Based on Acemoglu (2010) there are five groups of tasks: (i) non-routine analytical, (ii) non-routine interpersonal, (iii) routine cognitive, (iv) non-routine manual and (v) routine manual. Analytical tasks require logical thinking and creative

problem-solving. Interpersonal tasks relate to communication with other people, especially team management. Routine cognitive tasks require a precise performance of repetitive mental tasks. Manual tasks can be divided into routine tasks which require short repetitive activities, and non-routine tasks. It must be emphasised that the routine or non-routine character of a given task is not linked with the manual or non-manual character of the task. Distinguishing routine tasks is important as these are the types of tasks that may undergo automation with the use of computers.

Table I.4. shows the mean intensities of tasks in nine major groups of occupations. In occupations with lower id (managers, professionals and technicians) most tasks are non-routine, analytical and interpersonal. The highest index of analytical tasks was found in the group of professionals, with interpersonal tasks most intensely performed in the group of managers. The higher the id assigned to the occupational group, the lower the level of both these indexes; their lowest levels were observed in elementary occupations. A reverse situation occurred in manual tasks. The higher the id of the occupational group, the higher the intensity of manual tasks. The relationship between the classification id of the jobs and the task index indicates that non-routine cognitive tasks (analytical and interpersonal) are concentrated in high qualification jobs, with manual tasks in jobs requiring low qualifications. In routine cognitive tasks there is no such unequivocal relationship. The lowest values of the index for this type of tasks can be found among managers, professionals

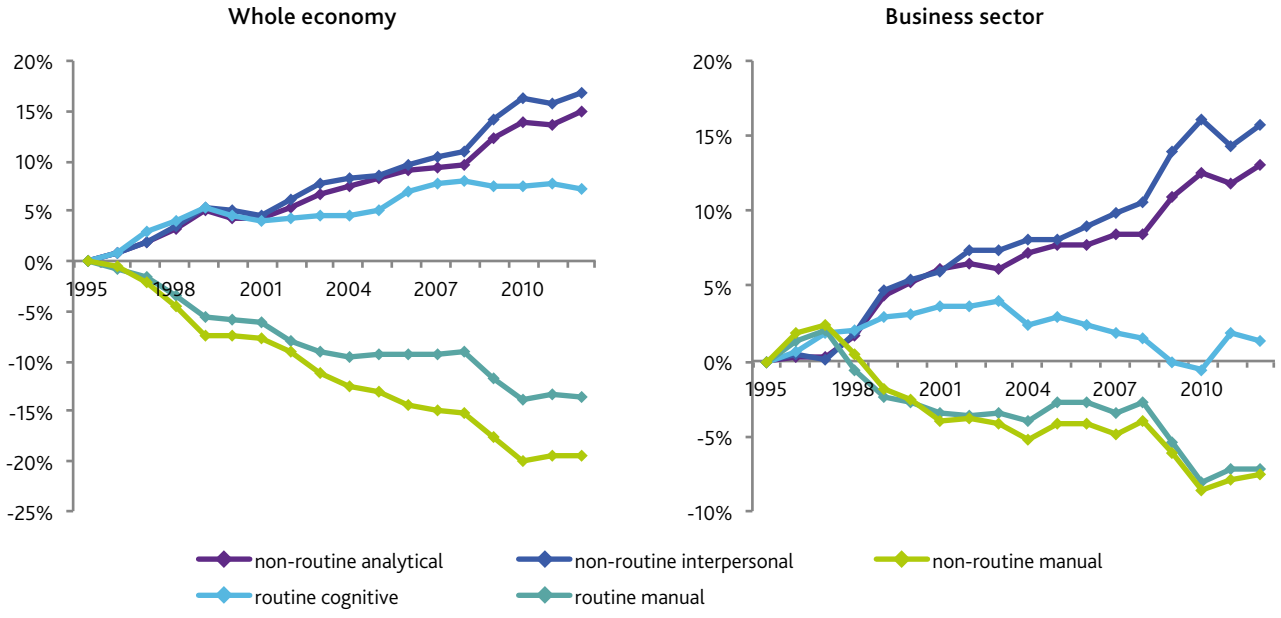
Table I.4. **Groups of occupations and intensity of tasks in Poland in 2012**

| | tasks | | | | |
|---|---|---|---|---|---|
| Id, Occupations | non-routine analytical | non-routine interpersonal | routine cognitive | non-routine manual | routine manual |
| 1. Managers | 0,73 | 1,61 | - 0,56 | - 0,87 | - 0,74 |
| 2. Specialists | 0,86 | 0,76 | - 0,44 | - 0,88 | - 0,90 |
| 3. Technicians | 0,15 | 0,23 | 0,29 | - 0,43 | - 0,38 |
| 4. Office clerks | - 0,62 | - 0,50 | 0,96 | - 0,26 | - 0,69 |
| 5. Service and sales workers | - 0,71 | - 0,13 | 0,05 | - 0,48 | - 0,17 |
| 6. Farmers | - 0,88 | - 0,66 | - 1,06 | 0,44 | 1,04 |
| 7. Labourers | - 0,56 | - 0 ,41 | 0,06 | 0,77 | 0,88 |
| 8. Machine operators | - 0,65 | - 0,31 | 0,19 | 0,85 | 1,06 |
| 9. Elementary occupations | - 1,07 | - 0,79 | - 0,29 | 0,80 | 0,69 |

*Notes: Task Indices were standardised (mean in the population is equal 0, and the standard deviation is 1 for each index). A higher value of an index denotes the higher significance of a given task in the occupation.*

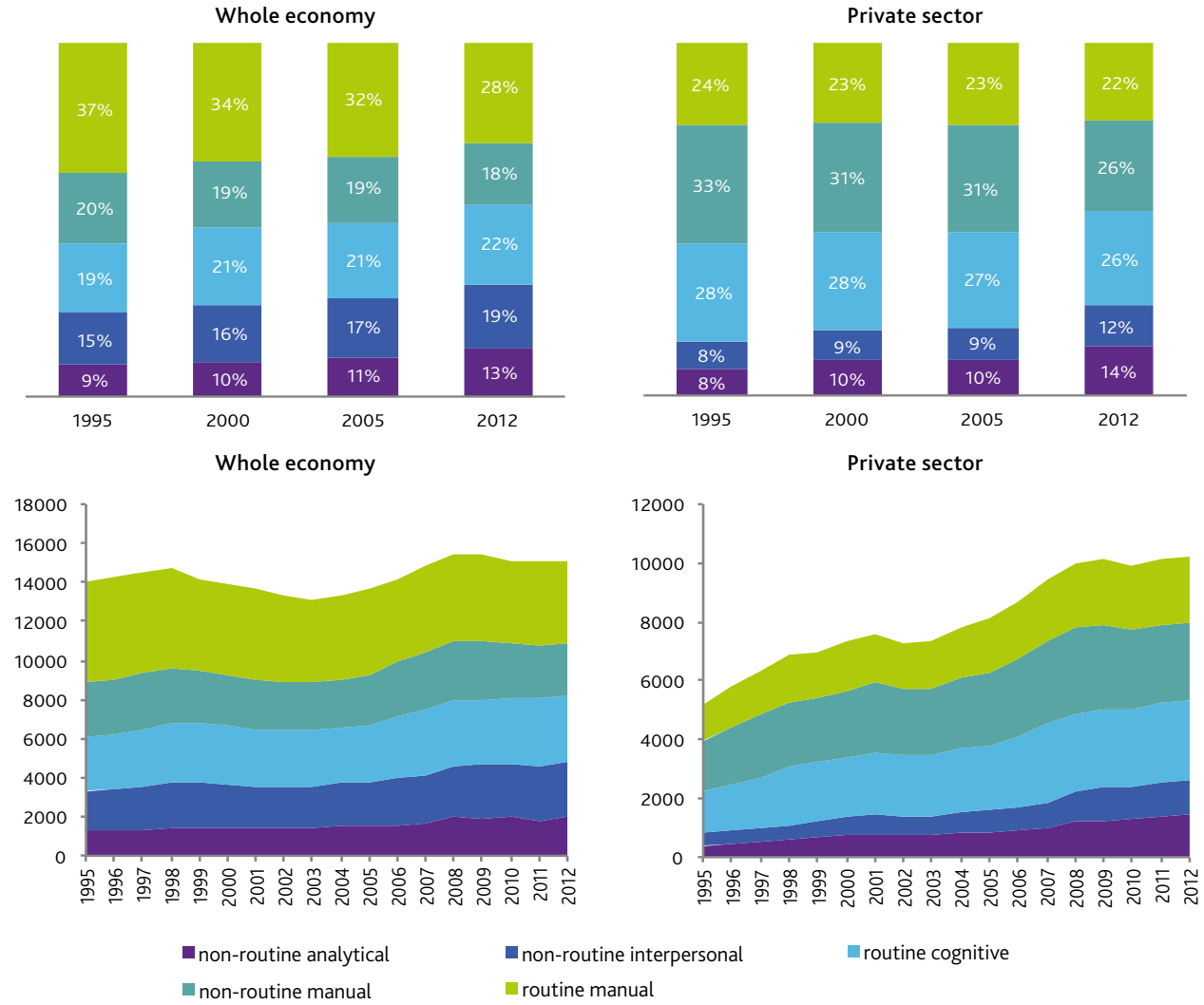
*Source: Own elaboration based on O*net and the Polish Labour Force Survey.*

Figure I.41. **Task indices in Poland 1995-2012**




*Source: Own elaboration based on Polish Labour Force Survey and O*net.*

Figure I.42. **Employment structure (upper panel) and the number of employed in thousands (bottom panel) by the main type of performed tasks in occupations in Poland 1995-2012.**




*Notes: Each occupation is assigned a dominant type of task, identified as the type of task with the highest intensity-of-use index.*

*Source: Own elaboration based on the Polish Labour Force Survey and O*net.*

and also elementary occupations. Routine cognitive tasks are typical for jobs requiring medium skills; especially high levels of this index can be found for office clerks.

The average intensity of tasks in the economy has changed over time. Figure I.41 shows that Poland has seen a distinct reallocation from manual tasks to cognitive and interpersonal tasks. This points to the importance of the modernisation process from 1995 to 2012. Compared to developed countries, Poland has not experienced the direct result of computerisation, namely a decline in routine cognitive index at the level of the entire economy. On the contrary, Figure I.41 shows a clear increase in the importance of this kind of task. However, the increase in the relative importance of routine cognitive tasks in the Polish structure of labour has been mainly due to a decrease in the number of farmers who do not perform such tasks. Additionally, the structure of tasks in the entire economy takes into account the public sector, which is not wholly subject to market forces. For this reason, it is worth taking a look at the situation in the business sector to eliminate the effect of the public sector and agriculture, since the vast majority of farmers in Poland are classified as self-employed. It turns out that trends for analytical, interpersonal and manual tasks are similar to those observed for the entire economy. A significant difference is observed only in routine cognitive tasks. In the business sector the importance of this type of task increased from 1995-2003, and then declined. This indicates that the disappearance of routine cognitive tasks in Poland is a relatively new phenomenon and relates to only a portion of the economy. It is worth noting that with the relatively high share of workers and farmers and low proportion of office workers, technological progress (usually resulting in the disappearance of routine cognitive tasks) has had a rather moderate influence on the occupational structure of employment in Poland.

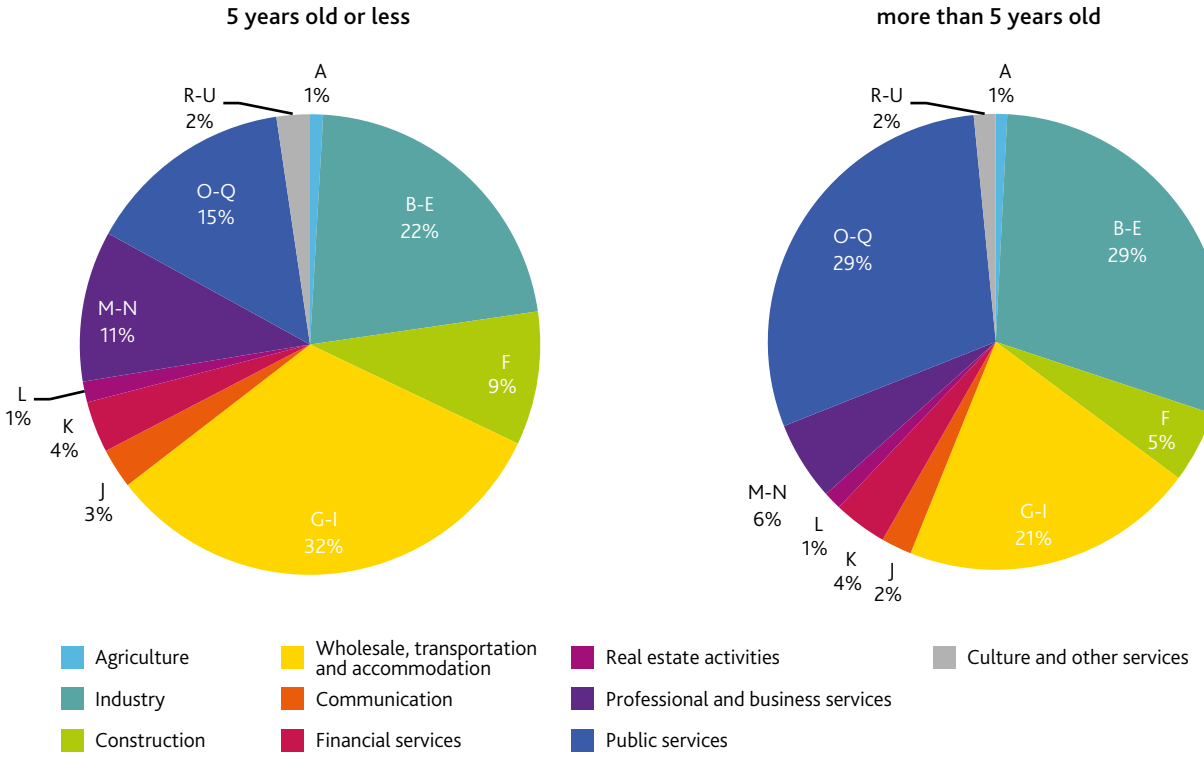
The task index analysis is complemented with an analysis of the structure of employment by dominant type of task in

the occupation. For example, the job of an IT specialist is predominantly based on analytical tasks. Along with the rest of the occupations in which analytical tasks dominate, they form a category of analytical occupations. Analogous reasoning is applied for the remaining four types of tasks. With this approach, final conclusions confirm the analysis of the indices. For the whole economy, the share of analytical jobs in employment increased from 9% in 1995 to 13% in 2012, while interpersonal occupations rose from 15% to 19%. This was accompanied by a decline in the share of manual occupations in the employment structure. From 1995-2012 it dropped from 57% to 46% in the entire economy, and from 57% to 48% in the private sector. In the whole economy a relatively greater change concerned routine manual occupations, while in the private sector it concerned mainly non-routine manual jobs. Employment dynamics in routine cognitive occupations differed between the whole economy and the private sector. For the former, the share of this category has grown steadily, while in the latter the share of routine cognitive occupations started to decrease after a slight growth in the late 1990s and early 2000s. This difference results from the fact that the public sector has increased both the number and proportion of employees performing routine cognitive tasks, such as handling the office or reception.

## Box I.7. Age of the company vs. structural change

It seems interesting to define the role of new companies in the structural change in labour demand. Neffke et al. (2014) indicate that the structural change in Sweden at regional level is driven by the creation of new companies. Activities of already existing companies do not significantly contribute to the change, as they usually tend to only widen their scope of operation. This observation is in line with the Schumpeterian idea of creative destruction, where old companies are superseded by new, more innovative ones. In Poland, as indicated by Figure I.43, employment in new companies with more than 9 employees is more often associated with the most modern sectors of the economy. It particularly concerns industries related to services, technologies and research (sections G-N). In 'new' companies, as many as 41% of employees work in those areas. In comparison, in 'old' firms this is only 33%. Although newly created companies contribute to the structural change, their number and contribution to total employment is still low. Employment in companies aged 5 years old or less was only 6% of total employment in 2012 (in the group of companies with more than 9 employees).

Figure I.43. **Age of the company (with more than 9 employees) vs. sectoral structure in Poland in 2012.**




*Notes: Age of the company is derived from maximal years worked by employees in a given company.*

*Source: Own elaboration based on the data from the Polish Structure of Earnings Survey.*

# 3 PROJECTIONS FOR THE LABOUR DEMAND IN POLAND AND THE EU

## 3.1 INTRODUCTION

In the ever-changing economic environment, historical analyses are insufficient to understand current or future phenomena in the labour market. This is why our analysis will also include projections concerning changes in labour demand until the year 2030. Forecasts and projections of this demand have a particularly great importance for the preparation of an evidence-based policy. Identifying the future demand for occupations and skills is important for both educational and labour market policies.

That is why individual EU countries have their own systems for predicting labour demand. In addition, at the level of the entire European Union, projections of labour demand and supply are prepared by the European Centre for the Development of Vocational Training (CEDEFOP). The latest CEDEFOP projection concerning labour demand in the EU until 2020 is presented in Box I.8.[6] This section of the Report also presents two scenarios for selected EU economies, with a particular focus on Poland.

### Box I.8. Projection of labour demand until 2020 by CEDEFOP

Every two years since 2008, the European Centre for the Development of Vocational Training (CEDEFOP) has regularly prepared prognoses for labour demand and supply of skills for the entire EU. The most recent projection (CEDEFOP, 2012) covers the period from 2013 and 2020. According to the document, by 2020 additional labour demand will amount to 80 million jobs. 8 million will result from expansion demand, with the remaining 75 million caused by replacement demand. The expansion demand will be concentrated in occupations requiring high and low skills, which will enhance the polarisation of labour markets. In the sectoral approach, expansion demand will grow particularly in the services sector. Replacement demand will concern all branches of the European economy.

The average level of education of the European workforce will steadily improve. According to the CEDEFOP, in 2020 37% of employees will have university education (compared to 29.8% in 2010), and 46.6% will have secondary education (46.8% in 2010). The employment rate among people aged 20-64 will reach 75% in 2020. The CEDEFOP projection mentions the risk of mismatch between labour demand and supply in terms of required skills. Shortages are expected especially in occupations requiring highly specialist knowledge and skills, as well as occupations associated with sales, services and some elementary occupations. On the other hand, many people will have to work below their qualifications since the demand for high skills will grow more slowly than supply.

Table I.5. **Projection of labour demand in Poland and EU27 according to CEDEFOP – groups of occupations, thousands of people.**

| | Poland | | | UE27 | | |
|---|---|---|---|---|---|---|
| | 2010 | change 2010-2020 | | 2010 | change 2010-2020 | |
| | | demand expansion | replacement demand | | demand expansion | replacement demand |
| 1. Managers | 1 103 | 69 | 267 | 19 239 | 1 575 | 8 537 |
| 2. Specialists | 2 809 | 306 | 497 | 33 010 | 2 466 | 11 590 |
| 3. Technicians | 1 838 | 134 | 302 | 37 000 | 4 787 | 10 608 |
| 4. Office clerks | 1 173 | -13 | 150 | 23 679 | -1 672 | 7 103 |
| 5. Service and sales workers | 1 562 | -190 | 227 | 31 020 | 990 | 8 206 |
| 6. Farmers | 1 874 | -249 | 577 | 9 426 | -902 | 5 303 |
| 7. Labourers | 2 639 | 65 | 352 | 28 217 | -1 807 | 7 303 |
| 8. Machine operators | 1 535 | -70 | 223 | 17 435 | -53 | 5 084 |
| 9. Elementary occupations | 1 259 | -77 | 290 | 22 974 | 2 462 | 8 531 |
| **All** | **15 861** | **-53** | **2 892** | **223 219** | **7 627** | **72 403** |

*Source: CEDEFOP (2012), pp. 90-92.*

6 In Poland, a complex projection of labour demand was presented by the Institute of Labour and Social Studies. Detailed information can be found at the website http://www.prognozowaniezatrudnienia.pl.

This Report's projections of labour demand were calculated in two stages. In the first stage, the projections concerned labour demand by sector. It is motivated by the fact that countries with a more traditional sectoral structure, e.g. with a high share of agriculture and low share of employment in services are likely to experience growth of the service sectors and a decline in agriculture; accordingly, the labour demand will change in the future. For example, along with a decrease in the importance of agriculture and increased demand for services, the demand for farmers performing manual work drops, while the demand for high-skilled professionals rises. In the second stage, the projection focuses on the structure of demand for occupations within sectors. A good example is industry, which used to employ a high number of manual labourers and today relies increasingly on technicians and professionals.

Distinguishing the between-sector and within-sector changes is important, as in less developed countries changes in occupational structure are driven mainly by sectoral convergence. In highly developed economies the sectoral structure is relatively stable and change depends mainly on trends within sectors. The result of our projection is the occupational structure of labour demand, for which the projection of sectoral structure serves an auxiliary role. A detailed description of the method used in the projection is presented in the Box I.9.

The projection of labour demand by sector takes into account the convergence of sectoral structures of middle income countries to those found in highly developed countries. Therefore it is important to identify the point of convergence for the European economies. Our projection assumes two scenarios. In the first, sectoral structures will converge to the structure projected for Germany. This very specific country has an exceptionally high share of manufacturing in the economy, 19% of all employment, which is 5 percentage points more than the average for the EU15. Also the share of occupations associated with manufacturing, which is roughly covered by the group of technicians, is about 3 percentage points higher than the EU15 average. In terms of industrialisation, Germany is different even compared to the most developed European economies. This is why the scenario of convergence to the German economy is called the 're-industrialisation of Europe'.

The other scenario assumes that the EU economies will converge to the model represented by the UK. A specific feature of this economy is the above-average share of the service sector, at 83% of total employment, against the EU average of about 76%. The sectoral structure in the UK is very different to Germany. As shown in Figure I.44, the UK industrial sectors hire only 10% of all workers, half of the German level. In addition, the occupational structure is dominated by workers associated with services (see Figure I.45) – compared to the EU average, the UK has an exceptionally high percentage of managers (11%), professionals (23%), and those hired in personal service and sales (20%). Due to the very high significance of services in the United Kingdom, this scenario can be described as the 'servitization of Europe'.

**Box I.9. Characteristics of the model – projection of labour demand**

In the model of labour demand projection we assumed that the sectoral structure of labour demand for individual economies will converge to the structure of the target country, which – according to each scenario – is either Germany or the United Kingdom. The share of the sector's *i* employment in the period *t+1* is calculated according to the formula:

$$EMP^{i}_{t+1} - \overline{EMP}^{i} = \beta_i\left(EMP^{i}_{t} - \overline{EMP}^{i}\right)$$

Where denotes the point of convergence, while is the pace of sectoral convergence, i.e. the distance between the actual and target values covered in one period of time (here it is a year). The formula concerns all three sectors, apart from manufacturing, for which the future share is determined as an exogenous trend. Thanks to this analytical structure, the sectoral structure will converge to the target point, while at the same time, regardless of the sectoral convergence, the share of manufacturing will decrease and hence the share of the remaining sectors will increase.

In the case of within-sector changes, the projection will also be based on the mechanisms of convergence. It was assumed that the occupational structure within sectors converges to the target point. The target was defined as the projected occupational structure of employment for each sector in the target country (depending on the scenario) in 2030. The projection of the target point takes into account trends in the occupational structure in the sectors. Hence, the target point is projected according to the following formula, where *i* denotes the sector, and *j* is the occupation:

$$\overline{EMP}^{ij}_{t+1} = \left(1 + \gamma_{ij}\right)\overline{EMP}^{ij}_{t}$$

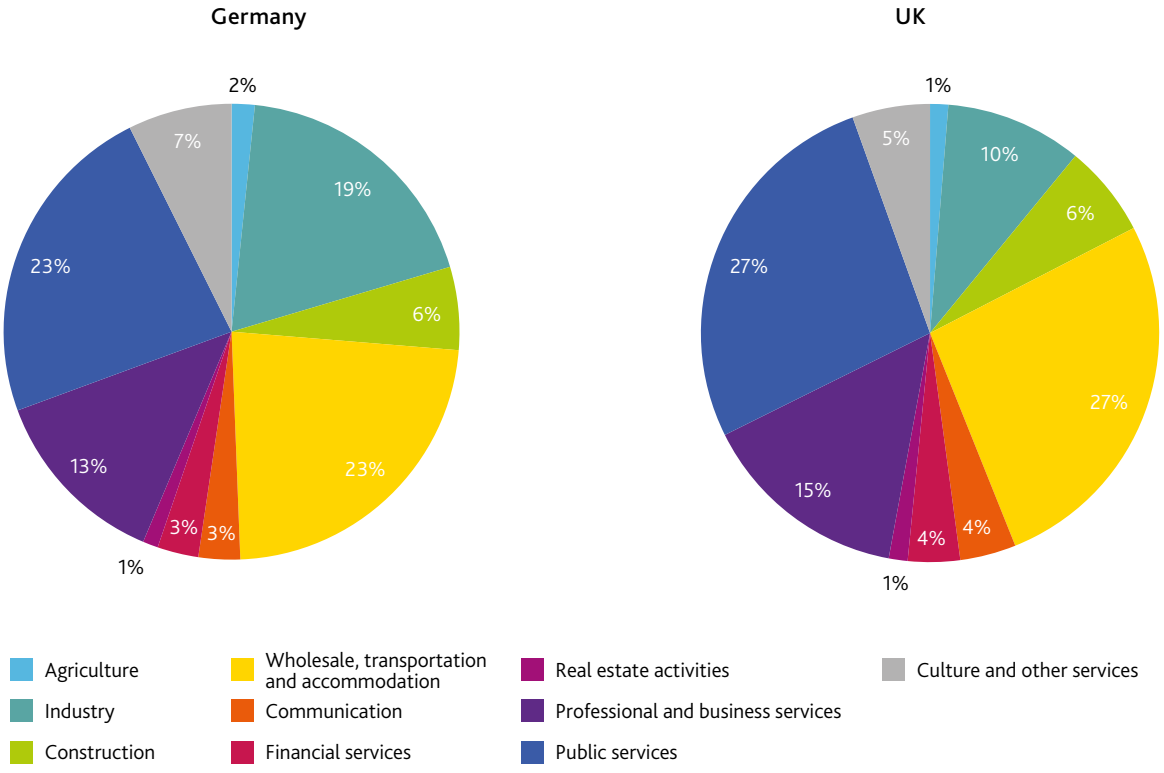
Having a projection for the target point , it is possible to calculate a projection for the occupational structure of employment according to the following formula:

$$EMP^{ij}_{t+1} - \overline{EMP}^{ij}_{2030} = \alpha_j\left(EMP^{ij}_{t} - \overline{EMP}^{ij}_{2030}\right)$$

Parameters (excluding manufacturing) are estimated based on sectoral data from 1980-2007 from the KLEMS database using the 'rolled' least square method with a ten-year long period. is estimated in a time series for the reference country. Within-sector trends and the pace of sectoral convergence were estimated based on LFS date for the EU from 1990-2010.

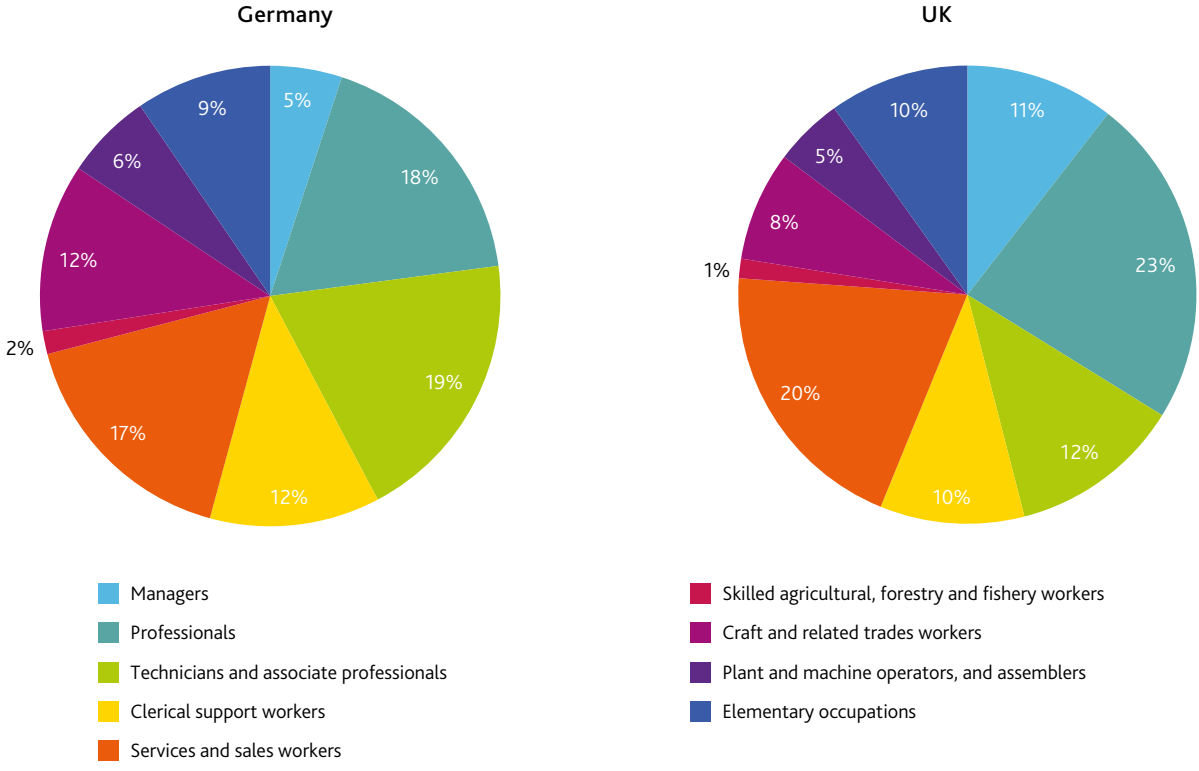
*Source: Own elaboration.*

Figure I.44. **Sectoral structure in Germany and the United Kingdom in 2011.**




*Source: Own elaboration based on Eurostat data.*

Figure I.45. **Occupational structure in Germany and the UK in 2011.**




*Source: Own elaboration based on Eurostat data.*

## 3.2 REINDUSTRIALISATION OF EUROPE – CHANGES IN LABOUR DEMAND

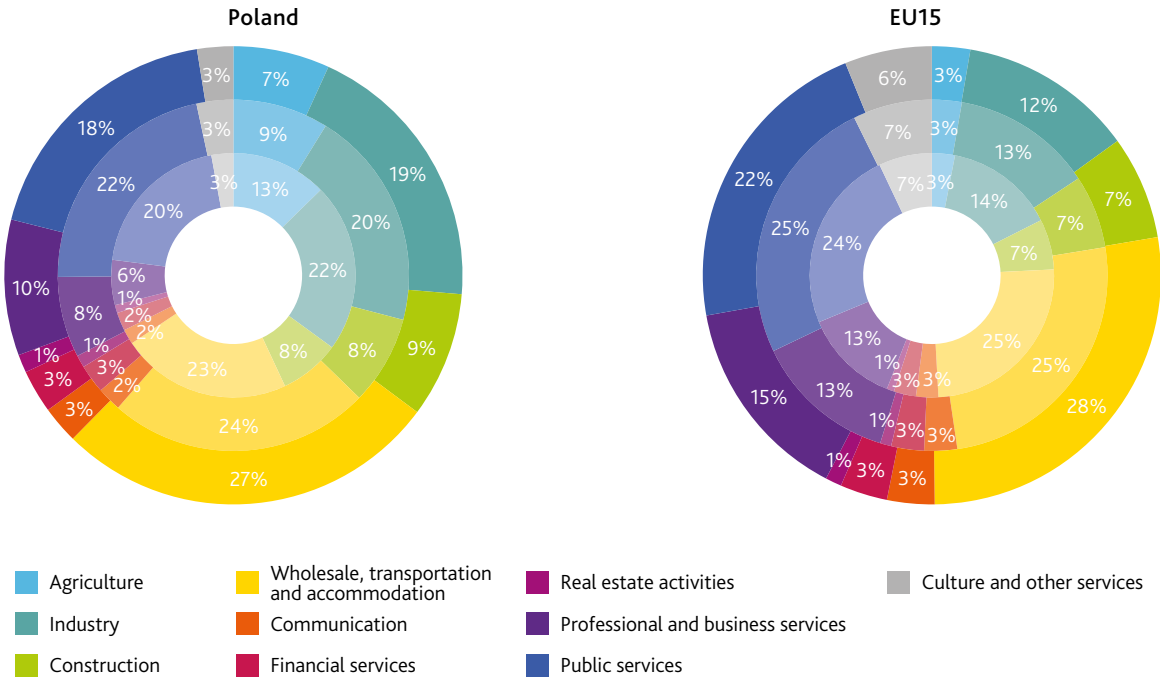
In the 'reindustrialisation of Europe' scenario we assumed the convergence of European economies to the German economy in terms of sectoral and occupational structures. Figure I.46 presents the results of the projection for labour demand. Differences between Poland and the EU15 are clear, with the greatest difference found in agriculture. In Poland, the decline of agriculture will likely continue, decreasing the share of farmers from a high initial level of 13% to 7% in 2030. Another area of difference is the projected dynamic growth of labour demand in sectors associated with science, technology, and administration and business services for companies, from 6% in 2011 to 10% in 2030. Moreover, we expect a relative growth in labour demand in other service sectors, e.g. in telecommunications and finances.

In contrast to Poland, the EU15 economies have a low share of employment in agriculture and highly developed services. The structural gap between the average EU15 country and Germany is not significant, and hence we do not expect considerable convergence-related changes in the sectoral structure of the EU countries. However, regardless of convergence, the projection takes into account the universal downward trend in manufacturing and an increase in services. Hence, the projection for the EU15 indicates a decrease in the share of manufacturing in employment by 2 percentage points by 2030. This will happen to the advantage of work in services, e.g. in trade and transport (an increase by 3 pp.).

Despite the convergence to Germany, the projection for Poland shows only a slight decrease in the share of industrial sectors. This is a result of a general trend common for the entire EU and the high level of employment in these sectors in Poland. In 2011 it was 22%, 3 percentage points higher than in Germany. That is also why the share of Polish industry in employment decreases even in the 'European reindustrialisation' scenario. What is more important, some of the currently important sectors of Polish industry are traditional, i.e. those whose role decreases in a modern economy. This group includes mining, energy supply and waste management. In Poland, the percentage of those employed in traditional industrial sectors is 4%, two times higher than in Germany. That is why in Poland, reindustrialisation will be qualitative rather than quantitative. This is also indicated by technological and structural differences between Polish and German industry (see section 1.2). For the EU15, in which differences in the share of traditional industries are low, our projection indicates a gradual decrease in the share of industry in total employment.

In the projection for the occupational structure, we distinguished nine major groups of occupation, identical to those used in the description of historical trends (based on ISCO classification). In Poland, we project an increased demand for professionals (by 2 percentage points), technicians (5 pp.), office clerks (1 pp.), personal service workers (1 pp.) and elementary occupations (1 pp.). We expect a decrease in demand for farmers (by 7 pp.), labourers (1 pp.) and machine operators (2 pp.). In the case of managers the projection does not show any significant changes. Labour demand in this market segment will stay at a relatively stable level.

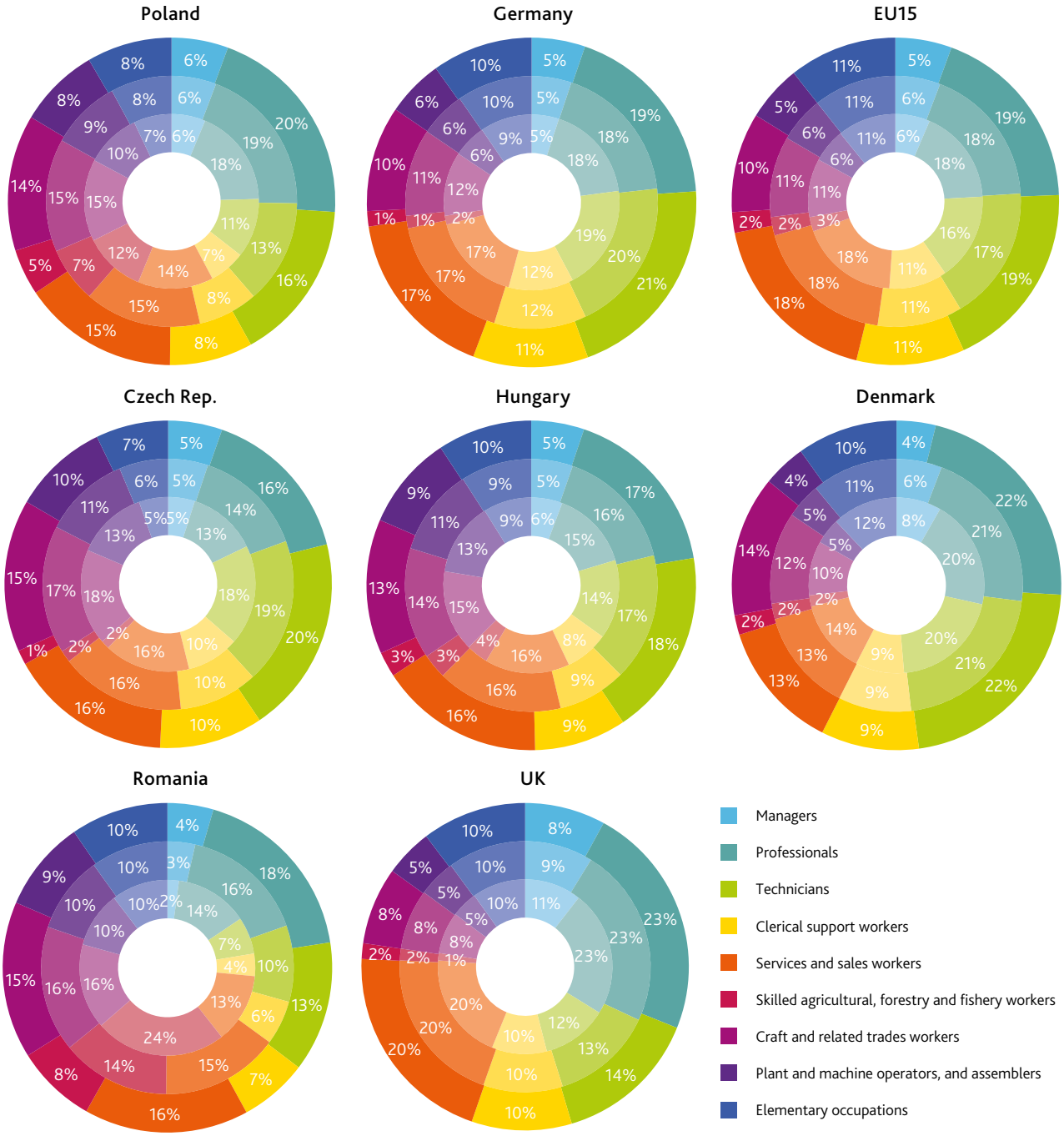
Figure I.46. **2030 projection for the sectoral structure in selected countries – the 'reindustrialisation of Europe' scenario.**




*Notes: The rings (in order from the inner to the outer ring) denote the years 2011, 2020 and 2030.*

*Source: Own calculations.*

Figure I.47. **Projection of the occupational structure of labour demand until 2030 – 'Reindustrialisation of Europe' scenario.**




*Notes: The inner ring represents the structure of labour demand in 2011, the central ring denotes 2020, and the outer ring represents 2030.*

*Source: Own elaboration.*

In all the EU economies, the demand for professionals will grow, typically by 2-3 pp. This is also expected in Poland where the share of professionals in total employment will grow from 18% to 20% in 2030, i.e. slightly more than the projected EU15 average of 19%. Moreover, if we look only at the NMS10, then Poland will reach a higher share of professionals in total employment compared to the Czech Republic (16%) and Hungary (17%) for example. In addition, it is interesting to mention two countries here, namely Romania and the UK. Starting from a low initial level, Romania is expected to have a particularly rapid growth in the projected share of professionals (from 14% to 18%). In the UK – which had the second-highest share of professionals in the EU in 2011 (after Luxembourg) – the share of professionals in employment is projected to reach 24% in 2030.

Managers constitute another highly-skilled group, projected to have similar dynamics in all the analysed countries. In the next ten or so years, in most European economies demand for managers will not grow. The same applies to Poland where the share of managers in total employment is expected to remain at 6%. In countries with a low share of managers in employment, such as Romania, the share of this group should grow. It is different in countries with a considerable share of managers in employment, such as the UK, which is expected to experience a decrease in the percentage of managers in the 'European reindustrialisation' scenario.

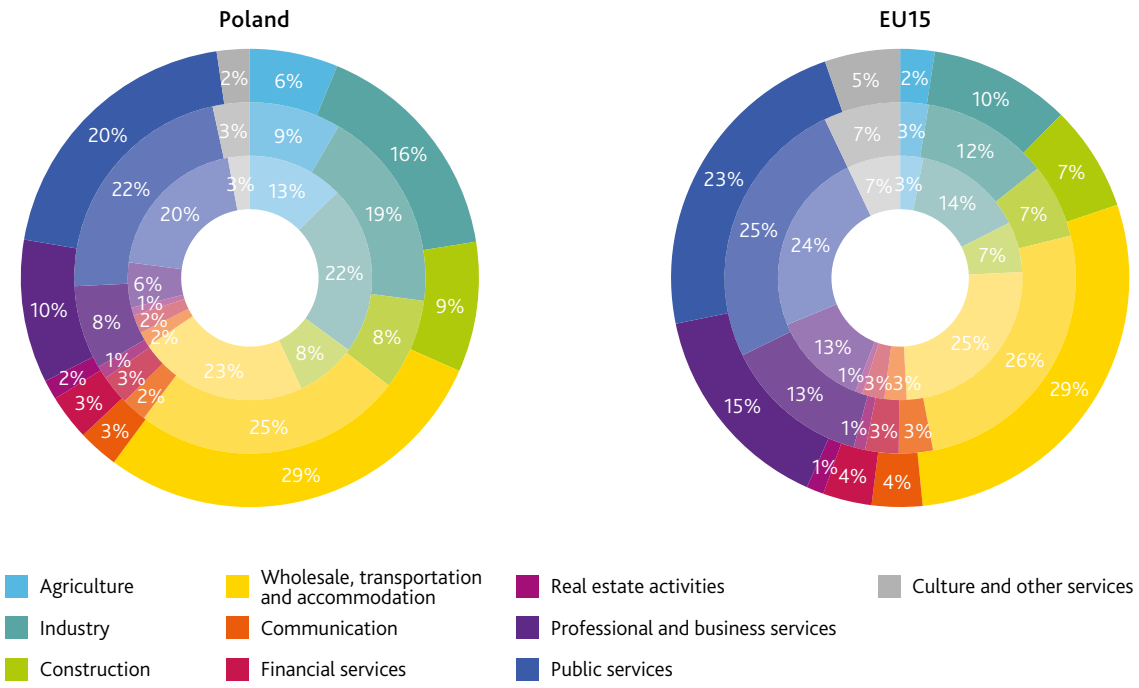
Technicians are another group expected to grow in significance in the entire European Union. The pace of growth is expected to be especially fast in Poland due to the low initial level (11%). According to the projection for 2030, technicians will constitute 16% of all employed in Poland, still 3 pp. less than the projected EU15 average. Moreover, the gap between Poland and Germany or Denmark, countries with a high proportion of technicians, is expected to be even greater, more than 5 pp. Other countries of the region, e.g. Hungary and the Czech Republic, will also have a higher share of technicians in total employment than Poland.

Our projection shows a relative stabilisation in the demand for office jobs requiring lower skills. The exceptions are countries with an initial low share of office clerks in total employment. In those countries (e.g. Poland and Romania) labour demand will grow in this sector, but in some countries with a higher initial share of office clerks in employment, their share will slightly decrease, for example by 1 pp. in Germany.

Another group of low skilled occupations is personal services. In contrast to professionals and technicians, these occupations do not show a consistent direction of change across the EU. In the 'European industrialisation' scenario, the demand for personal service workers in Poland will increase by 1 pp. from 2011-2030, at an initial value of 14%. An even higher growth is projected for Romania, from 13% of total employment in 2011 to 16% in 2030. In countries with a well-developed service sector, it is expected that the share of these workers will remain constant. In some cases it may even slightly drop, e.g. as in Germany – by 1 pp.

Similar to the analysis of historical trends, we use one category for all three groups of occupations associated with manual labour. This category includes farmers, labourers and machine operators. In the 'European reindustrialisation' scenario, we may expect a decline in the importance of this category in the structure of employment in European countries. Demand for manual labour will decrease faster in converging countries, such as Poland (by 10 pp.) or Romania (by 18 pp.), than in economies with a modern structure; the average for the EU15 is expected to drop by 3pp. In the reindustrialisation scenario one may also observe exceptions from this rule, e.g. Denmark, where the share of manual workers will increase by 3 pp. The last analysed group of occupations is elementary occupations. Demand for this group will grow in economies with an initial low share of this group (e.g. the Czech Republic, Poland), and decrease in countries with an initially high level. On average, in the EU15 the share of those employed in elementary occupations will not change and will reach 10% in 2030. In Poland this proportion will be 8% in 2030, compared to 7% in 2011.

Figure I.48. **Projection for the sectoral structure in selected countries until 2030 – 'European servitization' scenario.**



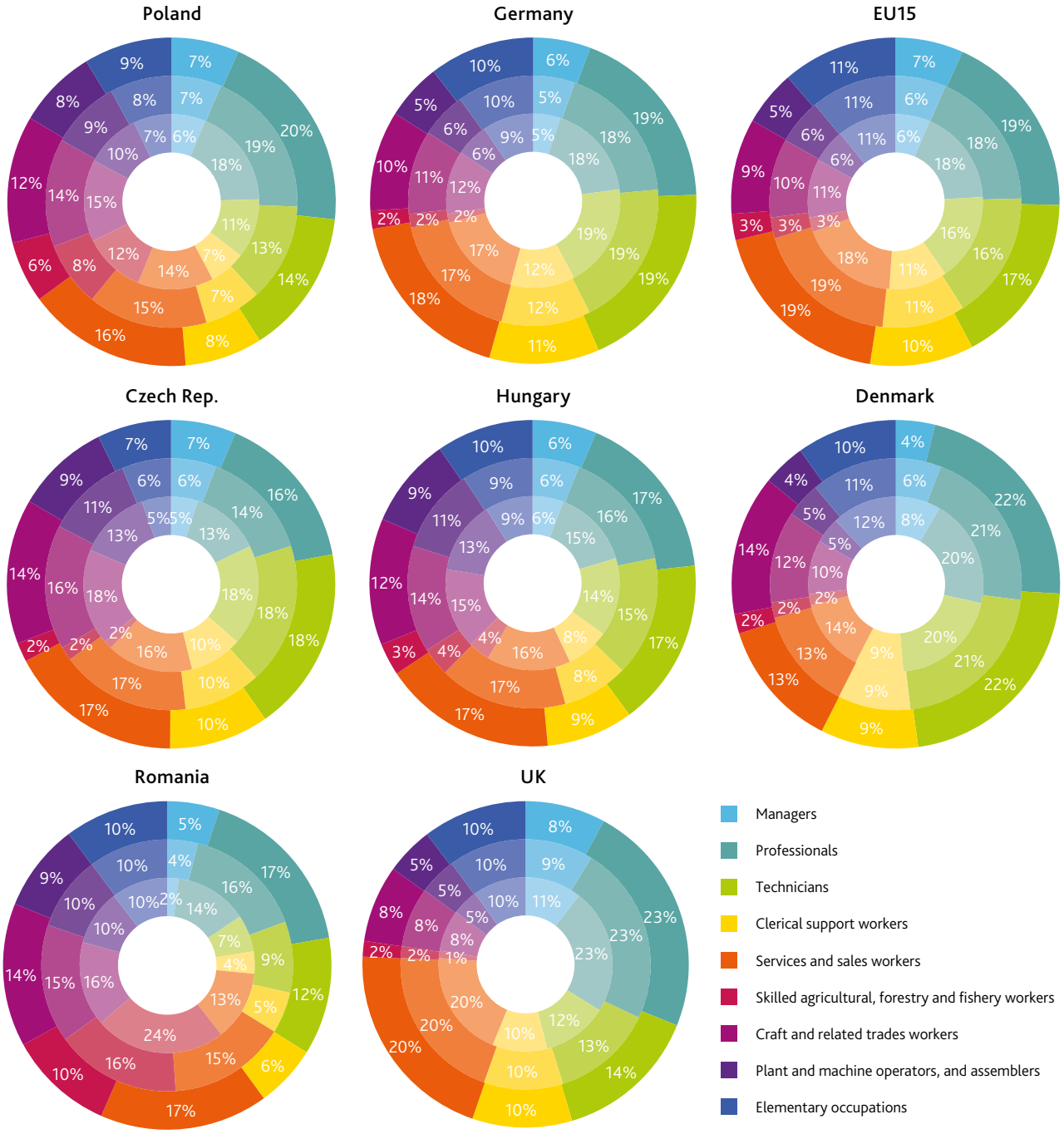

*Notes: The inner ring represents the structure of labour demand in 2011, the central ring denotes 2020, and the outer ring represents 2030.*

*Source: Own calculations.*

## 3.3 SERVITIZATION OF EUROPE – CHANGES IN LABOUR DEMAND

In this second scenario we assume a convergence to the UK, an economy with a strongly developed service sector. Due to numerous similarities between the results of the 'German' and 'British' scenarios, we focus on the major differences. The first difference is the direction and force of the change in the labour demand in the industrial sectors. In Poland, compared to the first 'European reindustrialisation' scenario, the 'servitization' scenario results in a greater decrease (by 3 pp.) in employment in industrial sectors. For the EU15 economies this difference is slightly lower (2 pp.). The share of service sectors also changes in the servitization scenario; this refers especially to education, health care, culture and entertainment, which are projected to experience the greatest increases in labour demand. Employment in those sectors is projected to be 3 pp. higher than in the 'reindustrialisation' scenario.

Figure I.49. **Projection for the structure of labour demand until 2030 – 'Servitization of Europe' scenario.**




*Notes: The inner ring represents the structure of labour demand in 2011, the central ring denotes 2020, and the outer ring represents 2030.*

*Source: Own elaboration.*

In the 'British' scenario the significance of Polish agriculture in total employment will drop faster. In the reindustrialisation scenario the estimated percentage of employment in agriculture in 2030 is 8%, while in the 'servitization' scenario it is 6%. However, it is worth noting that the faster decrease in agricultural employment is significant for economies with a traditional sectoral structure.

In the projection of labour demand by occupation, differences between the scenarios concern mainly four occupational groups: managers, technicians, personal service workers and labourers. The 'European servitization' scenario projects a higher percentage of managers, 1-2 pp. more in 2030. In this scenario, Poland has a 7% share of managers in total employment in 2030 (compared to 6% in the reindustrialisation scenario). In the case of the EU15 this difference is 2pp. in favour of the servitization scenario.

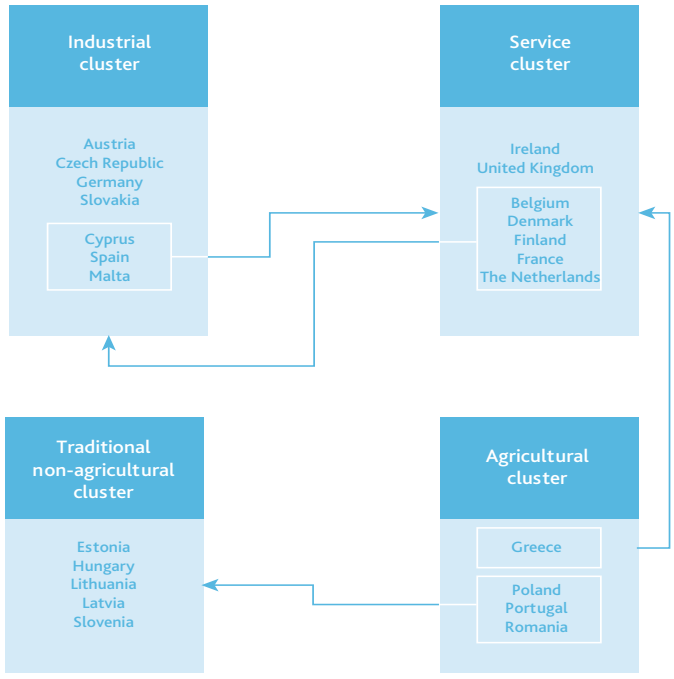
The scenarios also significantly differ in the share of technicians in the structure of labour demand. In the reindustrialisation scenario, the dynamic growth in this category will be universal, while in the servitization scenario it will be less dynamic and will not include all countries. For example, in Germany and the Czech Republic the share of technicians does not change in the projections. For Poland, in both scenarios there will be an increase in the share of technicians, although greater in the reindustrialisation scenario (16% against 14%). This is typical as the share of technicians in 2030 is also on average 2 pp. lower in the servitization scenario in the EU15 economies.

Another group which shows a difference between the scenarios is personal service workers. In the servitization scenario, the 2030 demand for this type of worker is on average about 1 pp. higher than in the reindustrialisation scenario. In Poland the percentage of personal service workers is expected to be 15% for the reindustrialisation scenario and 16% for servitization. Moreover, in countries where reindustrialisation is expected to result in no change in the share of personal service workers (e.g. in Germany, Czech Republic or Hungary), in the servitization scenario we may observe a slight increase in the significance of this category.

The scenarios also differ in the projection of the share of labourers in total labour demand. In the 'servitization of Europe' scenario, the percentage of labourers in total employment is about 1 pp. lower than in the reindustrialisation scenario. The projection for Poland shows that the proportion of labourers in the servitization scenario will be 12% in 2030, about 2 pp. less than in the scenario for reindustrialisation. It is still much less than the projected value of 9% for the EU15 in 2030.

Summing up the results of both projections, it may be stated that they show certain symptoms of polarisation of employment in Poland. They both show an increased demand for occupations requiring high skills (managers and professionals), and for elementary occupations and personal services workers. At the same time, the projections indicate a gradual decrease in the demand for medium skilled occupations with medium wages, such as labourers and machine operators. The only exception is the groups of office clerks, projected to slightly grow in our projections, which is due to the initially low share of this group in Polish employment. All in all, the trends indicated by the projections seem to be consistent with the expected direction of technological progress, in which new technologies are going to replace routine labour, performed mainly in medium-skill occupations.

Diagram I.1. **Groups of countries by occupational structure in 2011 and the flows between the groups according to projections of labour demand in 2030, at the assumed sectoral convergence to Germany.**




*Notes: Arrows denote the projected change of a country's assignment to a given cluster.*

*Source: Own elaboration.*

## 3.4 COMPARISON OF SCENARIOS - EVOLUTION OF THE LABOUR DEMAND

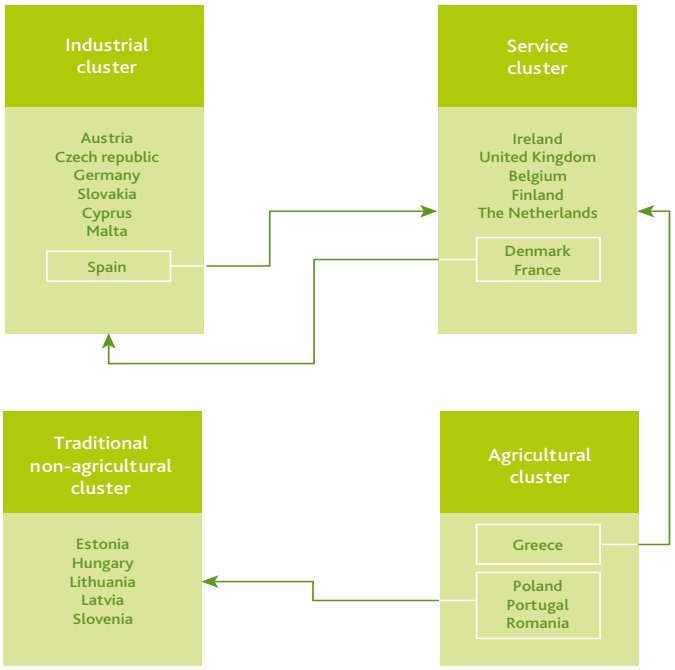
In order to compare the international results of projections for labour demand, countries were grouped by occupational structure of employment into four clusters: industrial, service, traditional non-agricultural and agricultural. The industrial cluster has a high share of technicians and machine operators, and currently includes e.g. Austria and Germany. The service cluster consists of countries with an above-average proportion of professionals and personal service workers, e.g. the UK and Netherlands. Both these clusters include economies with a modern occupational structure. The remaining two clusters, agricultural and traditional non-agricultural, contain countries with more traditional occupational structures of employment. They both have a high share of manual workers and a low share of service workers. They differ mainly in the share of farmers in total employment. The agricultural cluster includes Poland and Greece, while the traditional non-agricultural cluster includes e.g. Slovenia and Hungary. Importantly, if the country has been assigned to e.g. the agricultural cluster, this does not mean that the majority of workers are employed in agriculture, but rather that agriculture has a much greater role in the country's employment structure than in the countries from other clusters.[7]

Diagrams I.1 and I.2 present the division of countries in 2011, with the arrows showing the flow between the initial cluster to the cluster based on the projection for 2030, for the scenarios assuming convergence to the German and British economies, respectively.[8] It is worth noting that in the initial year 2011, the EU countries are divided into high-income countries, assigned to the industrial and service clusters, and middle-income countries belonging to the agricultural or traditional non-agricultural clusters. Our projections indicate that by 2030 all the countries from the agricultural cluster will have moved to other clusters. For example, Poland will join the traditional non-agricultural cluster in both scenarios in 2030. One may observe significant flows between the industrial and service clusters. For example, in the reindustrialisation scenario, a group of six countries (e.g. Belgium, France) from the service cluster will then be included in the industrial cluster in 2030. In the same scenario one can see a flow in another direction: from the industrial cluster to the service cluster; for example Spain. In the servitization scenario, the flow between the service and industrial cluster is lower, especially in the service cluster. As a result, the service cluster in 2030 will be more populated than the industrial cluster. The last group of countries is the traditional non-agricultural cluster. In either scenario, none of the countries leave this cluster; it gets only larger through inflows from the agricultural cluster (Poland, Portugal, and Romania). This shows that sectoral convergence alone is not able to diminish the difference in the occupational structure of labour demand between high- and middle-income countries. This requires a change in the labour demand within the sectors.

7 Generally, this clustering is relative, which means that a given country belonging to a given cluster has a relatively high share of people employed in the occupations defining a given cluster, compared to countries belonging to other clusters.

8 This projection takes into account only the sectoral convergence. Hence the flows between the groups give an answer on how the clustering of countries would change if all the countries had the same occupational structures within sectors as in the initial year, and the change only happened in the sectoral structure. After adding the effect of occupational convergence in the sectors, differences between countries are smaller.

Diagram I.2. **Groups of countries by occupational structure in 2011 and the flows between the groups according to projections of labour demand in 2030, at the assumed sectoral convergence to the UK.**




*Notes: Arrows denote the projected change of a country's assignment to a given cluster.*

*Source: Own elaboration.*

# SUMMARY

The first part of Employment in Poland 2013 is devoted to changes in the structure of labour demand. We discussed the trends that had been observed in Poland since the early 1980s, and those since the middle of the 20th century for the more developed EU economies. Structural change in the Polish economy has followed the long-term macrotrends observed in most of the developed economies of the world: deagrarization, deindustrialisation and the increased importance of the service sector.

In Poland, this dynamic period of structural change needs to be divided into two periods. The first, the period of systemic transition in the late 1980s and early 1990s, was accompanied by an abrupt decline in employment across the entire economy, resulting from opening markets to international competition and from restructuring intended to tackle hidden unemployment. The greatest adverse effects occurred in mining, manufacturing and construction, where 1.6 million people lost their jobs over a few years. After 1993 structural changes were of a different nature: deindustrialisation decelerated, and some industrial sectors even started to increase employment. Labour demand in Poland began to be influenced by development of the service sector, a consequence of the evolution of consumer preferences. In the more developed countries, as households had higher incomes at their disposal, they increased the proportion of spending on services related to entertainment, education, health care, insurance and finances, thus stimulating employment in services. Another factor that stimulated the demand for services was growth in the global trade in services. Poland, which is a net importer of goods, is however a net exporter of services, with the most notable increase in exports of ICT services over the last decade.

In the scale of the entire economy, the implementation of ICT contributed to a lower demand for routine office work and a higher demand for high skills. Automation of production resulted in a lower demand for low-skilled farmers and industrial labourers. Increased demand for personal services contributed to an increased demand for low-skilled labour. On the other hand, Polish service sectors, employing relatively most of the highly-skilled workers, experienced the greatest increase in labour demand over the last decade.

The aforementioned processes lead to a polarisation of labour demand, with a growing demand for low and high skills at the expense of medium skills. These symptoms identified in Poland are less intense than in Western Europe and the U.S. This is probably associated with the lower saturation of the economy with ICT and therefore we may expect an intensified polarisation of labour demand in the future.

Our projections for labour demand indicate that regardless of the direction of evolution of the sectoral structure (towards re-industrialisation or servitization), we will see a relative growth in the demand for high-skilled labour (managers and professionals), elementary occupations and personal services. Relative labour demand for medium skills, performed by labourers or machine operators, will fall. Office clerks are the only exception, as their share in total employment in Poland is still relatively low. Nonetheless, future technological progress may also reduce the relative demand for this type of work too.

## TABLES



## BOXES



## FIGURES

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Employment in Poland 2013 Part II

# Labour supply in the face of population ageing

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# INTRODUCTION

In the first Part of Employment in Poland 2013 we discuss changes in the structure of labour demand, both in terms of sectors and qualifications. These changes were accompanied by partly independent processes in the supply of labour, such as the evolution of demographic and educational structures, and also by changes directly linked to labour demand, such as the employment rate and the occupational and sectoral structure of employment. The second Part of the Report focuses on both these types of processes in labour supply. Detailed analysis of older groups of workers being replaced by younger ones with different levels of education and areas of expertise is then used for forecasting if the present trends are to continue, stop or reverse in both the next twenty and fifty year periods. Based on the analysis of the observed changes we present either growing or new threats as well as opportunities, especially those associated with the growing significance of older people in the labour market (i.e. the silver economy). Our analyses and projections are supplemented with recommendations for social and economic policies.

Processes occurring in labour supply in Poland are consistent with the trends observed in other EU and OECD countries. Changes in the structure of qualifications in labour supply are a consequence of the different educational paths of the younger generations of Poles compared to their parents, and also of older groups of workers ageing and leaving the labour market. The main trend, as in other EU economies, is a greater number of people enrolled at universities. Poland, similar to other New Member States, has experienced a strong growth in enrolment ratios at university level. This has resulted in a smaller number of Poles who complete their formal education with only basic skills. The Programme for the International Assessment of Adult Competencies (PIAAC) tests show how the increased education of successive cohorts translates into higher levels of skills, and how Poland compares against other OECD economies. We also examine how the educational boom has resulted in a mismatch between supply and demand in terms of qualifications.

Analysis of changes in the structure of qualifications is supplemented with conclusions from the Survey on Inheriting Professions, performed on a group of two thousand thirty year olds. The survey was intended to provide the answer if, and to what extent, the educational boom currently experienced by Poland, as well as structural changes in the Polish economy, help alleviate social inequalities and create equal opportunities in the labour market. The survey also helped determine to what extent entrepreneurship and occupational and spatial mobility are inherited.

Based on the diagnosis of the changes, in the next chapter we formulate forecasts for the structure of labour supply in Poland until 2060. The population ageing and the decreasing numbers of young people entering the labour market will result in a reduced working population. According to Eurostat's demographic projections, Poland will be one of the EU countries in which the depletion of the working age population will be the strongest. In the medium-term – until 2030 – the population of people aged 15-64 will decrease by 3 million people. The expected increase in employment rate will not be able to offset the negative effect of demographic factors on total employment in Poland. On the other hand, along with the population ageing , the average qualifications of people in working age will improve.

Comparison of this projection with the conclusions of the first Part of the Report will show the combined effect of structural changes in labour demand and supply. We identify the areas of possible mismatch between qualifications sought in the labour market and the actual characteristics of workers. Our conclusions are the basis for recommendations for social and economic policies.

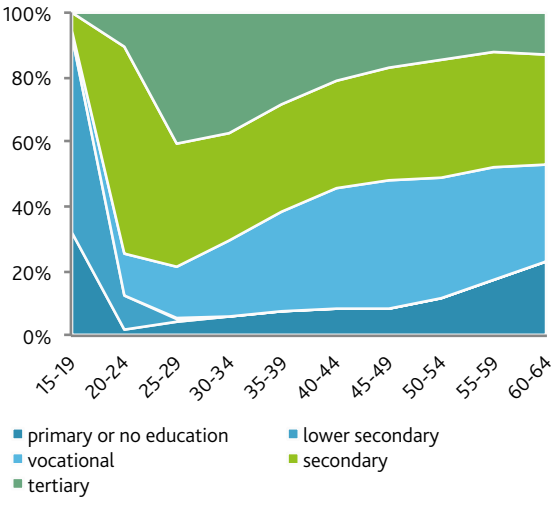
# 1 THE EDUCATIONAL BOOM AND ITS EFFECTS

The educational boom observed since the mid-1990s, has been the most important phenomenon for the characteristics of labour supply in Poland as it has significantly improved the level of education in the working age population. Over the last two decades, university education has become common in Poland. At the end of the 1990s, one fourth of 20 year olds in Poland continued education at the university level, while now it is as much as a half (see Figure II.2). This was reflected in the explosion in the number of students: 400 thousand people studied at universities in 1990; in 2000 it was 1.6 million; with a peak of 1.9 million in 2005. As a result, the proportion of people aged 25-64 years with tertiary education increased from 12% in 2001 to 26% in 2013, the highest increase in the EU (cf. Figure II.3). However, in Poland the share of people with tertiary education in the entire working age population in 2013 was still lower than the EU average (28%). The improvement of educational indicators is more visible when the reference group is limited to those aged 25-34 years. Then, in the analysed period the proportion of people with tertiary education in Poland increased from 15% to 42%, compared to a change from 24% to 36% across the EU27. A strong improvement in educational indicators has also been experienced by other New Member States (particularly Lithuania, Latvia, Czech Republic, Slovakia and Slovenia). This stronger increase in educational indicators in the New Member States, which began from a lower level than did the EU15, has resulted in a convergence of qualifications levels between these two regions of the European Union (cf. Figure II.3).

The educational boom in Poland was a reaction to conditions in the labour market after the systemic transformation. Thanks to the high demand for higher skills, people with tertiary education were much less exposed to the risk of unemployment and could count on higher wages than those with lower levels of education (World Bank, 2012; Ben Porath, 1967; Mincer, 1974). Moreover, under conditions of information asymmetry, tertiary education became a sign of the potential high productivity of an employee. In effect, tertiary education resulted in a wage premium even when the performed tasks were not connected with the skills acquired during the studies. 'Raw' wage premium, i.e. the difference in average wages between those with a tertiary education and those with secondary education increased from 45% in 1995 to 66% in 2004 (own calculations based on SES). In recent years Poland has seen a stabilisation of the wage premium for tertiary education to about 60%, despite the growing popularity of university studies. This stabilisation accompanied large inflows of university graduates into the labour market (cf. Figure II.2). Some estimations of wage premiums try to exclude the influence of factors other than education (e.g. age, sex or sector), but this comes at the cost of not taking into account the indirect effect of education on the choice of occupation or sector. In this way, wage premium is estimated at distinctly lower levels (at 15-30%) and has clearly decreased over the last 15 years, down to the lower limits of this range in the last two decades, especially in the private sector (cf. Gajderowicz et al. 2012).

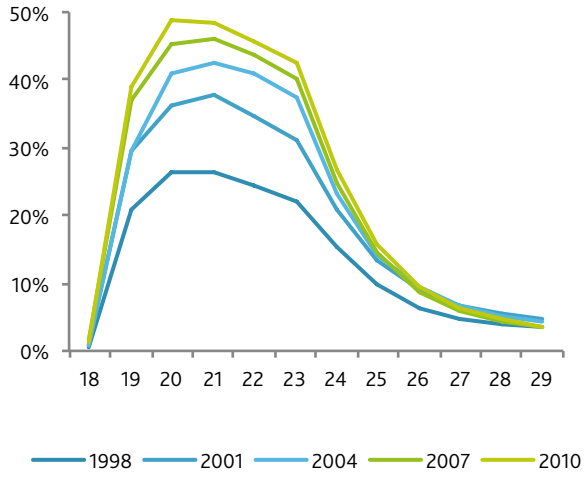
Apart from the wage premium, the Polish educational boom has been caused by easier access to university education.

Figure II.1. **Educational structure in Poland in 2011, by age.**




*Source: Own elabouration based on LFS data.*

Figure II.2. **University enrolment ratio among the population aged 18-29 years in Poland 1998-2010.**



Universities began to open new branches away from the main academic centres, while the numbers of students at the already existing centres grew rapidly. In addition, the number of universities, especially private ones, has grown significantly since the beginning of the systemic transformation. The decrease in the population born after 1983 has resulted in an increased competition for students, followed by lower requirements from renowned universities (cf. World Bank, 2012). The boom has also been associated with the growing popularity of external and evening studies, which made it possible for people who did not qualify for fees-free full-time studies or were willing to combine work with education to study at a university.

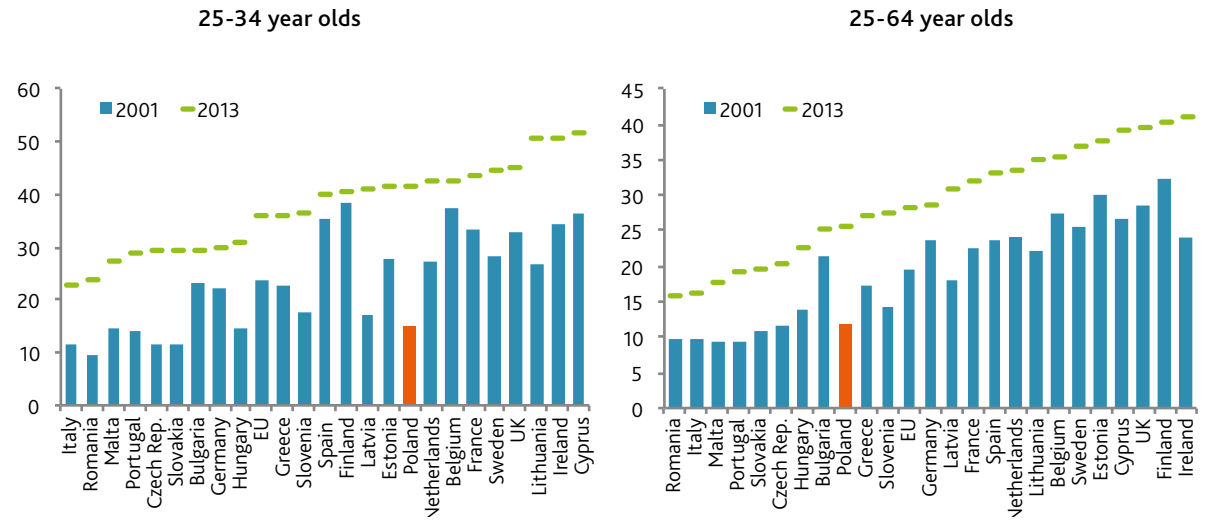
Young people who are currently entering the labour market are better educated than those who are leaving it. Persons aged 25-29 years are the best educated group in Poland: 41% of them have higher education, and 38% have secondary education (data for 2011). Among 50+ year olds, not more than 15% have higher education, while 35% have secondary education. Basic vocational education is most common among people aged 40 to 54 years old. Older age groups also have a distinctly higher proportion of people with basic skills (20% in the 55-64 group). In the group of 25-34 year olds, the percentage of junior high school graduates is only 6%. These significant differences mean that the educational structure of employment will significantly improve with the gradual exit of older groups. The average level of education of the working age population will grow in the next decades, even if the popularity of university education decreases.

Changes in the educational choices of young Poles are presented in Figure II.4 showing the evolution of educational structure of selected groups since the mid-1990s. Compared to the older generations, younger cohorts increasingly often chose to continue education at university level. This choice is decided as early as secondary level, as high schools have become the most popular type of secondary school. The proportion of youth obtaining secondary vocational education has remained the same, while the popularity of basic vocational education has decreased tremendously, as it gives no right to continue education at university level. This drop in popularity has been caused by the slow rate of vocational schools adjusting their curricula to market demands, an increased emphasis on general education in educational policy and the increased educational aspirations among students (cf. Chłoń-Domińczak et al., 2014). A clearly positive change is the reduced number of people completing their education too early. Among all surveyed thirty year olds, those who did not complete their secondary or basic vocational education constituted only 6% in 2012, compared to 12% in the mid-1990s.

Another trend shown in Figure II.4 is an increase in qualifications in the prime-age group (i.e. 25-44 year olds). The proportion of people with university education has grown steadily in cohorts older than the typical age for university studies. In addition, persons with primary education have often complemented their education to be more competitive in the labour market. For example, the percentage of people born in the late 1960s and early 1970s with no secondary or vocational education fell from 12% in 1995 to about 8% in 2012. Therefore, the improvement in the educational structure of the population has resulted both from different educational decisions taken at different stages of education by the younger cohorts, and from older groups deciding to further their education. However, the latter effect has been weaker than the educational decisions of the younger cohorts.

Social and business-related studies dominate among students in Poland, similar to other EU countries (cf. Figure II.6). Compared to other European countries, Poland has relatively many more students of pedagogy, while much fewer students of health and social services. This structure of education implicates future mismatches between the competences of graduates and the

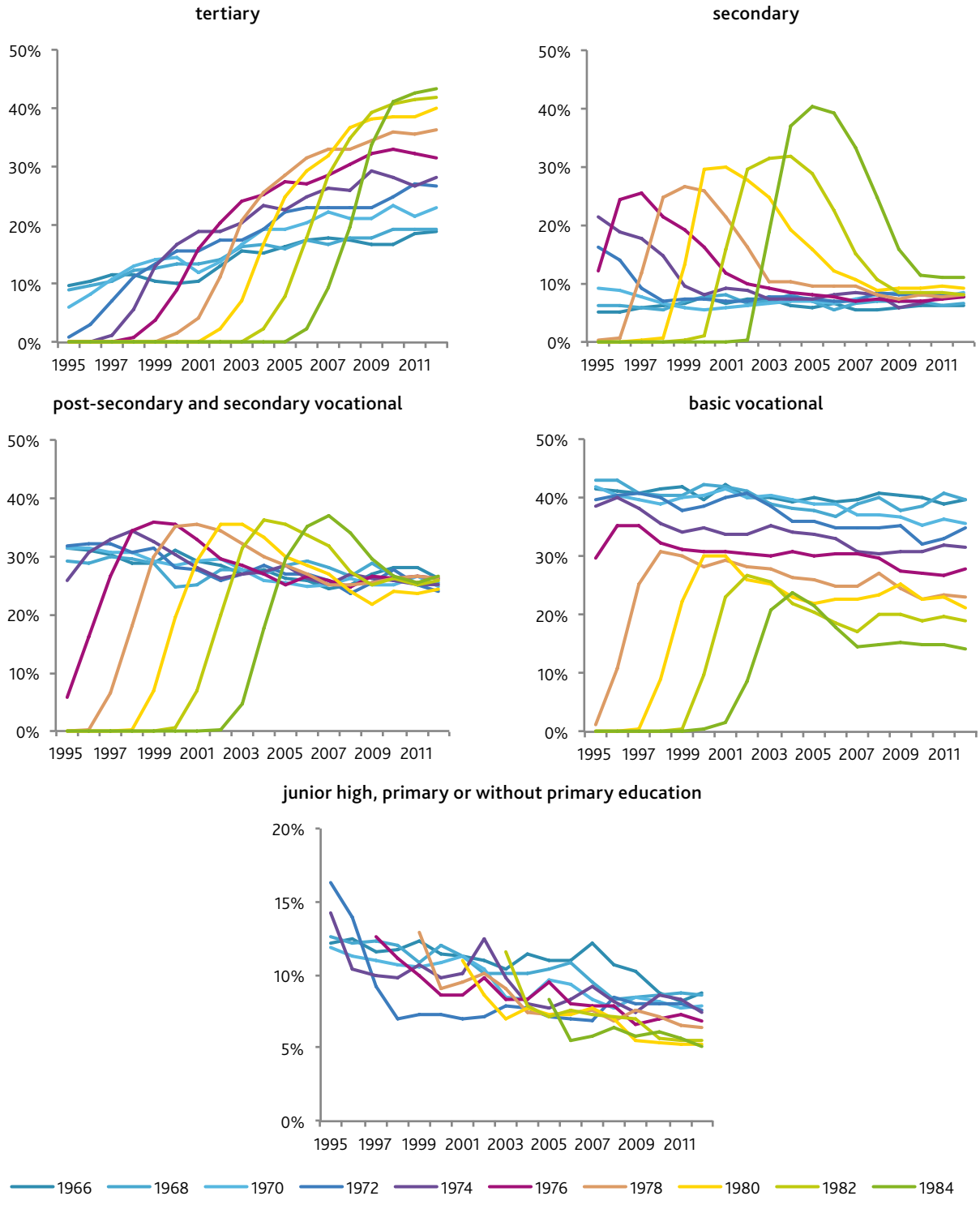
Figure II.3. **The percentage of people with higher education in the EU in 2001 and 2013 (%).**




*Source: Own elabouration based on Eurostat data.*

skills sought in the labour market. Due to a low fertility rate, the demand for teachers will decrease, which means that the graduates of pedagogy will be increasingly often forced to look for work outside the education system. In addition, the population ageing will increase the demand for health services. The lower proportion of people studying health related sciences in Poland compared to the EU may deepen the deficiency of doctors in the future. The proportion of doctors in the Polish population is already distinctly lower than in the EU or OECD on average (data.worldbank.org, stats.oecd.org).

Figure II.4. **Educational structure of selected cohorts according to LFS, 1995-2012 (percentage of people with a given level of education).**




*Notes: The legend gives the cohort's year of birth. Minor fluctuations may result from the selection bias.*

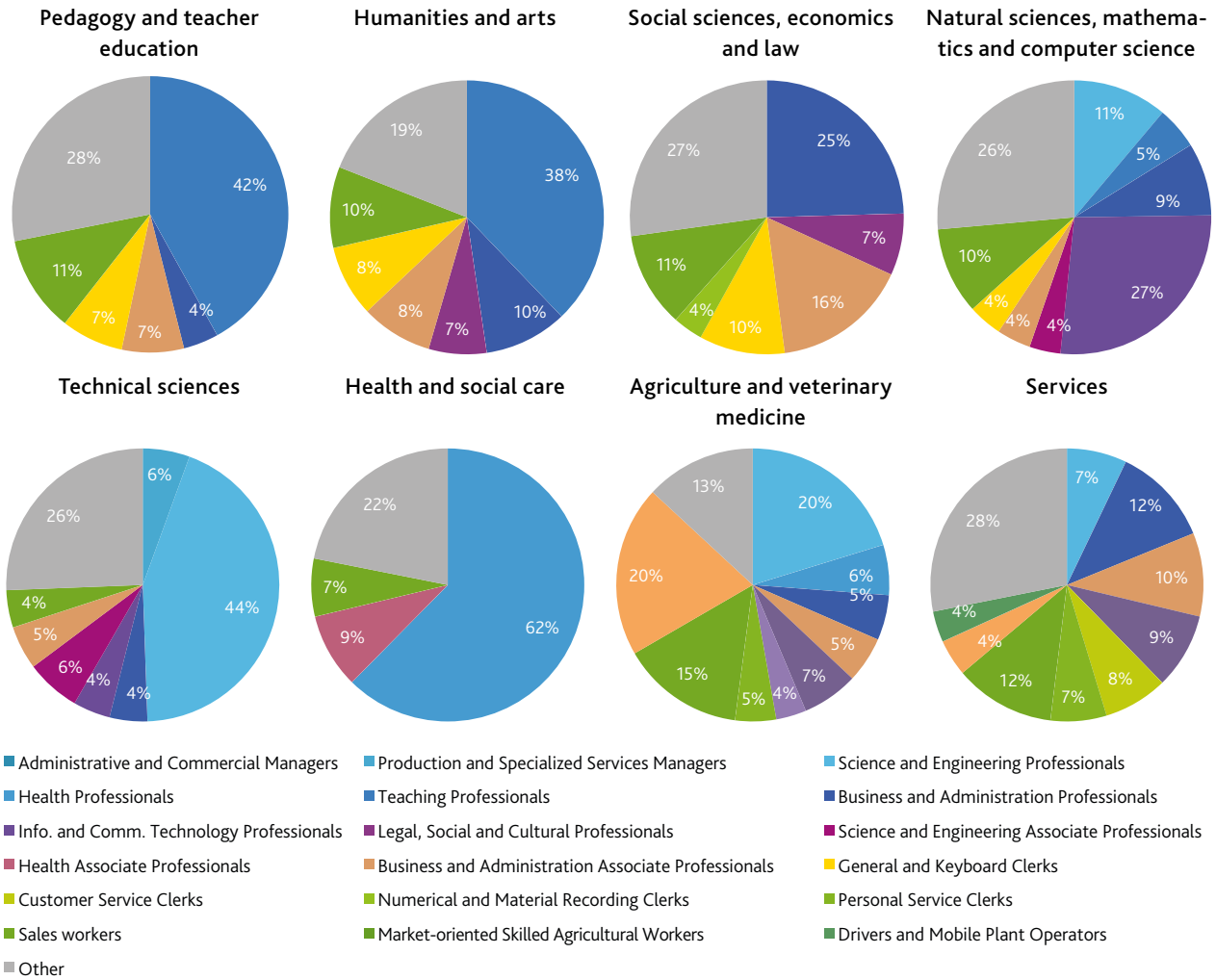
*Source: Own elabouration based on LFS data.*

## Box II.1. Where do tertiary-level graduates work two years after graduation?

The risk of unemployment among tertiary-level graduates is lowest among graduates of technology and health departments. The highest unemployment rate two years after graduation is found among graduates of pedagogy, social sciences, services and agriculture (based on BAEL data for 2010-2012).

The greatest chance of employment in high-skilled occupations (managers and professionals) is observed for graduates of health, technology, natural sciences, mathematics, computer science and humanities. In each group, the proportion of graduates working as managers and professionals reaches at least 60%. A level below 50% was found for graduates of social, agricultural and service--related studies. This means that the graduates of those departments are most exposed to the risk of employment below their qualifications at the very beginning of their careers. At the same time this shows that competences in those fields of science are not as valued by employers.

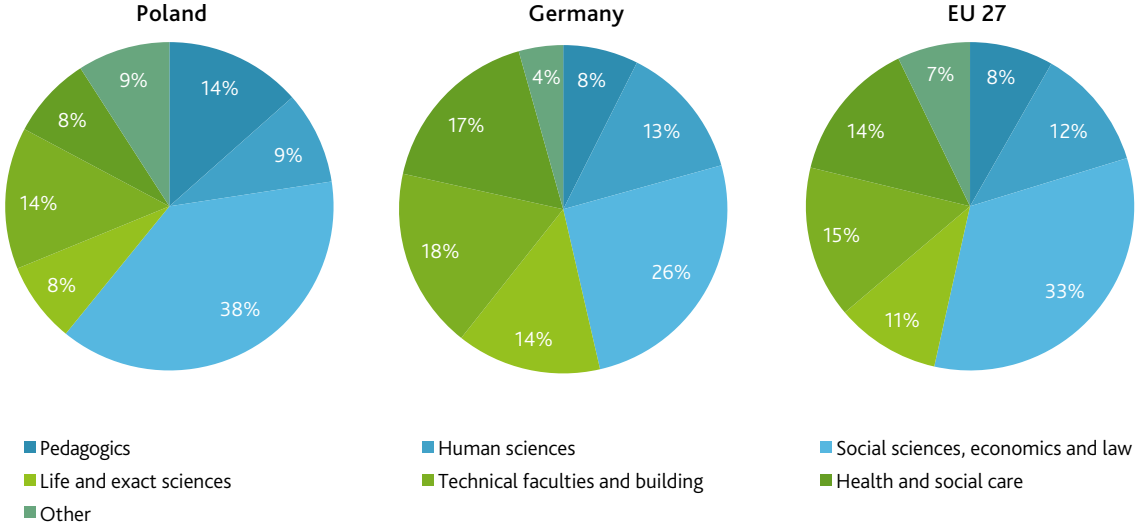
Figure II.5. **Occupational structure of employed tertiary-level graduates two years after first graduation, average for 2010-2012.**




*Source: own elabouration based on LFS data.*

The aforementioned trends are at least partly reflected in the recently observed educational choices of young Poles. Faculties providing poor career prospects have been losing in popularity. Between 2007 and 2011 there was a clear decrease in enrolments at social and economic departments, with the share in the structure of newly enrolled students dropping from 40% to 33%. A strong decline was also observed in admissions to teacher studies (share lower by 2.8 pp.). This was accompanied by a significant increase in the number of enrolments at technical faculties, with the share growing from 13% to 18%, and in medicine (cf. Ministry of Science and Higher Education, 2013). The increase in the popularity of technical faculties and exact

Figure II.6. **Structure of tertiary education by the groups of faculties in 2011 in Poland, Germany and the EU.**

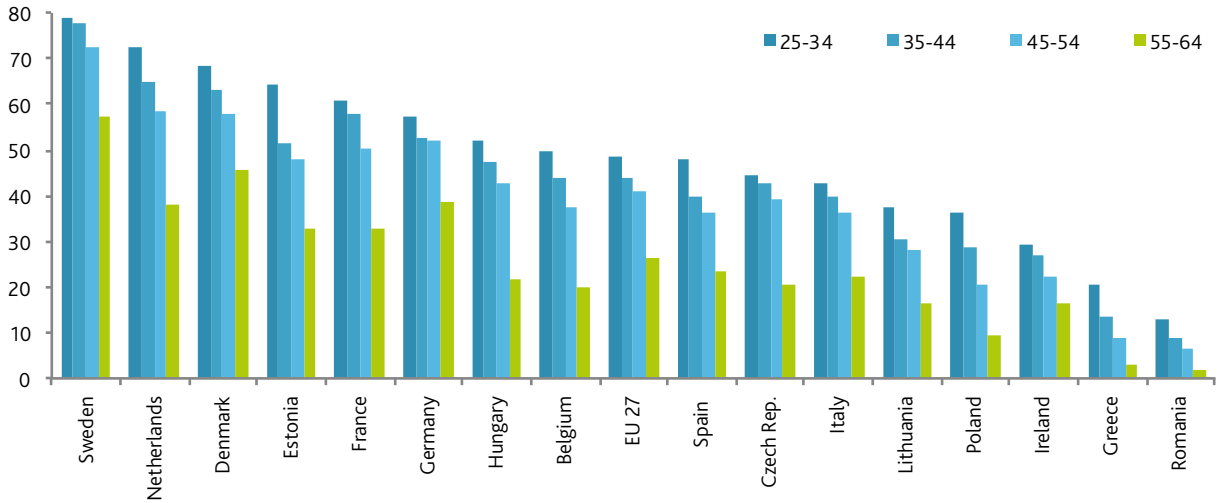



*Source: own elabouration based on Eurostat data.*

sciences accompanied the restoration of obligatory tests in mathematics in Matura exams in 2010, and the implementation of the *ordered specialty* programme, under which 1.1 billion zlotys was spent in 2008-2013 and 87 thousand students began studies at the supported faculties (Grotkowska et al., 2014). Despite this, the programme has been criticised, e.g. for its high cost. It was also mentioned that the number of student dropping out of the supported faculties was higher than other similar but non-supported departments (Grotkowska et al., 2014). Moreover, the programme concerned mainly the faculties which enjoyed growing popularity among applicants, which puts into the question the legitimacy of public intervention in this area (Górniak, 2014).

The quality of human capital depends significantly on lifelong learning. According to the models of human capital accumulation (Mincer 1974, Ben-Porath 1967), the level of investment in human capital decreases with age but remains significant until the end of the career. The models imply a significant intensity of education throughout the whole period of work. In this area, differences between the EU economies are more important than the differences between age groups within individual countries (cf. Figure II.7). The highest percentage of adults undertaking further education can be found in the Scandinavian countries, as well as the Netherlands, France and Germany (on average more than 50% of people aged 25-64 years). Poland has one of the lowest positions in the EU, with 24% in this age group. The proportion of Poles participating in educational activities at the age of 55-64 is especially low at 10%, against 57% in Sweden and 45% in Denmark. The low indicators of educational activity in Poland concern both sexes, all educational levels and all occupational groups (cf. Chłoń-Domińczak and Lis, 2013; CRZL, 2008). These particularly low numbers are in clear opposition to Poland's leading position in the number of tertiary-level

Figure II.7. **Percentage of people involved in lifelong learning by age groups in selected EU countries in 2011.**




*Source: own elabouration based on Eurostat data.*

students. This disproportion may lead to a faster loss of human capital gained during tertiary-level studies compared to Western and Northern Europe. Investment in human capital in the form of lifelong learning improves adaptability to the changing labour demand, minimising the risk of mismatch between the labour demand and supply.

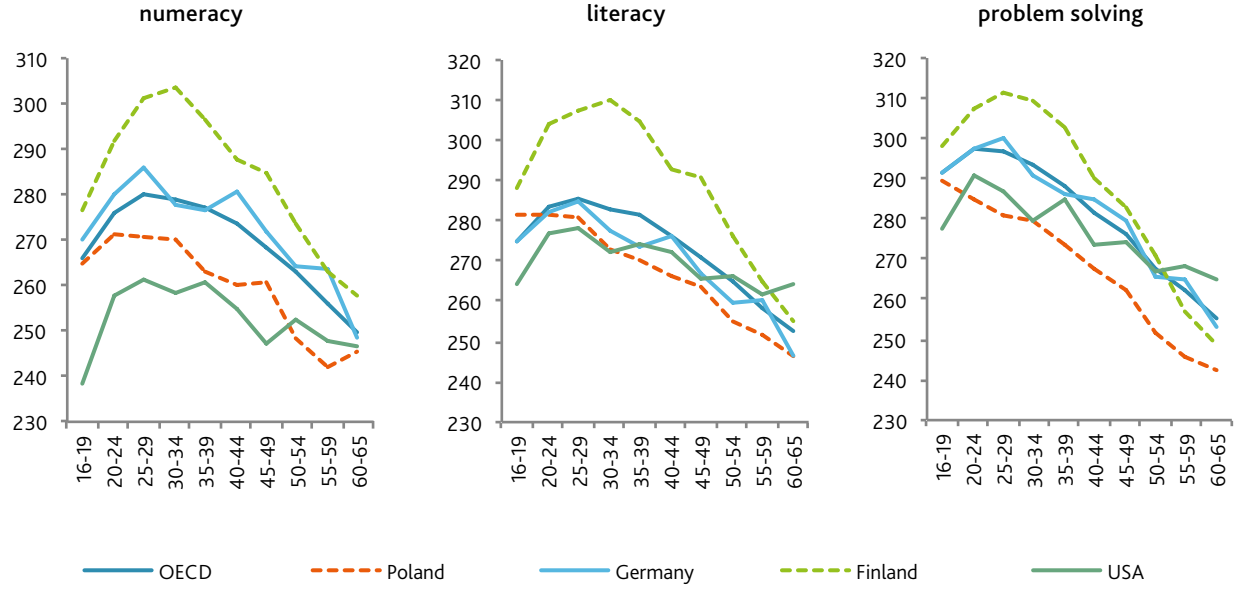
Employers are more interested in the real skills of employees than their formal education level. A higher level of education does not necessarily mean higher skills. This must be borne in mind in comparisons between countries with different educational systems. To date, the Programme for the International Assessment of Adult Competencies (PIAAC) prepared by the OECD has been the richest source of information on the skills of adults, both in Poland and other countries. Surveys were carried out in 2011 and 2012 in 24 countries and involved 166 thousand people (including 9 thousand in Poland) aged 16-64 years. Their aim was to assess the competencies of adults in three key areas: literacy, numeracy, reading and, additionally, problem solving in technology-rich environments.

One of the main conclusions that can be drawn from the survey is the positive correlation between the skills and the level of education. Another crucial observation is the lower results obtained by older participants (cf. Figure II.8), which partly results from the different educational structure than the younger cohorts, and partly from the depreciation of human capital with age.

The leaders in the PIAAC survey are Japan, the Netherlands and Scandinavian countries. The lowest literacy and numeracy skills were shown by Spaniards and Italians. Importantly, Germany had better results than Spain, although the percentage of Germans aged 25-64 with tertiary education was about 5 pp. lower than of Spanish. This confirms the hypothesis that the quality of human capital not only depends on the enrolment ratio. The average level of competencies for adult Poles in the PIAAC survey is below the average for OECD in all areas. This mainly results from a different educational structure. The greatest gap in skills between Poland and OECD countries concerns people who had completed their formal education at the upper secondary or post-secondary non-tertiary level (ISCED 3-4) (cf. Rynko (2013), p. 68). In this group, Poland fared worst in all groups of competencies. In addition, this gap in competencies is significant for both the younger and older age groups. Other educational groups achieved better results. Skills of Poles aged 30-39 with tertiary education are similar to Americans and Koreans of the same age and education. However, Poles with tertiary education fare much worse than graduates from Finland, Sweden, the Netherlands and Japan. It must be emphasised that above-average results in those countries are found at all educational levels, which means that the competencies of those with tertiary education strongly depend on the earlier stages of education.

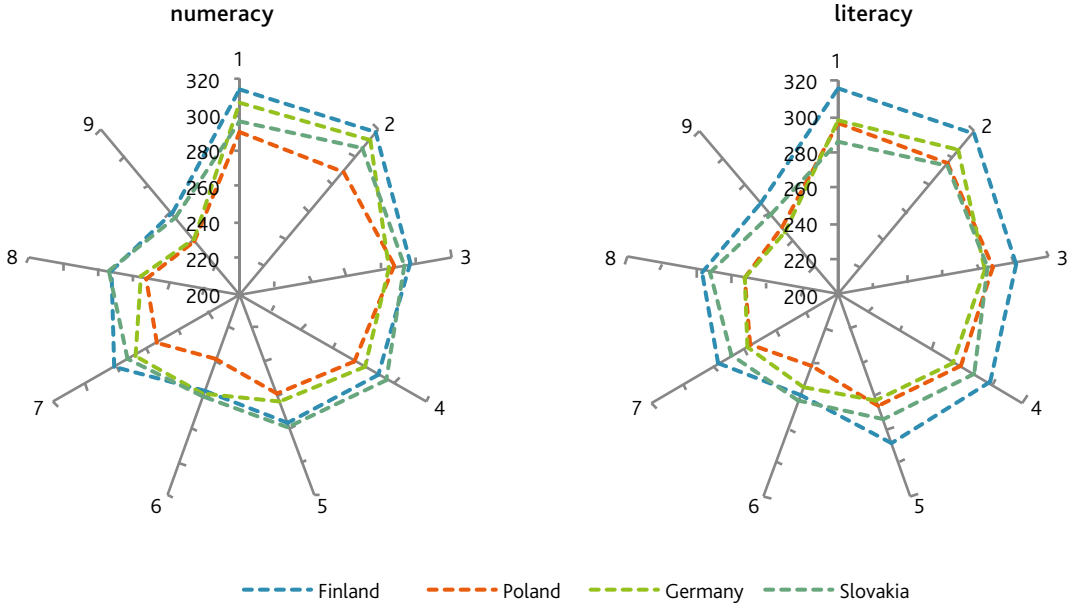
The level of skills correlates with occupation. This is not surprising as in the first Part of the Report we showed that the level of education strongly correlates with occupation. Groups of occupations with lower indexes in the ISCO classification (e.g. 1 – managers, senior officials and legislators, 2 – professionals) have the highest proportion of people with tertiary education. At the same time, the PIAAC survey indicates that people with those occupations, regardless of the country, had better results than other occupations. The lowest level of skills is usually found among agricultural workers and elementary occupations. However, in countries where agriculture is intensive and employment in this sector in low (e.g. in Germany) the competencies of agricultural workers are not much different from plant and machine operators.

Figure II.8. **Average competencies by age group according to the PIAAC survey in selected countries.**




*Source: own elabouration based on data from the PIAAC survey (OECD).*

Figure II.9. **Average level of skills of employees by occupation according to the PIAAC survey.**




*Notes: The digits on the horizontal axis correspond to the following groups of occupations from the International Standard Classification of Occupations: 1 - Legislators, senior officials and managers; 2 - professionals; 3 - technicians and associate professionals; 4 – clerical support workers; 5 – service and sales workers; 6 – skilled agricultural, forestry and fishery workers; 7 - craft and related trades workers; 8 – plant and machine operators and assemblers; 9 - elementary occupations.*

*Source: own elabouration based on data from the PIAAC survey.*

The lower general skills of agricultural workers in Poland, compared to other occupational groups and other countries, are especially significant due to their significant share in employment, exceeding 12% (in 2013). Given the still relatively low level of capitalisation and mechanisation of agriculture, Polish agricultural workers are more frequently engaged in manual labour and less often in tasks requiring cognitive skills. The low level of general skills makes it difficult for agricultural workers to change occupation and find employment outside elementary occupations. As we showed in Part I of this Report, the mechanisation of routine tasks concerns all sectors of the economy and the low general skills of agricultural workers are a barrier to the further process of decreasing the share of agriculture in total employment. Agricultural workers find it difficult to find work in non-routine occupations and according to LFS data, as many as ¾ of agricultural workers who changed their occupation in 2000-2010 found employment in manual occupations (groups 7, 8, 9 of occupations, cf. Magda, Pogorzelski and Kamińska, 2012).

# 2 SKILL MISMATCH BETWEEN SUPPLY AND DEMAND

Mismatch between the labour supply and demand results in structural unemployment, and may have several dimensions. First, it may refer to qualifications (level or specialty) or skills required from workers. Mismatch may consist of a deficiency of workers with appropriate qualifications, but also an insufficient number of jobs requiring high skills (overeducation). When the number of high-skilled applicants exceeds the number of appropriate jobs, some of them have to start working below their aspirations and abilities. This phenomenon is especially significant in the context of an exponential increase in the supply of high qualifications in the Polish economy over the last twenty years.

According to the job search model (cf. Cahuc and Zylberberg, 2004) describing the functioning of the labour market, the level of mismatch results from imperfect information in the labour market, and is its natural feature. The model assumes – in line with intuition – that a worker looks for a job that best suits his expectations, and an employer looks for a worker best suited for a given position. The key assumption of the model is imperfect information; workers know only about a fraction of offers, while employers may choose only between applicants. A worker may accept the offer or look for another one, better suited to his skills and preferences. The process of searching is expensive for both parties; the worker does not earn anything during the job search, while the employer has to incur the cost of the unfilled position. When the cost of further searching becomes too high, both parties may agree to employment, even when the characteristics of the worker/job do not fully match their preferences. In effect, the model implies that among the employed there always exists some mismatch between the labour demand and supply. It cannot be eliminated, but can be minimised through a more efficient system of job placement, i.e. the flow of information between the workers and employers.

Another source of mismatch is the spatial differentiation of demand and supply in the labour market. Due to economies of scale and the higher mobility of capital, the geographic concentration of companies is usually greater than the concentrations of the population (Rosenthal and Strange, 2004). In consequence, jobs, especially those requiring higher skills with better pay, are concentrated in larger cities. This is especially significant in Poland due to the low level of urbanisation and relatively high share of industry. This is the cause of significantly higher wages in large cities and high unemployment rates in some districts located in peripheral areas (cf. HRDC 2010, HRDC 2011). Moreover, the spatial dimension of the mismatch between the demand and supply has been relatively stable.

The mismatch between the structure of labour demand and supply in the EU is reflected in the persistently high unemployment rate, especially its structural component (cf. Boeri and van Ours, 2013). The Great Recession resulted in the deepening of the mismatch. After 2009, the EU countries experienced a growth in the number of open vacancies and unemployed.[1] This means that employers are finding it more difficult to find workers than before the crisis. The probable explanation is the divergence of characteristics and locations of the free workforce and requirements and locations of companies. This comes as no surprise given the fact that layoffs during the crisis happened mainly in manufacturing and construction where the qualifications of workers are relatively low, while the service sector was not hit as badly. It is likely that despite the number of vacancies, the unemployed cannot find work as they lack the qualifications and competencies needed to work in industries which were less affected by the crisis, or they live in places where the shortage of labour demand deepened during the downturn. The increase in the mismatch between labour supply and demand since 2008 is confirmed by the skill mismatch indicator (European Commission, 2013). It must be emphasised that this results from the lower demand for labour, and it is not the cause of increased unemployment in the aftermath of the crisis.

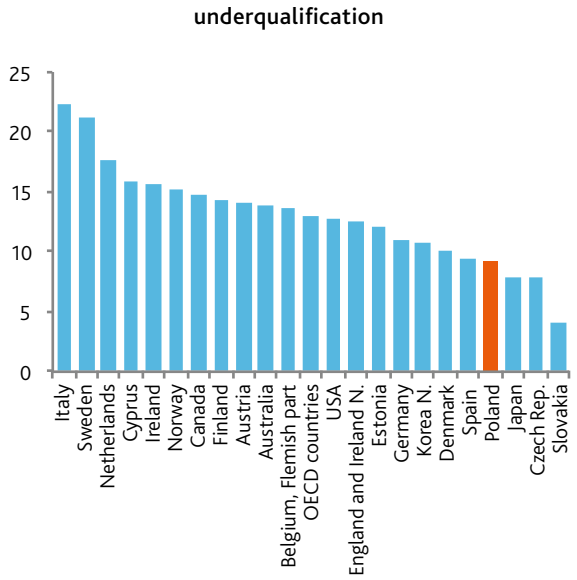
Insufficient qualifications or skills in the context of labour demand result in the lower employability of workers and raise the risk of structural unemployment. On the other hand, the lack of appropriate labour supply gives rise to a wage pressure and can slow down the increase in productivity. As complex production processes require skilled workers, the lack of adequate competencies inhibits the growth of existing companies and discourages investors, including foreign companies, to start new enterprises. Nonetheless, it is the overqualification of the population which has started to arouse more and more interest.

Working below one's qualifications has an adverse effect on career paths, limiting the opportunities of getting better jobs in the future. It may result in the deterioration or the loss of unused skills. Moreover, the worker may be affected by the "scar effect" (cf. Gregg and Tominey, 2005; Gangl, 2006) which makes employers less prone to hire workers with experience in worse jobs. Accordingly, accepting work below one's qualifications may lead to the worker being permanently stuck in a worse sector of the labour market, which means a waste of skills from the point of view of the entire economy. However, from the company's point of view,

1 The Beveridge curve has moved.

Figure II.10. **Percentage of overqualified workers according to the PIAAC survey.**


Figure II.11. **Percentage of underqualified workers according to the PIAAC survey.**




*Source: OECD (2013).*

hiring overeducated workers has a positive effect on productivity (Kampelmann et al. 2012).[2] That is why in the situation of an excess of qualifications in the labour market, companies increase educational requirements even when it is not objectively justified; this has been termed skill inflation (cf. Quintini 2011). Moreover, it is worth noting that employing high-skilled workers in a elementary occupations decreases the wage premium for higher education, and so is a signal for young people to change their educational plans. Although people with higher qualifications employed in occupations below their qualifications earn less than those in high-skill occupations, at the same time they receive a wage premium compared to the less skilled counterparts in the same occupation (OECD, 2013).

Skill mismatch is a dynamic phenomenon which may be partly alleviated by appropriate adjustment on the side of workers or employers. Too low employee qualifications may be alleviated by offering them on-the-job training or sending them to training courses. Too high qualifications may be more effectively used by promoting the worker to a higher or more appropriate position in the company.

Another reason for the shortage of skills is the increase in the requirements at the workplace. Introduction of new technologies, standards and regulations means that workers need to acquire new skills, with the old ones become unsuitable or insufficient. Computerisation of jobs is a good example of this process. Older workers are especially at risk, as they much less frequently improve their skills through participation in training or other forms of lifelong learning (cf. Figures II.7).

In practice, identifying the areas of mismatch consists of comparing the average requirements related to a given workplace and the characteristics of workers. However, mismatch in terms of formal qualifications does not necessarily mean a mismatch in terms of real skills.[3] That is why analyses based on formal education should not be used to formulate definite conclusions. Nonetheless, according to this methodology, Poland is a country with the highest mismatch between the faculties and the structure of labour demand (European Commission, 2013). Another method of mismatch assessment is questionnaires where workers and employers are asked directly about the presence and nature of mismatches.

According to the PIAAC, Poland is only slightly affected by the deficiency of skills and jobs requiring qualifications. Only 12% of the employed in Poland have qualifications higher than needed at the workplace, while a lack of skills is reported in 9% of the employed. The average for OECD countries which took part in the survey is 21% and 13%, respectively. Overqualification is especially high in Japan and in Anglo-Saxon countries: the UK, Ireland, Australia and Canada. Significant under-qualification can be seen in countries with a poor educational system, such as Italy, but also in Sweden and the Netherlands (cf. Figure II. 11).

2 In theoretical literature on the effects of hiring overqualified workers, two approaches may be found. In the first, better educated workers have a higher human capital and show higher adaptability to changes in the workplace, and so employing them even when no high skills are needed has a positive effect on the productivity of the enterprise. The second approach focuses on psychology. Overeducation results in frustration and discontent, and thus lowers worker productivity and adversely affects the attitude of the rest of the staff. Research by Kampelmann and Rycx (2012) suggests, however, that the first effect is stronger than the second and that the net effect will be positive for the company.

3 PIAAC survey results suggest that overqualified workers have on average lower qualifications than the rest of the population in a given educational group. Underqualified persons in terms of formal education may also have relatively higher skills (OECD 2013). This means that the mismatch may be ostensible, as generally real skills are important to employers, and not just formal qualifications.

Underqualification is especially common among immigrants, workers in small companies, part-time workers and those employed under fixed-term contracts (OECD, 2013). Poland, next to Australia and Japan, belongs to the countries in which about half of the employers report the highest problems with finding workers with appropriate qualifications. At the other end are Ireland, Spain and the UK where these indicators do not exceed 10% (Quintini, 2011). In addition, according to the assessment of young employees by employers in Europe and Central Asia (ECA), including Poland, the greatest obstacle to the growth of companies is the shortage of a qualified workforce. As the authors indicate, this results from the low quality of tertiary education and the mismatch between the acquired skills and the ever-changing requirements in the labour market, especially those concerning technical and soft skills (World Bank, 2012). In the context of the Polish educational boom and the associated increase in the number of workers with higher formal qualifications, and the unemployment rate persistently above 10%, the significant problems of employers with finding suitable employees indicate a serious mismatch between education and labour market needs.

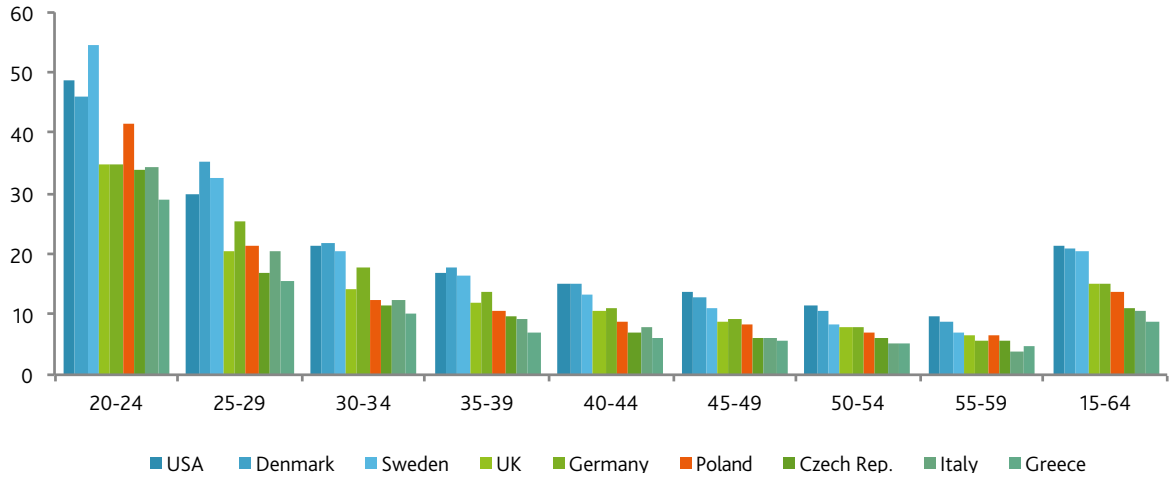
Skill mismatch is observed most frequently among young workers working full-time in small companies. The mismatch may have an effect on the duration of unemployment. As argued by Croce and Ghignoni (2012), overeducation occurs cyclically. Demand for highly-skilled workers results in an increased number of students, which in turn leads to an excess supply of highly-skilled workers and a shortage of low-skilled workers (unemployment occurs). Demand for graduates of tertiary-level schools decreases and overeducation becomes less significant. Then the mechanism is repeated. Importantly, workers who were not given tasks at the level of their qualifications are more likely to remain unemployed after losing a job (Ordine and Rose 2011).

The problem of skill mismatch in the workplace is alleviated in a situation of a high rotation of workers in the labour market (cf. Cahuc and Zylberberg, 2004). Higher turnover of labour promotes the flow of workers to jobs better matched to their skills and at the same time makes it easier for the unemployed to find work. Labour turnover in individual countries strongly depends on labour market institutions, especially employment protection legislation (negatively) and the level of social security for the unemployed (positively). Mobility is enhanced by the low cost of hiring and firing workers (cf. Boeri and van Ours, 2013) and efficient job placement. In the EU the highest mobility of labour is found in Scandinavian labour markets, especially in Denmark, due its flexicurity model combining a high level of assistance to job seekers (high benefits for the unemployed and active labour market policies) with the relative ease of terminating employment contracts. An equally high mobility of the workforce can be found in the US. Poland is below the European average, although above Slovakia, Czech Republic, Italy and Greece. Although the willingness to change jobs decreases with the age of workers, relevant labour market institutions can stimulate higher mobility in each age group (cf. Figure II.12).

Higher mobility of workers results in better utilisation of their skills and qualifications by the market. However, the departure of an experienced worker generates cost for the employer due to the loss of specific human capital (specific skills required in a given job) and the need to educate the new worker. In order to minimise this cost, employers are willing to offer higher wages to experienced workers. The wage premium for specific human capital acquired at the workplace is one of the causes of labour mobility decreasing with age.

To sum up, Polish workers relatively rarely report their own skill mismatch compared to their counterparts in OECD countries. Yet the comparison of educational and occupational structures and the results of employers' surveys places Poland among countries with the greatest skill mismatch between labour demand and supply. Low level of flows in the labour market confirm this negative assessment. This is a great challenge for educational and labour market policies, and shows that the observed educational boom brings also serious threats to the Polish economy.

Figure II.12. **Percentage of workers staying at a given workplace for less than a year, selected OECD countries in 2012.**




*Source: OECD, stats.oecd.org.*

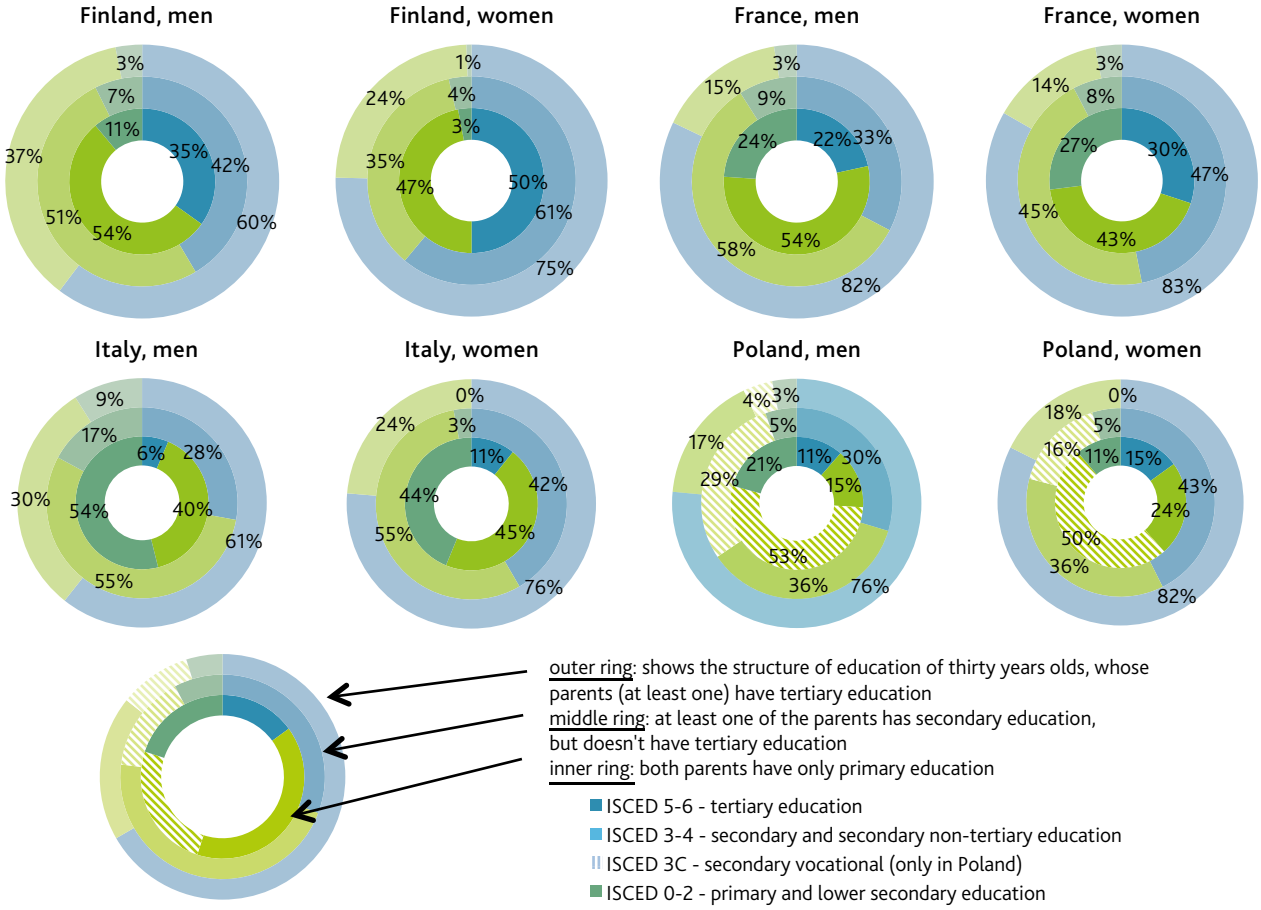
# 3 INHERITING EDUCATION AND SKILLS

The level of qualifications of young people is largely inherited, i.e. it depends on the level of education of the parents. This phenomenon has been confirmed by a number of studies from different countries, including the Netherlands and the UK in the 1970s (Micklewright, 1989), and Spain from the late 1980s and 1990s (Ahn et al., 1996). In addition to the level of education of the parent, the level of education of the children depends also on the occupational status of the parent. For example, in Spain, children show higher educational attainments if their fathers work in the public sector (Ahn and Ugidos 1998). By contrast, parents being unemployed, especially mothers, has a negative impact on the children's education. Data from Spain also show a particularly strong relationship between the careers of sons and their fathers.

According to a PIAAC survey, inheriting an education level from the parents has also been observed in Poland. More than three-quarters of 30-39 year olds with at least one of the parents holding a tertiary-level degree have also completed tertiary education (see Figure II.13). If the parents have only secondary education, the proportion of children with tertiary education decreases by half. But when both parents have only a primary level of education or none at all, the proportion of 30-39 year olds with a university degree in this group is only 11% for men and 15% for women, about 5-7 times less compared to when parents have tertiary education. Furthermore, over half of the children of low-skilled parents do not have secondary education. This group also has a high proportion of those who dropped out of formal education at the primary school stage.

International comparisons based on the PIAAC survey indicate that in the EU relatively high intergenerational educational mobility can be found in the Nordic countries and in France. The lowest mobility is observed in Southern European societies (OECD, 2010). In Finland, the proportion of people with higher education who also had parents with higher education is 1.5-2 times higher than of those with parents with only basic qualifications; in Italy it is 7-9 times higher (see Figure II.13.). This means

Figure II.13. **Education of people aged 30-39 years in selected countries in 2011, by parents' education.**




*Source: own elabouration based on the PIAAC survey.*

that in terms of intergenerational educational mobility, Poland is closer to the least mobile Southern countries than the mobile Nordic societies where social advancement is easier. Moreover, as shown by Herbst and Rok (2014), Poles from families with a low socio-economic status have limited access to fees-free full time tertiary education, which is generally regarded as better and more prestigious. As the employment status (income, risk of unemployment) depends on qualifications, inheriting a low level of education and acquiring an inferior education increases the risk of poverty in the next generation in the same family. On a scale of the entire society this means reduced social mobility.

According to sociologists, improvement in qualifications compared to the parent generation is possible only if parents communicate an appropriate hierarchy of values to their children, which then influences their attitude towards education and work (Kohn and Schooler, 1984). Those children who believe in achieving these objectives do achieve a higher education than their parents, while a conformism or demanding attitude combined with minimal effort results in children remaining in the same social group as the parents (Głuszek, 2007). Both Polish and foreign research indicates greater strength of this latter effect than an improvement in education (Głuszek 2007, Becker 2009).

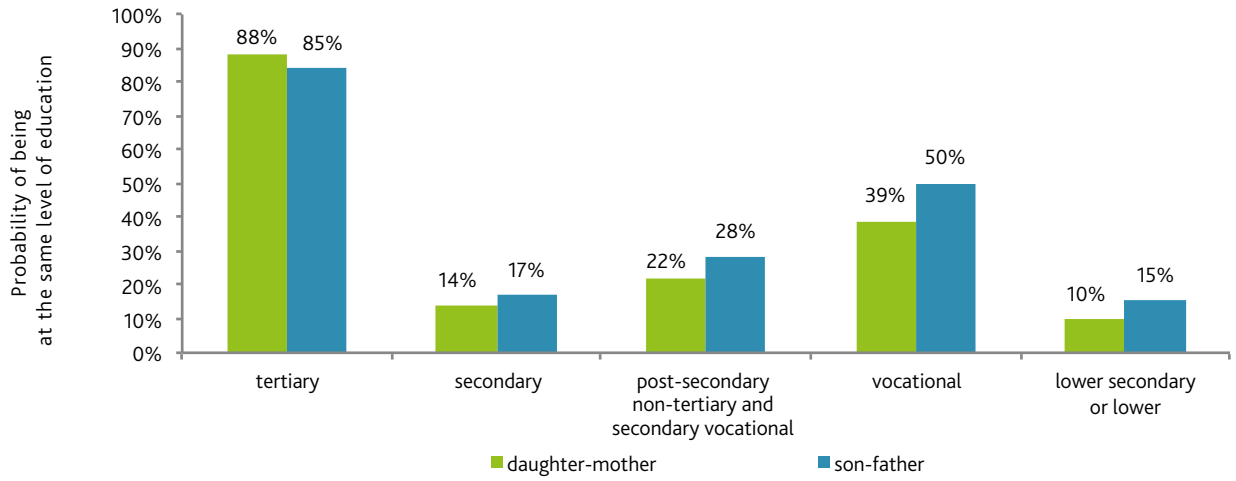
In order to examine how education and qualifications are inherited, we carried out an Occupation Inheritance Survey. The survey was conducted in March 2014 by computer assisted telephone interviewing (CATI) on a random sample of 2000 people aged 30-39 living in Poland.[4] The study gathered information about the level and field of education among 30-39 year old Poles compared to their parents' education; the survey also collected information on labour market participation and occupations in both generations. The choice of 30-39 year olds was dictated by the fact that the professional life is stabilised in this age group, and those people were young enough to start their working life after 1990. Between them and their parents' generation we can see visible structural changes in the labour market – the results of the systemic transformation and enhanced integration of the Polish economy with the global economy. In addition, the current generation of 30-year-olds will play an important role in the Polish labour market over the next 20-30 years. A detailed discussion of the results of the survey is presented in the following sections.

In searching for the causes of changes in skills and types of work, we examine how the skills valued in the labour market are transmitted within a household. This shows the extent to which the educational boom and structural changes preserve or offset socio-economic diversity. The existence of intergenerational mechanisms is an important constraint for labour market policies, and shows areas where the adverse effects are particularly strong.

## EDUCATION

The main conclusion of the Occupation Inheritance Survey is a clear positive correlation between parental education and children's education. Children of people with higher education

Figure II.14. **Inheriting education level from parents, by sex.**




*Notes: The bars represent the frequency of having the same education as the mother or father, for daughters and sons respectively. Most of the research on the inheritance of education shows no association between the education of daughters and fathers and between sons and mothers (cf. Ahn and Ugidos 1998). Data from the Occupation Inheritance Survey confirms the absence of such dependences, and therefore only daughter-mother and son-father relationships are presented.*

*Source: own calculations based on the Occupation Inheritance Survey.*

4 In order to improve the representativeness of results, we used analytical weights. First, we established the *ex ante* probability of being classified into the population sample based on the number of telephones under which a given person is available. Then the weights were *ex post* linearly callibrated (cf. Deville and Särndal, 1992) using the distributions by sex, voivodeship, education and 5 year age groups according to data based on the National Census from 2011.

## Table II.1. Structure of the level and field of education of 30-39 years olds compared to their parents.

| level and direction of parent education | | | | level and direction of education | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | tertiary | | | | | | | |
| | | | | under secondary | secondary | teacher education | human sciences | social sciences | exact and technical sciences | health and social care | agriculture | other | No. of observations |
| women | father | | under secondary | 35% | 36% | 4% | 6% | 9% | 5% | 4% | 0% | 1% | 564 |
| | | | secondary | 8% | 35% | 9% | 12% | 14% | 11% | 6% | 2% | 5% | 318 |
| | | tertiary | teacher education | 0% | 11% | 28% | 9% | 4% | 15% | 33% | 0% | 0% | 20 |
| | | | human sciences | 0% | 13% | 49% | 29% | 0% | 10% | 0% | 0% | 0% | 7 |
| | | | social sciences | 0% | 7% | 0% | 12% | 56% | 0% | 21% | 0% | 4% | 16 |
| | | | exact and technical sciences | 1% | 11% | 12% | 17% | 8% | 19% | 27% | 0% | 5% | 83 |
| | | | health and social care | 0% | 3% | 0% | 5% | 0% | 2% | 76% | 14% | 0% | 26 |
| | | | agriculture | 0% | 5% | 16% | 12% | 0% | 0% | 10% | 21% | 37% | 9 |
| | | | other | 0% | 19% | 4% | 18% | 2% | 6% | 15% | 0% | 36% | 19 |
| | mother | | under secondary | 40% | 35% | 5% | 6% | 6% | 5% | 2% | 0% | 1% | 444 |
| | | | secondary | 10% | 35% | 8% | 8% | 14% | 9% | 11% | 1% | 4% | 466 |
| | | tertiary | teacher education | 0% | 17% | 14% | 28% | 12% | 18% | 11% | 0% | 1% | 44 |
| | | | human sciences | 0% | 0% | 0% | 33% | 19% | 18% | 27% | 0% | 4% | 20 |
| | | | social sciences | 0% | 14% | 6% | 23% | 29% | 6% | 12% | 0% | 9% | 19 |
| | | | exact and technical sciences | 0% | 18% | 2% | 13% | 19% | 12% | 36% | 0% | 0% | 18 |
| | | | health and social care | 0% | 6% | 10% | 16% | 9% | 3% | 40% | 10% | 7% | 32 |
| | | | agriculture | 0% | 0% | 17% | 35% | 0% | 20% | 0% | 27% | 0% | 4 |
| | | | other | 0% | 30% | 0% | 3% | 6% | 10% | 2% | 0% | 48% | 15 |
| men | father | | under secondary | 52% | 34% | 2% | 2% | 2% | 7% | 1% | 0% | 1% | 511 |
| | | | secondary | 8% | 36% | 3% | 5% | 11% | 32% | 2% | 1% | 2% | 234 |
| | | tertiary | teacher education | 0% | 7% | 43% | 2% | 11% | 28% | 9% | 0% | 0% | 23 |
| | | | human sciences | 0% | 12% | 7% | 38% | 18% | 4% | 18% | 0% | 4% | 16 |
| | | | social sciences | 0% | 21% | 3% | 8% | 53% | 10% | 5% | 0% | 0% | 22 |
| | | | exact and technical sciences | 5% | 17% | 4% | 3% | 6% | 45% | 8% | 2% | 9% | 77 |
| | | | health and social care | 0% | 2% | 3% | 4% | 0% | 2% | 87% | 0% | 1% | 33 |
| | | | agriculture | 0% | 24% | 0% | 0% | 8% | 0% | 12% | 46% | 12% | 7 |
| | | | other | 0% | 3% | 11% | 0% | 19% | 9% | 12% | 24% | 21% | 15 |
| | mother | | under secondary | 51% | 33% | 1% | 2% | 3% | 8% | 0% | 1% | 1% | 390 |
| | | | secondary | 21% | 33% | 5% | 5% | 6% | 21% | 7% | 2% | 1% | 412 |
| | | tertiary | teacher education | 3% | 9% | 20% | 4% | 15% | 35% | 9% | 0% | 4% | 30 |
| | | | human sciences | 8% | 6% | 0% | 13% | 18% | 30% | 24% | 0% | 0% | 15 |
| | | | social sciences | 0% | 26% | 3% | 0% | 59% | 5% | 7% | 0% | 0% | 18 |
| | | | exact and technical sciences | 0% | 13% | 0% | 16% | 10% | 49% | 7% | 0% | 6% | 25 |
| | | | health and social care | 0% | 8% | 10% | 0% | 1% | 28% | 34% | 10% | 9% | 38 |
| | | | agriculture | 0% | 0% | 11% | 11% | 27% | 51% | 0% | 0% | 0% | 4 |
| | | | other | 0% | 34% | 0% | 0% | 0% | 5% | 0% | 0% | 61% | 6 |
| No. of observations: women | | | | 176 | 348 | 91 | 106 | 112 | 87 | 97 | 10 | 35 | 1062 |
| No. of observations: men | | | | 240 | 292 | 43 | 38 | 66 | 170 | 51 | 13 | 25 | 938 |

*Notes: percentages show the structure in each row according to the categories in columns. The sum for each row is 100%.*

*Source: Own calculations based on the Occupation Inheritance Survey.*

practically always have at least secondary education. If parents had secondary education, 57% of children gained tertiary education. Having low-skilled parents significantly reduced the chances of educational success. Only 29% of 30 year olds with parents without secondary education had tertiary education. These results are similar to previously reported data obtained from the PIAAC survey. Moreover, a significant proportion of children of people without secondary education complete only one level of education more in relation to the parents, to give them basic vocational or secondary vocational training. This means that the parents' education level significantly determines the educational achievements of their children.

Intergenerational dependences are not only found in the level but also in the field of education. A strong positive correlation is observed particularly in faculties related to prestigious occupations, such as doctors, lawyers and economists. This is particularly evident for people with degrees in the field of health and social care. As many as 83% of the children of fathers with this type of education chose the same faculties. However, in the case of mothers educated in the area of health and social care, the percentage of children inheriting this type of education is much lower (37%). In the area of services and general education, inheriting the same type of education is also significant (59% for mothers and 31% for fathers). A fairly strong relationship is also observed for social sciences, such as economics and law (55% for fathers and 43% for mothers) and technical sciences, although only for sons.

Gender and inheriting education in both the mother-daughter and father-son lines do differentiate educational choices, but their impact is much smaller than the mere presence of a person with a higher education. Sons and daughters inherit education from their mothers and fathers to a similar extent (cf. Figure II.14). These results indicate that both the levels and fields of study are strongly conditioned by the aspirations and attitudes communicated by parents, both mothers and fathers.

## 3.1 CAREER PATHS

Inheriting the level and field of education in many cases also implies the inheritance of careers. More than ¾ of skilled white-collar workers inherited this type of occupation from their parents, while for unskilled white-collar workers this was observed in only ⅓ of children. Sectoral changes in the Polish

Table II.2. **Occupational structure of people aged 30-39 compared to the parents' occupations.**

| | | practised occupation | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | women | | | | | | men | | | | | | | |
| parent | parent's occupation | skilled mental | unskilled mental | farmer | skilled physical | unskilled physical | not working | skilled mental | unskilled mental | farmer | skilled physical | unskilled physical | not working | No. of observations: women | No. of observations: men |
| father | skilled mental | 80% | 18% | 0% | 2% | 0% | 0% | 81% | 9% | 0% | 9% | 1% | 0% | 310 | 280 |
| | unskilled mental | 52% | 40% | 0% | 6% | 1% | 1% | 46% | 28% | 0% | 25% | 1% | 0% | 78 | 51 |
| | farmer | 29% | 45% | 7% | 11% | 2% | 7% | 27% | 6% | 37% | 23% | 3% | 4% | 84 | 68 |
| | skilled physical | 39% | 45% | 1% | 9% | 4% | 2% | 26% | 14% | 1% | 54% | 5% | 0% | 487 | 455 |
| | unskilled physical | 42% | 41% | 0% | 3% | 5% | 8% | 40% | 15% | 2% | 34% | 9% | 0% | 62 | 48 |
| | not worked | 38% | 35% | 0% | 10% | 1% | 16% | 12% | 27% | 0% | 43% | 5% | 14% | 41 | 36 |
| mother | skilled mental | 72% | 24% | 0% | 3% | 1% | 0% | 70% | 8% | 0% | 18% | 3% | 1% | 366 | 318 |
| | unskilled mental | 43% | 45% | 0% | 7% | 2% | 3% | 33% | 15% | 3% | 47% | 2% | 0% | 333 | 298 |
| | farmer | 29% | 40% | 13% | 14% | 0% | 4% | 35% | 3% | 32% | 20% | 8% | 2% | 55 | 36 |
| | skilled physical | 41% | 42% | 0% | 10% | 5% | 1% | 27% | 20% | 0% | 47% | 6% | 0% | 110 | 99 |
| | unskilled physical | 31% | 43% | 2% | 10% | 8% | 6% | 18% | 25% | 3% | 47% | 7% | 0% | 61 | 50 |
| | not worked | 36% | 38% | 1% | 12% | 4% | 8% | 28% | 15% | 6% | 45% | 4% | 2% | 137 | 137 |
| No. of observations | | 572 | 353 | 13 | 67 | 24 | 33 | 440 | 115 | 30 | 310 | 33 | 10 | 1062 | 938 |

*Notes: The percentages show the structure in each row according to the categories in the columns. The total value for each row is 100%. Occupations were grouped according to the classification proposed by the ILO (ILO 2008) extended by singling out agricultural workers for the purposes the survey. The group of skilled white-collar workers includes government officials, senior officials, professionals, technicians and associate professionals; unskilled white-collar workers: office clerks, service and sales workers; agricultural workers: farmers, gardeners, foresters and fishermen; skilled labourers: manufacturing labourers and craftsmen, plant and machine operators and armed forces; unskilled workers: elementary occupations. Detailed classification of occupations can be found in the annex.*

*Source: own calculations based on the Occupation Inheritance Survey.*

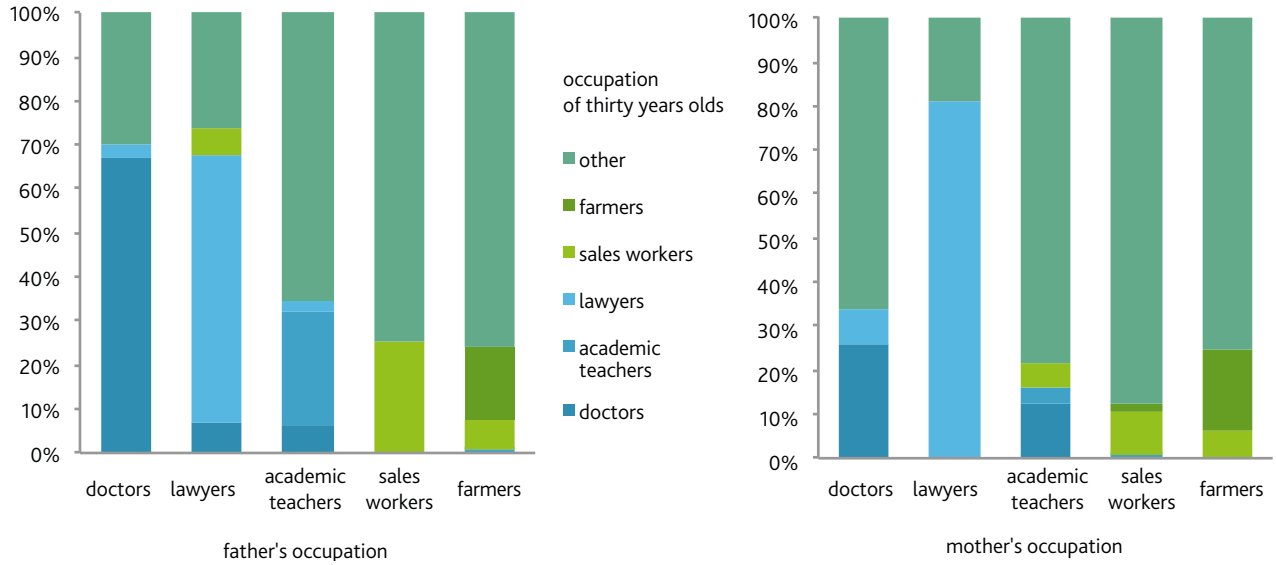
economy, as described in the first part of this report, result in a situation where remaining in the parental occupational group is lower for agricultural workers – on average 22%, skilled manual workers – 29% and unskilled manual workers – 7%. However, the inheritance of employment in agriculture and manual skilled occupations is several times stronger for men than women. Only 7% of women with fathers employed in agriculture are also employed in agriculture, compared to 37% of men in the same situation. 9% of women whose fathers had a skilled manual occupation had a similar job, compared to 54% for men. As in the case of education, social advancement to skilled white-collar occupations is more likely when parents also had white-collar jobs than when parents had manual or agricultural jobs. When the father had an unskilled white-collar job, the probability that his child would advance to the more prestigious group of skilled white-collar occupations is approx. 50 %. When the father was employed in agriculture, this probability is 28%. This means that social promotion is not equally accessible to people from all social circles.

A particularly weak intergenerational mobility is especially significant in the case of sons of agricultural workers. Almost 37% of sons remain in agriculture. Such a strong intergenerational relationship and difficulty with changing qualifications may result in a slower decline in the share of agriculture in employment in the future (cf. Table II.2), especially that after leaving agriculture, sons often choose occupations that do not require qualifications and are susceptible to layoffs resulting from structural changes (cf. Part I). The most important factor for remaining in agricultural occupation is the father-son line, while daughters are almost 2-3 times less likely to work in agriculture, and often choose white-collar occupations, either skilled or unskilled. If a son chooses a different career path than the father, the most common choice is a profession that requires skills – physical or intellectual. It is worth noting that in families with a large number of children (four or more) the chance of remaining in the agricultural sector is twice higher than in the case of smaller families (26% and 13%).

Analysis of major occupational groups reveals that differences in education between 30-39 year olds and their parents resulted in a growing importance of professionals (25%) than the dominant category of manufacturing workers among fathers (33%) and sales workers among mothers (23%). Following the same career path is also significant for unskilled jobs, especially for sales workers.

High inheritance is observed for some prestigious professions: doctors, lawyers and academic teachers (cf. Figure II.15). Sales workers are another group of relatively frequently inherited occupations. The data indicates that over 67% of children with a father working as a doctor also become a doctor. The percentage of children inheriting the occupation of the father is also very high for other health professionals (58%) as well as lawyers (63%). The academic teaching career of a father is inherited by ¼ of the children. Relatively high rates of inheritance also apply to occupations with low prestige: workers employed in manufacturing and sales (25%). High qualifications of parents, but from a different sector, greatly reduce the chances of becoming a doctor or a lawyer. Children of doctors or teachers have only a 10% chance of becoming lawyers. Similarly, only 10% of children of lawyers and academics will be doctors. Moreover, we note that having the same profession as the mother is much rarer than the inheritance from the father; this is observed only 35% of children of female lawyers, 31% of children of female health care professionals, and 25% of children of female doctors. The high frequency of subsequent generations remaining in the occupations of doctors and lawyers, with strong mechanisms of

Figure II.15. **Occupational structure of people aged 30-39 compared to the education of parents for selected occupations (%).**




*Source: Own elabouration based on the Occupation Inheritance Survey.*

**Table II.3. Occupational structure of people aged 30-39 according to the mismatch between the qualifications and occupation (%).**

| practised occupation | learned occupation vs practised | | | No. of observations |
|---|---|---|---|---|
| | the same | higher | lower | |
| skilled mental | 93% | 0% | 7% | 1012 |
| unskilled mental | 52% | 25% | 24% | 468 |
| skilled physical | 79% | 13% | 8% | 377 |
| unskilled physical | 26% | 51% | 23% | 57 |
| farmer | 60% | 35% | 5% | 43 |
| TOTAL | 78% | 11% | 12% | |
| No. of observations | 1520 | 210 | 227 | 1957 |

*Notes: Percentages show the structure in each row according to the categories in the columns. The sum of values for each row is 100%.*

*Source: Own elabouration based on the Occupation Inheritance Survey.*

selection and relatively high-wage occupations in these groups, indicates considerable informal restrictions on access to these professions for people outside the groups.

People with tertiary and secondary vocational education are far more likely to work in occupations that require formal confirmation of qualifications; i.e. with barriers to entry. They include doctors and lawyers, as well as taxi drivers. At the same time, among people with lower secondary or general secondary education, almost no one works in such occupations. Regulated professions such as engineers, academics and other teachers do not differ in occupational inheritance from professional salespeople (approx. 23%). As in the case of inheriting occupations and education, regulated occupations are more frequently inherited from the father than from the mother.

Problems in finding a job consistent with the formal education level are an important phenomenon from the perspective of labour market policies, as well as the educational system. Contrary to common opinions in the media on the need to be re-trained during one's career, 70% of 30-39 year olds consider their occupation to be in line with their education (the largest correspondence is reported by skilled white-collar workers – 93%, cf. Table II.3). Occupations below the qualifications are most often found among unskilled manual workers (51% reporting a mismatch). Among the major occupational groups the greatest mismatch can be found among people educated to be professionals but working in positions that do not require high skills, as well as people with technical qualifications working as office clerks or in sales. Mostly, those people working in professions not consistent with their qualifications are salesmen (23%), office clerks (15%) and technicians (15%).

The problem of skill mismatch is mostly found among graduates with bachelor degrees (25%), and those with secondary (24%), secondary technical (34%) and basic vocational (21%) education, and least frequently among engineers (14%) and those with tertiary-level education (16%). It is also worth noting that as many as ⅔ of general secondary school graduates felt that they had acquired no vocational skills, while in other education groups only single persons reported this. Due to the growing popularity of bachelor-level studies, the high number of overeducated people in this group may be indicative of a strong positive selection for master studies, or the poor quality of bachelor studies which offer qualifications not valued in the labour market.

In the Occupation Inheritance Survey, respondents were also asked questions about running their own business. The results reveal that the propensity for entrepreneurship is much higher in people who have watched their parents leading companies. Almost 50% of respondents whose parents ran their own businesses, and 40% of those whose mothers were entrepreneurs, were self-employed, compared to about 25% of respondents whose parents were employees. Also running a company that employed workers is strongly conditioned by observing this in the parents, especially the father. The probability of hiring employees is 25% higher when the father owned a company and over 31% higher when he employed a workforce. For mother as entrepreneurs these values are lower by half and for mothers without employees the figures do not differ from employed parents (about 10%).

## 3.2 ECONOMIC ACTIVITY

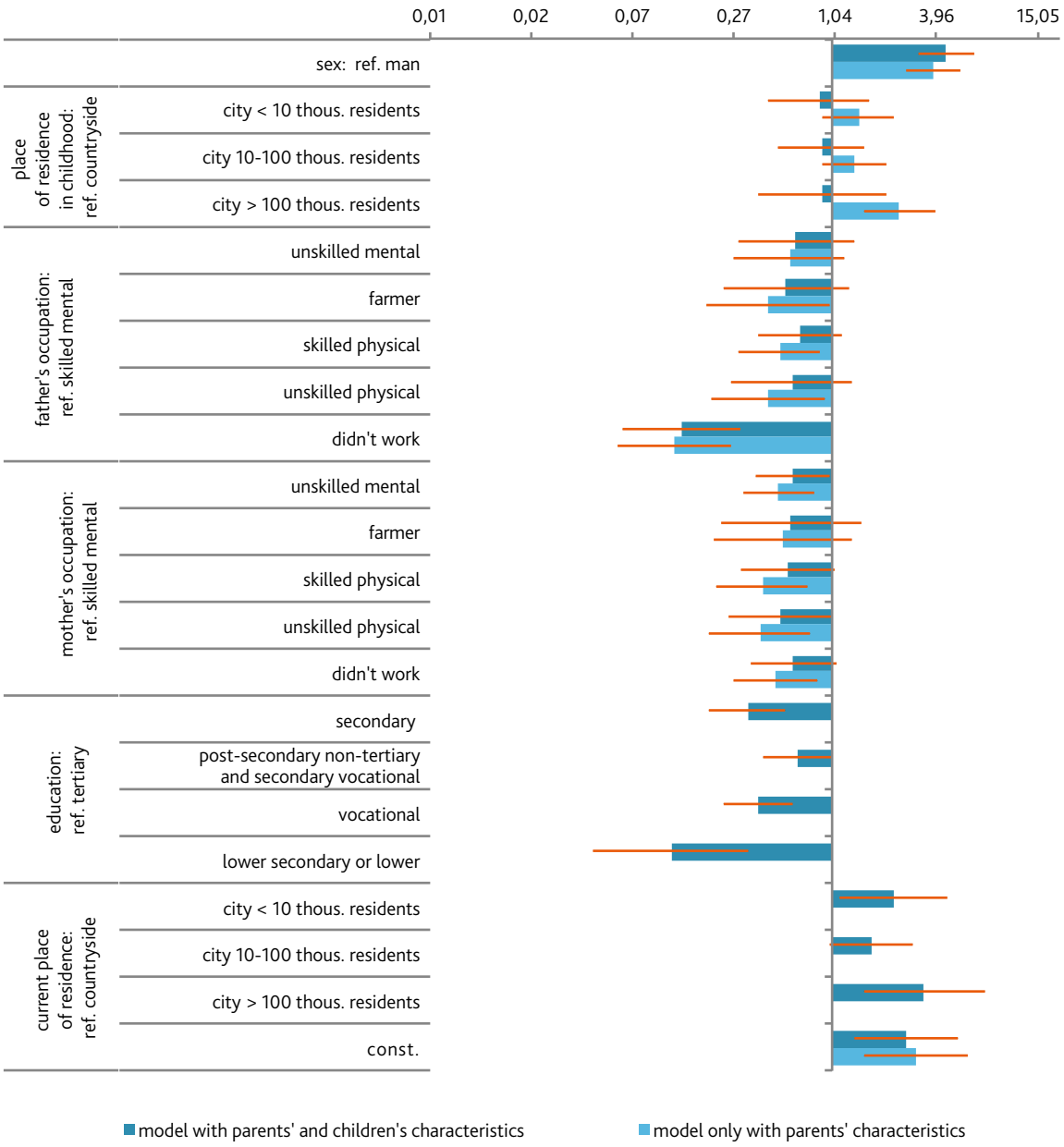
As shown in HRDC (2013), the intensity of labour in the household is of utmost importance against the risk of poverty. For this reason, intergenerational conditioning of labour market participation is fundamental in the perpetuation of poverty patterns. The working habits of parents have a big impact on the motivation of children to learn, their accumulation of human and financial capital and aspirations, which translates into the situation of the 30-39 year olds in the labour market. Those whose parents worked during their high school or vocational education have more of a chance of finding a job than those whose parents did not work in that period. Fathers working increased the employment rate from 78% to 90%, and mothers working from 86% to 90%. In contrast, the employment rate among people with both parents unemployed dropped to 75%. This means

that one working parent is sufficient to provide the motivation to work, and children of unemployed parents should be given special attention in terms of educational policy and social assistance. Those households are the most likely to perpetuate the negative patterns of conduct.

From the perspective of educational and social policies it seems important if a negative impact of unemployed parents is reflected in early educational and occupational choices. In order to answer this question we built two econometric models. In the first, the labour market status (employment or unemployment) is explained only in terms of the characteristics of the parents (job, occupation, place of residence at the time of raising the children), while the second model additionally includes the respondent's characteristics (education, place of residence). If, after the inclusion of the respondents' characteristics, the parents' characteristics remain significant, it means that the influence of the parents (their upbringing, aspirations) on the employment status is reflected in the initial educational and professional career choices, as well as impacting on the current labour market opportunities.

Estimation results are presented in Figure II.16. According to the results of the first model - containing only the characteristics of

Figure II.16. **Impact of parents' work on the economic activity of 30-39 year olds – results of the logit model.**




*Notes: The Figure shows the odds ratios for each variable obtained using the logit model on a logarithmic scale. Values above 1 indicate that a given characteristic increases the probability of employment, while less than 1 has the opposite effect. Using the horizontal lines we indicate 95-percent confidence intervals for the assessment of the parameter. If the confidence interval does not contain a value of 1, the level of the variable statistically significantly differentiates the likelihood of employment in relation to the reference level.*

*Source: Own elabouration based on the Occupation Inheritance Survey.*

Table II.4. **Occupational mobility of 30-39 year olds in relation to the type of work contract.**

| Type of employment contract | change of occupation | | No. of observations |
|---|---|---|---|
| | no | yes | |
| without formal contract | 40% | 60% | 23 |
| specific-task contract | 58% | 42% | 27 |
| casual work contract | 62% | 38% | 110 |
| fixed-term contract | 56% | 44% | 295 |
| permanent contract | 62% | 38% | 816 |
| self-employment | 55% | 45% | 7 |
| no answer | 75% | 25% | 473 |
| No. of observations | 1150 | 601 | 1751 |

*Notes: Percentages show the structure in each row according to the categories in columns. The sum of values in each row is 100%.*

*Source: Own elabouration based on the Occupation Inheritance Survey.*

parents – employment of either the father or mother at a time when the respondent was 15 years old definitely increases the chances of employment, and that the children of white-collar workers are almost always employed at an age of 30 years. People from cities (over 100 thousand residents) are more often employed than those from rural areas; the difference between large and small towns is statistically insignificant.

The inclusion of the respondent's education and the size of the current place of residence in the model results in all parents' characteristics losing in significance and impact, except the difference between sons fathers in one of the highest occupational groups and those with unemployed fathers. This means that the parents' influence consists mainly in the educational choices of the children. It should also be pointed out that although those living in cities are far more likely to work, those who were born in large cities are employed less frequently than those who came to the big cities from smaller towns.

## 3.3 OCCUPATIONAL AND SPATIAL MOBILITY

Contrary to frequent opinions on the necessity of changing employment many times over the working life, career paths of most of the 30-39 year olds were relatively stable. Almost ⅔ of respondents had been employed in only one job, with the mean duration of work at about 11 years. A lack of tertiary education resulted in a distinctly longer work experience, to 15-17 years in the groups of people who were employed. The inclusion of people with no work experience resulted in a clear decrease in the difference between groups with different levels of education.

Occupation is least frequently changed by people with at most lower secondary education. The greatest mobility is observed among persons with basic vocational education (25% had only one occupation). Occupational mobility does not differ significantly between sexes. In addition, about 40% of the people working under stable employment contracts and those with less stable employment (contract for specific work and self-employment) have changed their occupation at least once. In the case of workers with no formal contract, most (60%) have changed their occupation at least once (cf. Table II.4).

The results of the Occupation Inheritance Survey show that gaining education and job searching are rarely accompanied by a change in the place of residence. Almost ¾ of 30-39 year olds live in the same place where they grew up, and only 5% moved more than 150km from their family home (admittedly, the sample population does not include people living abroad).[5] Although the analyzed population took part in the educational boom, their low spatial mobility may result from their return to their home town after their studies.[6] The directions of migration are dominated by an influx into larger cities (12%), which is an element of urbanisation. A detailed picture of the migration of people from towns of various sizes is presented in Figure II.17. A distinctly higher spatial mobility is shown by people from smaller towns. More than half of the people growing up in rural areas had changed their place of residence,[7] while among persons from cities above 100 thousand this concerned only every 20th person. Suburbanisation, i.e. moving from a large city to a smaller suburban town was at a small scale, at 4%. According to data from the Central Statistical Office of Poland, this usually concerned people over 40 years of age (cf. CSO 2013).

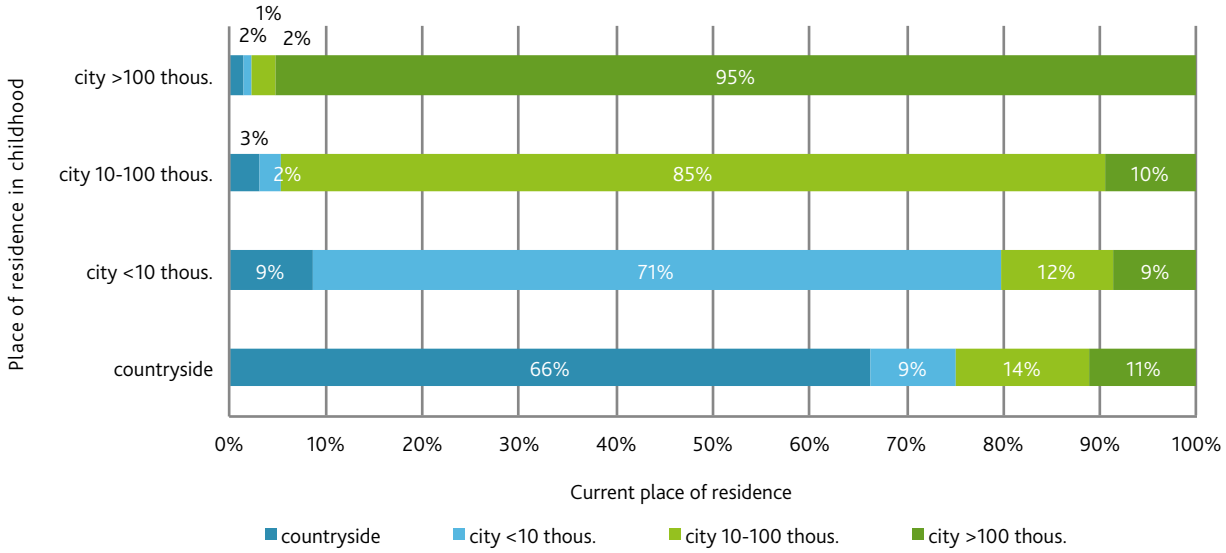
Movement towards large cities (more than 100 thousand inhabitants) was strongly associated with the level of education. The most frequent motivation in changing the place of residence was starting tertiary education (48%). People with lower education moved to large cities less often: 18% of those with

5 According to the National Census, in 2011 people aged 30-39 staying abroad for more than 3 months constituted 9.5% of people of the same age living in Poland.

6 This suggestion is in line with the initial results of research by Herbst and Rok (2013). Those authors analysed the spatial mobility of young Poles in relation to studying at tertiary level, using unique data obtained from *Nasza Klasa*, a social networking website. According to that data, 2/3 of people who started their tertiary education away from their place of residence went back to their hometowns.

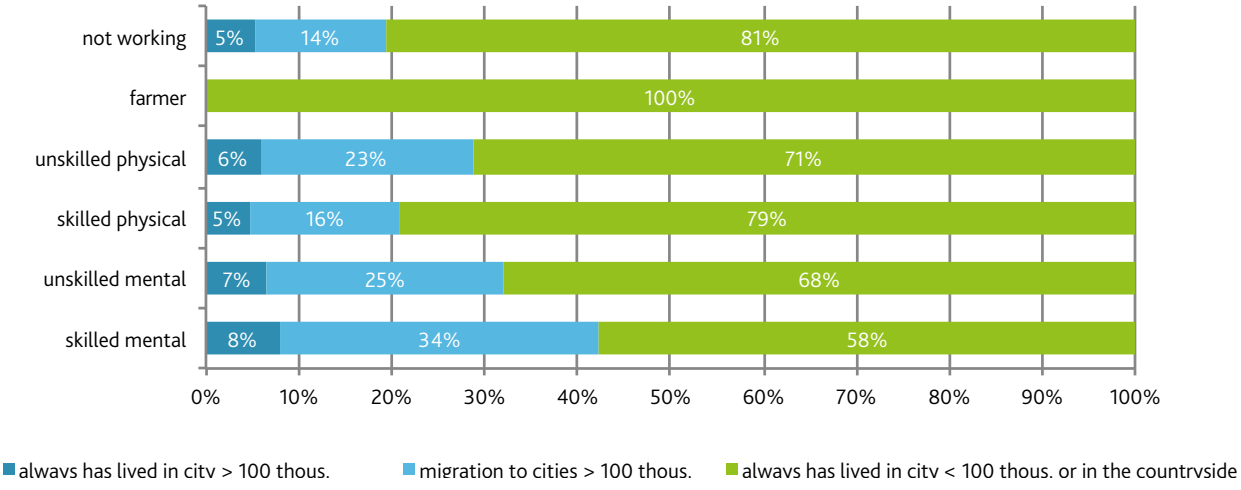
7 This refers to the place of residence at 15 years of age.

Figure II.17. **Structure of the place of residence at age 30-39 in relation to the place of residence at 15 years of age (%).**




*Source: Own elabouration based on the Occupation Inheritance Survey.*

Figure II.18. **Occupational structure of people aged 30-39 in relation to the size of the town of residence at the age of 15 and now (%).**




*Source: Own elabouration based on the Occupation Inheritance Survey.*

secondary vocational and 13% with basic vocational education. People with at most lower secondary education remained in their hometowns. Migration from rural to urban areas, and from smaller to larger towns, is connected with the greater mobility of those with lower education. Children of parents with basic vocational education and lower had 3-5 times higher mobility than the children of parents with tertiary education. As is shown by other studies (Pabiańska, 2011; Sikorska, 2008), the main causes of migration of young people (other than education) are family reasons (marriages, taking care of family), availability of apartments and higher wages.

The occupational structure depended on the place of residence. Remaining in cities with more than 100 thousand people concerned all occupational groups (about 6%), but it can be clearly seen that a dependence existed between the occupation and either a migration to large cities or remaining in smaller towns (cf. Figure II.18). The greatest mobility towards large cities was shown by skilled white-collar workers (34%) while the greatest stability in terms of remaining in smaller towns was shown by agricultural workers.

## 3.4 SUMMARY OF RESULTS OF THE OCCUPATION INHERITANCE SURVEY

The Occupation Inheritance Survey conducted for the purposes of this Report, showed that the parents' status strongly influenced the chances for educational and professional success of their children in Poland. The lower the education of the parents, the lower the chance that their children will obtain tertiary education. It is especially difficult for the children of parents with very low qualifications to obtain more than just one level of education higher than their parents. On the other hand, it practically never happened that the children of parents with tertiary education did not obtain at least a secondary education. The survey showed that young generations chose similar educational paths to their parents, especially in health and social and technical sciences. These decisions are significant for the occupational structure, in which the white-collar occupations are most likely to be manned by the children of white-collar workers. Most notable are the cases of lawyers, doctors and agricultural workers, three groups with the highest levels of inheriting the occupations of the parents. In the first two, this probability is more than 60% in the case of inheriting from the fathers. In the case of agricultural workers we observe that the chances of social advancement are strongly limited. Sons of agricultural workers rarely obtain education and qualifications that are necessary for the most prestigious occupations. It was also observed that having one's own company is more frequent among children of people with some experience in this regard. Unemployment of parents significantly increases the likelihood of unemployment among their children. Both parents being unemployed or an unemployed father are especially negative cases.

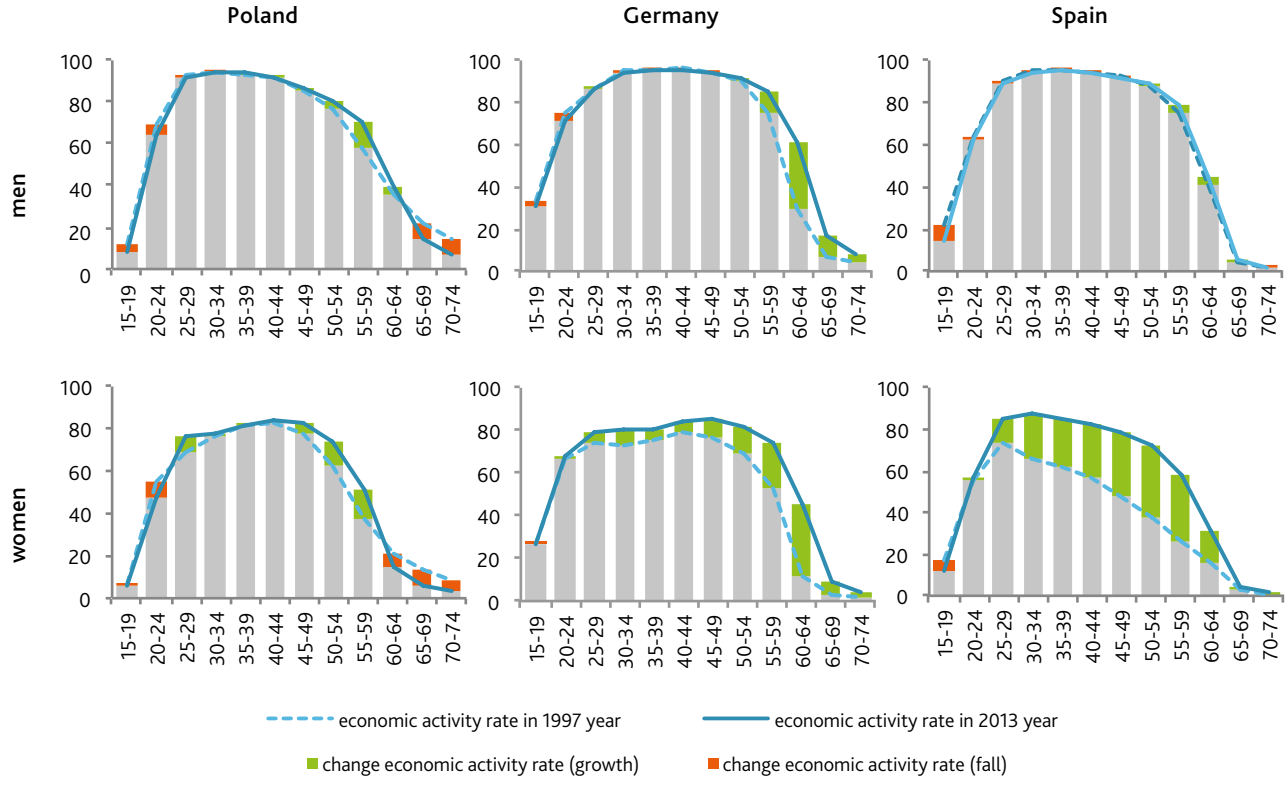
According to the declarations of 30-39 year olds, a mismatch of qualifications can be found in only 1/3 of cases. These are usually the graduates of secondary schools and bachelor level courses working as office clerks or sales workers. At the same time vocational retraining was reported by only ¼ of 30-39 year olds. Obtaining tertiary education and then working as a professional is often associated with a migration from smaller to larger cities. The smaller the town, the greater the chance that the student of a secondary or secondary technical school leaves the small town. The residents of large cities are significantly less likely to leave their place of residence, especially as tertiary education does not have to be followed by moving out. Migration is dominated by moving out to the nearest large city and only 5% of the current 30-39 year olds lived more than 150 km from their place of residence at 15.

# 4 CHANGES IN ECONOMIC ACTIVITY IN POLAND

Over the last 20 years the increase in labour market participation of women has been the key trend responsible for changes in the labour market activity rates. This trend has been especially strong in the countries of Southern Europe and Ireland, being those starting from a very low level. The Netherlands is another country which has managed to significantly increase the labour market participation of women in practically all age groups. This situation in the Netherlands is a result of widespread part-time employment which helps women combine work with family duties. The growing economic activity rates of people aged 50+ have been another crucial trend among both women and men. Longer labour market participation is partly the result of changes in retirement systems, especially in limited access to earlier pensions and a higher retirement age.

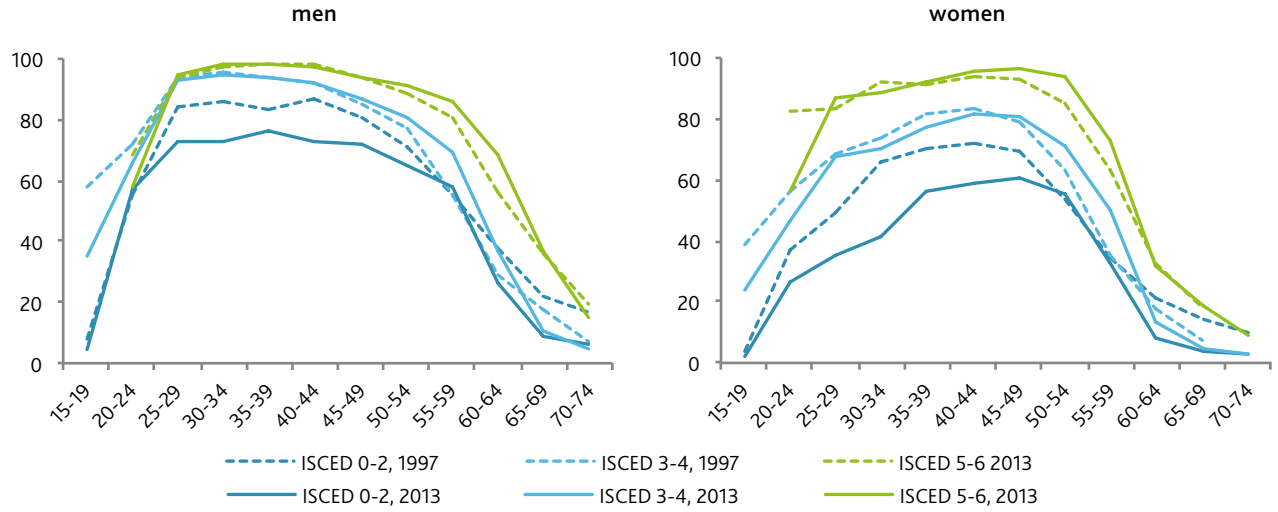
The educational boom has had an ambiguous effect on labour force participation rates. On one hand, those deciding to pursue tertiary education entered the labour market later than those that did not. In many EU countries, although not in all, this has caused a decline in labour market participation of those aged less than 25. It is worth noting that countries differ in term of combining work and tertiary education (cf. OECD 2010). In educational systems described as elitist, breaks in education are not perceived positively by employers and so have an adverse effect on any future career. In those countries, e.g. South Korea and Japan, young people do not start working before completing their tertiary education. An entirely different attitude can be observed in Scandinavian countries such as Denmark and Sweden. In those countries, young people begin their tertiary education a few years after finishing their secondary education, and during tertiary studies young people tend to have their first jobs. At the same time, the labour market does not punish graduates with unusual educational paths. In effect, the average age of beginning tertiary education in Scandinavian countries is the highest in the entire EU. In Poland the most preferred models are full-time studies and starting a career after graduation. Unlike Scandinavia, a few years break before starting tertiary education was discouraged in Poland by a high wage premium attached to tertiary education and a higher chance of obtaining employment. However, due to the limited number of places at fees-free full-time studies, a considerable number of young people started part-time studies which forced them to find jobs to pay for their education.

Figure II.19. **Labour force participation rates in Poland, Germany and Spain 1997-2013 (%).**




*Source: own elabouration based on the Eurostat data.*

Figure II.20. **Labour force participation rates in Poland in 1997 and 2013 by sex, age group and education (%).**




*Notes: ISCED 0-2 – lower secondary education or lower, ISCED 3-4: basic vocational, secondary, post-secondary education, ISCED 5-6 – tertiary education.*

*Source: own elabouration.*

On the other hand, the change in educational structure due to the educational boom resulted in an increase in economic activity in other age groups. Except for the period of studies, people with better education showed higher labour market participation in the entire life cycle, compared to those with medium and low skills. Thanks to the wage premium for higher education they obtained more benefits from their occupation, which implies a higher alternative cost of inactivity. In the case of workers with low skills and relatively low wages, labour market withdrawal and living on social benefits may be a reasonable strategy. It is also profitable for low-paid individuals to retire early due to the high replacement rate. Better-paid workers with higher qualifications are better-off when they retire later. This is reflected in the profiles of labour market participation for individual occupational groups presented in Figure II.20. For example, in Poland in 2013, the labour market participation rate for men with tertiary education aged 60-64 was 69%, while for men from the same age group with secondary education it was 37%. In addition, (Baran, Lewandowski, Magda, 2014) show that the educational change is responsible for 1/3 of the increase in employment of women in European countries in the 1990s and 2000s. In the NMS, which, due to the lower initial level experienced a stronger educational boom, the contribution of educational change to the increase in women's employment was even stronger. Improvement in the educational structure was also conducive to an increase in male employment. The propagation of tertiary education in the population will lead to further increases in labour market participation rates in the future.

The strong increase in the economic activity of women can only partly be explained by the improvement associated with the educational change, as participation grew in each educational group. Moreover, in the EU15 in 1997-2013 this increase among women with primary and secondary education was two times higher than among women with tertiary education. This means that apart from the aforementioned convergence among countries, there was also convergence of labour market participation between educational levels. In the case of men the changes were rather small, and many countries saw a decrease in the economic activity of men with low education, which is a result of the deteriorated situation in labour markets caused by the Great Recession.

Since the late 1990s, Poland has seen the greatest increase in labour market participation of women and men with tertiary and secondary education aged 50+ (cf. Figure II.20). A strong decrease was seen among those with low qualifications caused by institutional solutions alleviating the effects of high unemployment, including loosening the rules for granting social benefits and encouraging early retirement. Those solutions contributed two times to the significant outflow of people from the workforce. First, this happened at the beginning of the 1990s during the time of transformation when many companies were undergoing restructuring, and then again in the early 2000s, under the conditions of increased unemployment after the Russian crisis. Tightening up the rules for granting disability pensions and early old-age pensions and the improving economic conditions reversed the negative trend and increased the economic activity of people in pre-retirement age.

# 5 PROJECTION OF LABOUR SUPPLY

As has been shown in chapters I and II, the increased occurrence of tertiary education, the increase in general competencies, and the change in the occupational structure from the dominant share of blue collar workers to professionals, are the main trends in the supply of labour in Poland. Formulating a projection of labour supply also requires taking into account changes in the population in terms of age and economic activity. That is why we first present the results of demographic forecasts, and then a forecast for the population structure in terms of education. We conclude with the forecast of economic activity and an occupational structure of the employed.

Poland is one of three EU countries with the fastest shrinking workforce. According to the most recent Eurostat demographic forecast (Europop, 2013), by 2040 the number of people at working age in Poland will have fallen by 4.62 million compared to 2013, which means a decrease of 17%. Adverse demographic changes are going to be visible in the current decade. By 2020 the Polish labour market will lose 1.66 million people of working age, i.e. the size of the entire working age population in the Łódzkie voivodeship.[8]

The rapid decline of the working age population expected in Poland in the coming decades is a consequence of the retirement of the post-war baby boomers and small cohorts of people born after 1990 (cf. Figure II.12). The causes of the adverse demographic changes lie in a drop in the number of births after 1990. At the beginning of the 1990 transformation, the fertility rate[9] was 2.06, falling to an exceptionally low value of 1.3 in 2012. This puts Poland in penultimate place in the EU, just ahead Portugal. In order to ensure the mere replacement of generations, the fertility rate should be 2.1. This change in fertility has happened in all European countries, the earliest in the Scandinavian countries and the latest in post-communist countries. A regularity can be observed in that the later the change occurred, the more intense it was (Kotowska, 2014). Although the decrease in fertility rate had been experienced by all the post-communist countries of the region (and in 2000 many of them had a worse situation than Poland), some of them, unlike Poland, have managed to increase the fertility rate (the Czech Republic, Bulgaria, Slovenia, Lithuania, Latvia, Estonia).[10]

A low fertility rate leads to population ageing – a rapid growth of the population at a post-working age and the simultaneous depletion of persons at a pre-working and young working age (cf. Figure II. 21 for Poland and Spain). Relatively high fertility rates and a positive balance of foreign migration helps countries such as Sweden and France to maintain a stationary population structure; the new cohorts entering the labour market will be as numerous as cohorts leaving the labour market.

Among the EU countries, only Germany and Spain will see a decrease in the working age population greater than in Poland. By 2040 they will have lost 10.5 and 5.8 million people, respectively. In relative terms, the decline in the working age population in Poland will be as intense as in Spain and Germany (between about -17% and -19%). According to the projection, the greater drop in potential workforce will occur in the Baltic States (by more than 1/3 in Lithuania and Latvia) and the countries of Southern Europe, especially Bulgaria, Greece and Portugal (cf. Figure II.22). In the case of e.g. Latvia, Lithuania and Greece, the expected decline in the working age population is largely associated with the assumed large negative migration balance. In this regard, the Eurostat prognosis is moderately optimistic for Poland – the expected size of emigration of people at working age from Poland will have been less than 100 thousand by 2030, and so is not significant in the decrease in population aged 15-64. All Scandinavian countries are expected to have a greater working age population, mainly due to a positive migration balance (cf. Figure II.22)

The gap in workforce could potentially be offset by the inflow of workers from abroad. However, Poland is not able to use the potential of immigration in balancing the effects of adverse demographic changes in the labour market. According to Eurostat data, in 2012 foreigners constituted only 0.2% of workforce in Poland, which is the lowest level in the EU next to Bulgaria, Romania and Slovakia. In this context, the experiences of Ireland and Spain should be looked at (cf. Figure II.23). Both economies, similar to Poland now, started with a low share of foreigners in their labour markets. In a period of dynamic economic growth in the 2000s, they experienced a large inflow of foreign workers. After 2008, despite the deep recession and deterioration in the labour market, the proportion of foreign workers remained at a high level. This is a good example for Poland, which should liberalise regulations on immigration in times of economic prosperity to significantly and rapidly increase the number of employed in the entire economy.

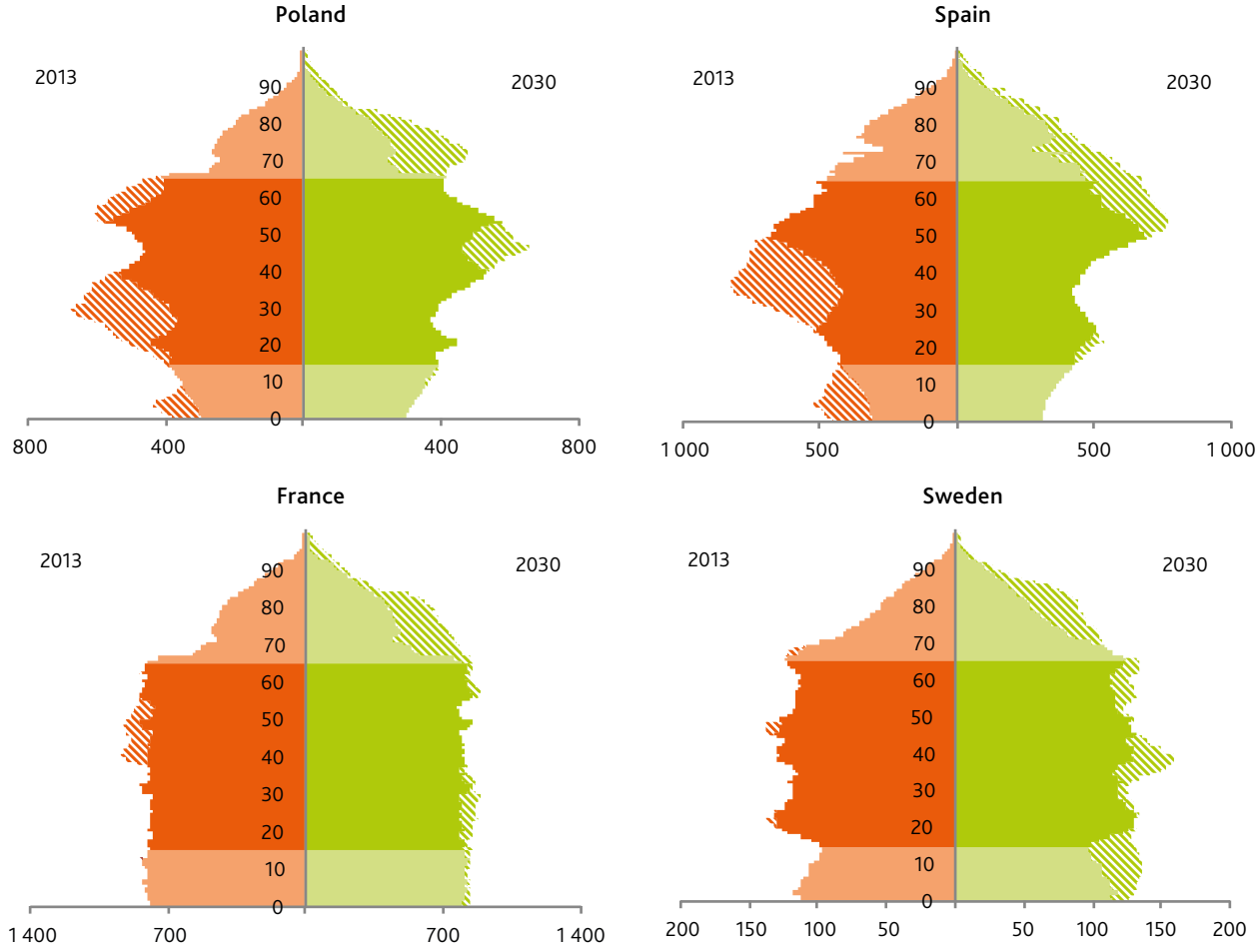
Demographic changes in Poland will not only result in a smaller working age population but also in ageing of the workforce. The share of those aged 50-74 in the group aged 15-74 will increase from 37% in 2012 to 43% in 2030 and 50% by 2050, and then will slightly decrease to 46% in 2060. Older workers have

8 According to a previous demographic projection of Eurostat (Europop 2010), the expected decrease in the 15-64 year old population in 2010-2020 was supposed to be 1.68 million people, and in 2010-2040 4.52 million people.

9 T*otal fertility rate* (TFR) is defined as the number of children which could be born by a woman during her reproductive years (15-40) given that that in the individual stages of that period she should bear children with the frequency observed in a given year.

10 Poland also experienced symptoms of improvement, but they were short-lived. The fertility rate between 2004 and 2009 increased from 1.23 to 1.40, but then decreased to 1.30.

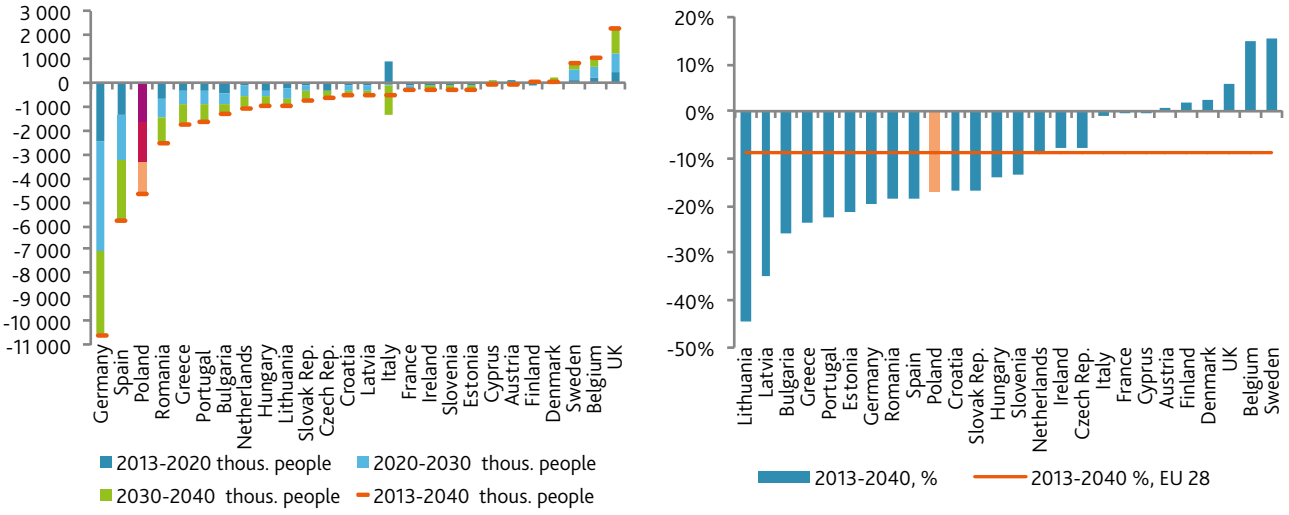
Figure II.21. **Comparison of the population age structure in Poland and selected countries in 2013 and 2030 (thousands of people).**




*Notes: The red dashed areas denote the loss of population in a given age group between 2013 and 2030. The green dashed areas denote the increase in the population in a given age group until 2030. The darker shade denotes the 15-64 age range.*

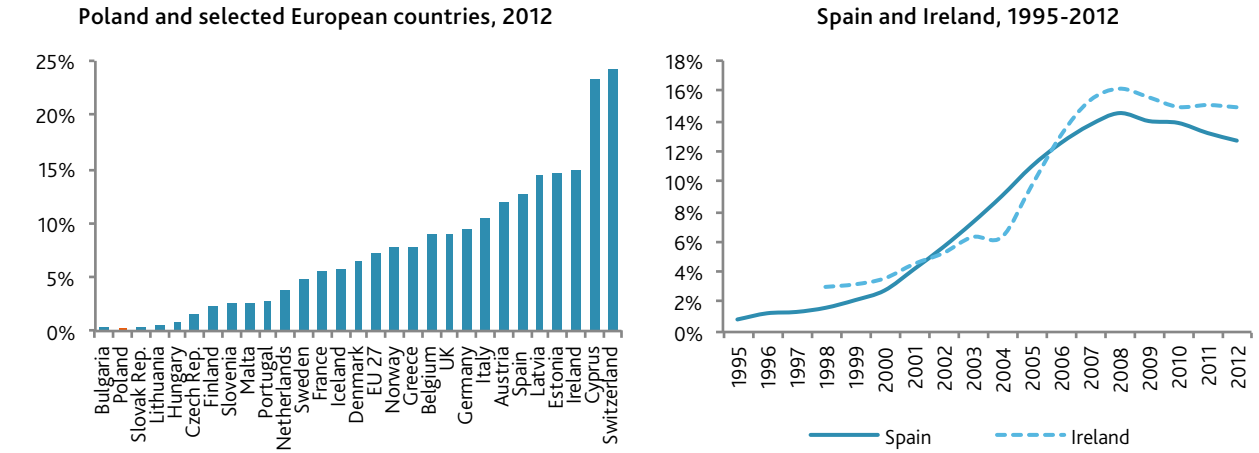
*Source: own elabouration based on the demographic projection of Eurostat (Europop 2013).*

Figure II.22. **Changes in the working age population by 2040 in the EU 27.**




*Source: own elabouration based on the projection Europop 2013.*

Figure II.23. **The share of foreigners in total employment**



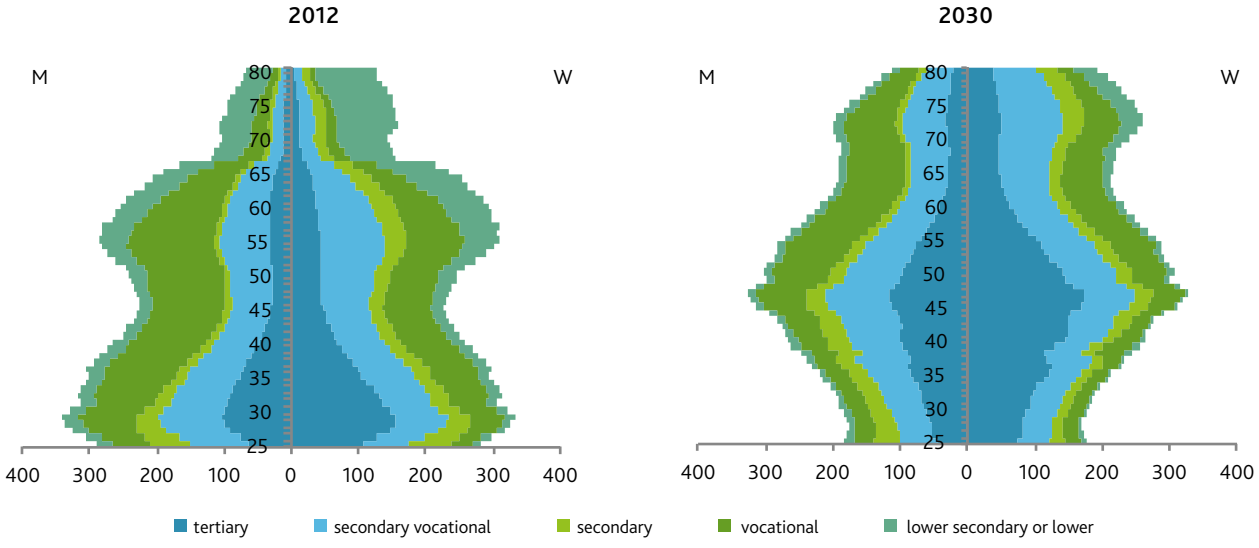

*Source: own elabouration based on Eurostat data.*

different skills than younger ones; they are more experienced but their mobility is lower. This change in the composition of the labour force creates a series of challenges associated with a smooth transition to a silver economy, i.e. an economy efficiently using the potential of older workers. These challenges and possible solutions are presented in greater detail in Part IV.

Along with the retirement of older cohorts to be replaced by younger and relatively better educated cohorts, the educational structure of the workforce will gradually improve. The educational boom, although currently ending, will improve enrolment ratios for a long time to come. Currently, only about 20% of those aged 20-74 have tertiary education. By 2030 this percentage will have increased to 32%. This upward trend will start to peak as late as 2040, at a level of about 40%. This means that the number of people with tertiary education will roughly double compared to the current status. By 2030 the percentage of women with tertiary education will be about 12 pp higher than the men.

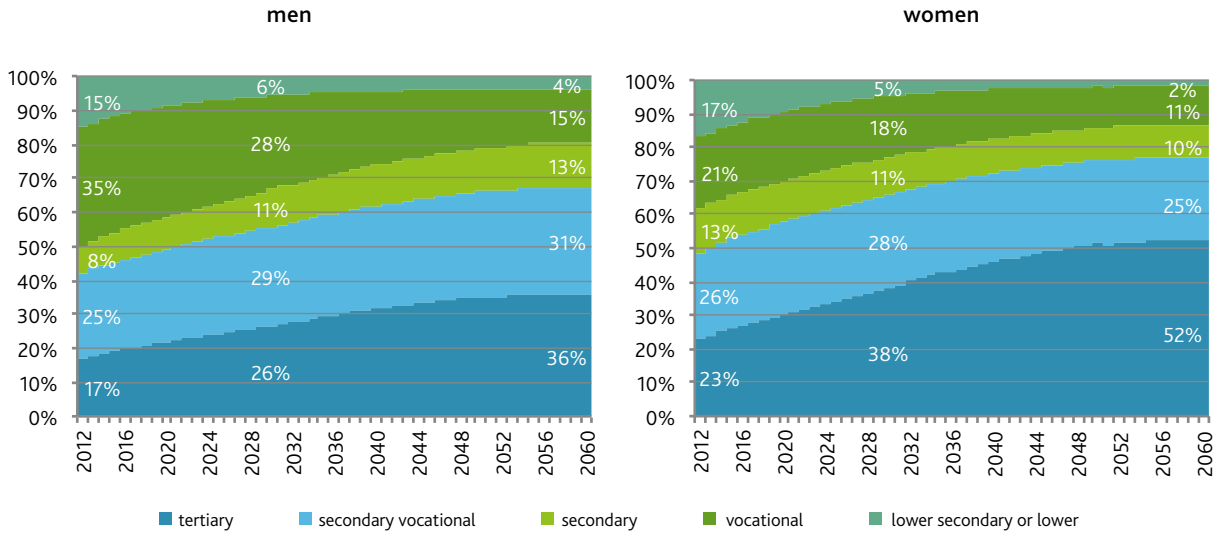
Another trend observed in the forecast of qualifications supply, caused by changes in the educational choices of Poles over the last two decades, is the lower supply of low qualifications. The percentage of people with primary or lower secondary education will drop from about 15-17% nowadays to 5-6% in 2030. The number of people with basic vocational education will also decline, which will be more distinct among men than among women, who had started from a lower share. The basic

Figure II.24. **Projection of the educational structure of the population aged 15-80 years, baseline scenario, 2012 and 2030.**




*Source: own elabouration.*

Figure II.25. **Evolution of the educational structure of people aged 20-74, 2012-2060.**




*Source: own elabouration.*

vocational schools will lose popularity in favour of technical secondary schools. On the other hand, we expect that a growing number of young graduates of secondary technical schools will continue their education, and so the current trends will be perpetuated. [11] As a result, the proportion of those with secondary technical education should grow to about 28-29% in 2030, and slightly increase among men and decrease among women. The share of people with general secondary education will be low. Currently in the older cohorts in the labour market this is a consequence of the low popularity of general secondary schools in the past, compared to vocational (lower and secondary level) schools. In the case of new generations, these schools will be the most popular type of a secondary school, but treated merely as a stage before beginning tertiary education, and the percentage of people completing their education at this stage is low. The share of people with secondary education will not change significantly as the outflows from this educational level to tertiary education will be offset by the inflows from lower levels of education. This will result in a significant drop in the share of people with at most basic vocational education (cf. Figure II.25).

Due to the uncertainty of the projection, we also prepared projections based on two alternative scenarios. The description of these scenarios is presented in Box II.2. The optimistic scenario compared to the baseline scenario shows a decrease in the number of people with general secondary, lower secondary and lower education. The number of people with basic vocational and secondary technical education will grow. Therefore according to this scenario, the number of people with medium technical qualifications will grow while those with general qualifications will decline in number. This situation would be favourable for the economy if manufacturing generates high labour demand in the medium term.

The projection indicates that although the labour supply will diminish due to adverse demographic changes, in the medium term Poland will still see an improved quality of the workforce. The number of people with tertiary education will grow in most age groups. The only exception will be among young persons. Although we expect further growth in the percentage of young people with tertiary education, the inflow of people with high skills into the labour market will decrease. This will happen due to the small cohorts of people born after the 1990s. Between 2012 and 2030 the number of people with tertiary education diplomas in the age group 25-34 years will decline by 700 thousand. Inflows will also decrease in other educational groups. This may mean trouble with finding young workers and that employers will have to increasingly rely on hiring older workers. The lower inflows of new workers to the labour market will also induce wage pressure. By 2030, the proportion of older workers (aged 55-64) with tertiary education will double and reach 25%.

The expected changes also concern the structure of qualifications obtained during formal education. Up to 2050 Poland will see a growing share of people with education in computer science, social sciences and health and services (cf. Figure II.27). These changes reflect the predominance of social sciences in Polish tertiary education. There will be a decline in the number of people with technical and agricultural qualifications, a consequence of the decreasing popularity of vocational training (secondary technical and vocational schools).

11 This will also have the effect on an increase in popularity (share) of technical departments at tertiary level.

## Box II.2. Assumptions and methods of projecting the supply of labour until 2050.

This method or projection is based on a heterogenous Markov chain. The structure ($V^{pl,wk}_{r}$) of each yearly age group (*wk)* divided by sex (*pl*) in the year (*r*) is given by the structure of people a year younger in the previous year, multiplied by a relevant transition matrix ($M_{pl,wk}$):

$$V_{r0+t+1}^{pl,wk_0+t+1} = \left(V_{r0+t}^{pl,wk_0+t}\right)^T M_{pl,wk}$$

The numerical values of individual states are obtained by multiplying the structure from each year ($V^{pl,wk}_{r}$) by the value of the Eurostat demographic forecast for a given sex, age and year.

The state-space in the model is determined by: the highest achieved level of education (6), area of education (9), economic activity (3), occupation (4) and sector (7).

The structure of individual cohorts in the baseline year was estimated with the use of LFS data and non-parametric regressions. Modelling is applied to the population structure until 80 years of age as economic and educational mobility after that age is negligible.

The probability of transition between states was estimated based on LFS panel samples from 2008-2012 for individual age groups. Estimations of results for the age groups (people born in a given year) were carried out by polynomial smoothing.

The limited representativeness of the LFS survey made it necessary to use a correction for educational structure and economic activity until 30 years of age. The structure of younger cohorts aged below 30 years in 2012, was matched with the structure built from data from the National Census of 2011 and administration data (NSO, System of Educational Information, POLON System of Information about Students) on the number of students at individual stages of education. Transition matrixes were transformed so that they reflected the population structure from 2012. A similar correction was required for the population structure in terms of economic activity after 45 years of age. In the baseline scenario we assumed convergence to employment and unemployment rates in the UK as it is the country with the highest economic activity of people in the older age groups among the large European countries. Due to large inter-cohort differences in Poland, the assumption of a significant growth in economic activity in the older age groups does not seem to be realistic within the next 40 years

The projection took into account a lower age of starting education. Starting with the cohort born in 2009, the evolution of structures in moved one year below, a period of 5-35 years.

2012 was the projection baseline year.

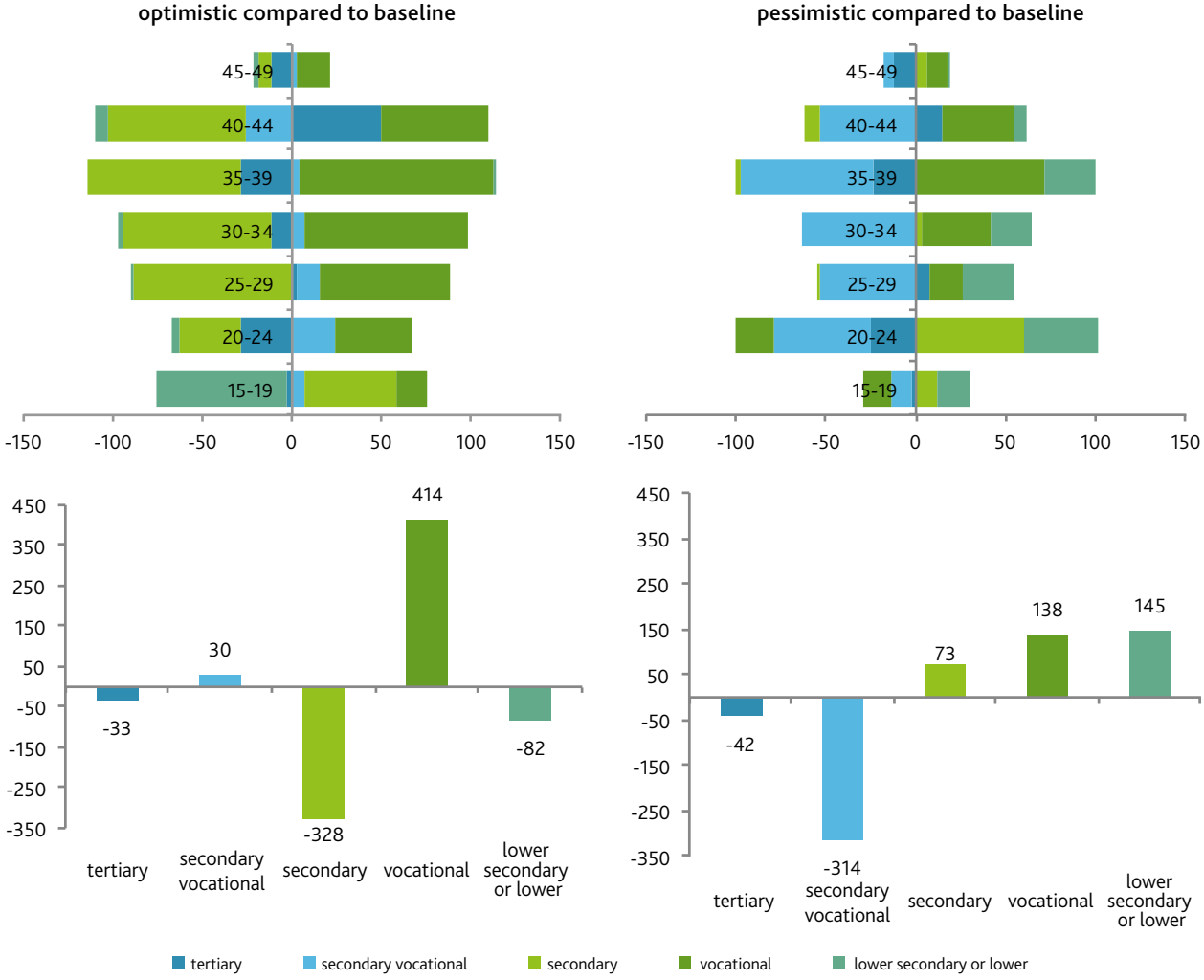
### Scenarios:

Due to uncertainty connected with the projection of labour supply, the baseline scenario was supplemented with two alternative variants, differing in the stationary profile of the life cycle to which they converge. This means the necessity of modifying the series of transition matrixes for each scenario. Compared to the baseline scenario, in the positive 'qualifications for growth' scenario, we assumed higher employment rates among young people (below 27 years of age) and a smaller decrease in economic activity after 44 years of age. We also assumed an improvement in the quality of technical education in secondary schools. In effect more students will choose technical secondary and vocational schools than general secondary schools. In the negative scenario 'poor education and stagnation in the labour market', we assumed opposite trends. Technical education loses in popularity and the proportion of people with general education rises. Employment rates for the lowest and highest age groups are lower than in the baseline scenario. Young people perceive technical education as unattractive and tend to choose general secondary schools. Deviations from this scenario were selected based on historical variation and international comparisons for individual variables.

| Variable | 'qualifications for growth' in relation to the baseline scenario | 'poor education and labour market stagnation' in relation to the baseline scenario |
|---|---|---|
| Employment <27 years, women | +6% | -4% |
| Employment <27 years, men | +8% | -7% |
| Employment >44 years, women | +8% | -1% |
| Employment >44 years, men | +2% | -3% |
| Secondary technical education, men | +7% | -10% |
| Secondary technical education, women | +3% | -14% |

*Source: own elabouration.*

Figure II.26. **Labour supply structure in 2030 – deviations from the baseline scenario (thousands of people).**




*Source: own elabouration.*

Changes in the structure of qualifications are a consequence of evolution in the structure of graduates and large differences between the younger and older cohorts. The intergenerational changes play a more important role. The lower share of graduates of social sciences and secondary vocational schools will be dominated by cohort effects. In the coming years, we will observe a distinct growth in the share of medical, computer, biological sciences and humanities in the total number of students (cf. Figure II.27). Among the students of secondary vocational schools, technical fields are losing in importance in favour of services, computer science and health. Most of the observed changes will translate into the structure of the 25-34 group in the next ten or so years, and after 2030 the structure of graduates will stabilise. The indicated increase in the popularity of faculties related to health care seems to be too low when compared to the expected demand for health services in the situation of population ageing (cf. Ministry of Health, 2008).

Ageing of the workforce puts pressure on total employment and the economic activity rate (e.g. Fallick et al. 2010). This results from the fact that workers in the older age groups (50+) are expected to grow in number and have distinctly lower rates of employment and economic activity. In order to counteract the effect of the demographic change, governments in developed countries are introducing changes in pension systems. For example, the employment rates of the older workers are being positively influenced by limited access to earlier retirement (cf. Euwals et al. 2010; Euwals et al. 2012; Staubli and Zweimüller 2013) and an increased official retirement age (Cribb et al. 2014). These changes have already started to bring noticeable effects. As shown in Figure II.28, the average effective retirement age in OECD countries was systematically decreasing until the mid-1990s (between the 1970s and 1990s the average age of men leaving the labour market decreased from 67 to 63 years, and among women from 65 to 61).[12] At the end of the 1990s, that trend was reversed. In Poland the increase in the effective retirement age over the last ten years concerned only women, and the process of increasing the official retirement age to 67

12 *Average effective age of retirement* is defined by the OECD as the average age of workers when leaving the labour market over the last five years. This exit from the labour force is estimated by comparing the economic activity ratios for five-year long age groups from 40 years of age five years ago, to ratios for the respective groups now.

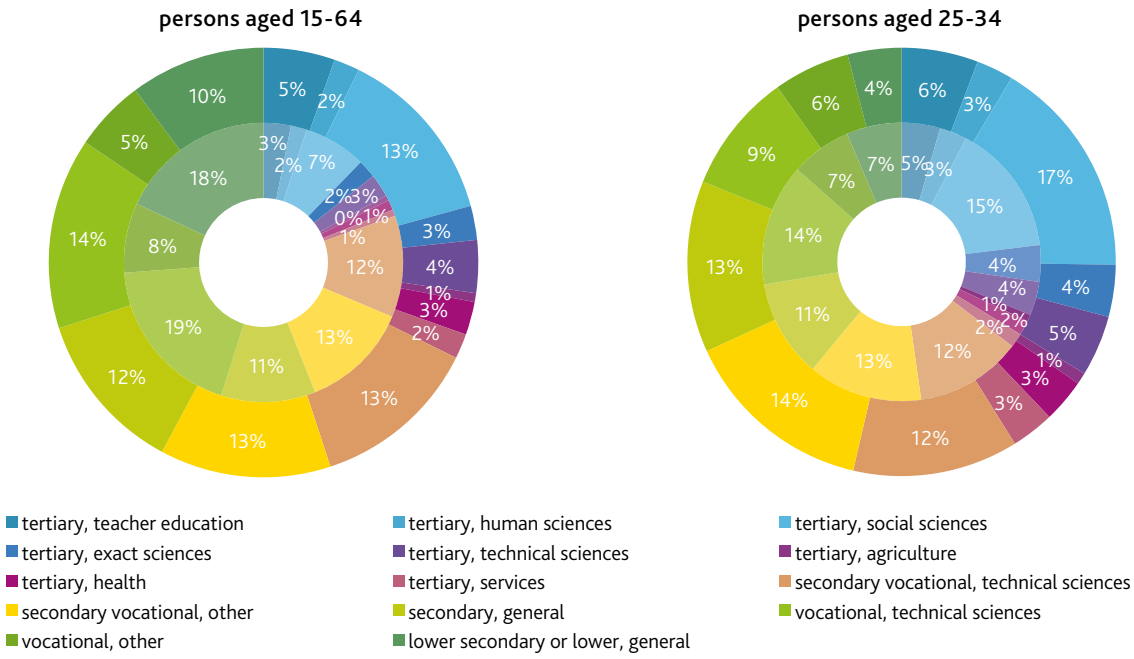
will be completed by 2020 for men and by 2040 for women. The effects of this extension are taken into account in the forecast of economic activity by age. It should also be expected that in Poland raising the retirement age will have a strong impact on the duration of economic activity in the population.

### Table II.5. Projection of the population by qualifications 2012-2030.

| | 2012 | | | | | 2030 | | | | | change 2012-2030 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | tertiary | secondary vocational | secondary | vocational | lower secondary or lower | tertiary | secondary vocational | secondary | vocational | lower secondary or lower | tertiary | secondary vocational | secondary | vocational | lower secondary or lower |
| 15-24 | 346 | 687 | 1108 | 407 | 2342 | 223 | 675 | 1050 | 419 | 1621 | -123 | -11 | -57 | 12 | -722 |
| 25-34 | 2226 | 1615 | 716 | 1334 | 403 | 1531 | 1007 | 482 | 552 | 151 | -695 | -608 | -234 | -782 | -252 |
| 35-44 | 1278 | 1381 | 394 | 1843 | 436 | 2306 | 1369 | 529 | 746 | 176 | 1028 | -12 | 136 | -1097 | -260 |
| 45-54 | 743 | 1460 | 314 | 1933 | 565 | 2416 | 1630 | 483 | 1350 | 206 | 1673 | 169 | 169 | -583 | -359 |
| 55-64 | 684 | 1435 | 415 | 1755 | 1135 | 1137 | 1332 | 334 | 1591 | 244 | 453 | -103 | -80 | -164 | -890 |
| 65-74 | 296 | 496 | 257 | 555 | 1272 | 766 | 1439 | 345 | 1358 | 380 | 470 | 943 | 88 | 803 | -892 |
| 15-64 | 5277 | 6578 | 2946 | 7272 | 4881 | 7614 | 6013 | 2879 | 4657 | 2398 | 2336 | -565 | -67 | -2614 | -2483 |
| 15-24 | 7% | 14% | 23% | 8% | 48% | 6% | 17% | 26% | 10% | 41% | -1pp | 3pp | 4pp | 2pp | -7pp |
| 25-34 | 35% | 26% | 11% | 21% | 6% | 41% | 27% | 13% | 15% | 4% | 6pp | 1pp | 2pp | -6pp | -2pp |
| 35-44 | 24% | 26% | 7% | 35% | 8% | 45% | 27% | 10% | 15% | 3% | 21pp | 1pp | 3pp | -20pp | -5pp |
| 45-54 | 15% | 29% | 6% | 39% | 11% | 40% | 27% | 8% | 22% | 3% | 25pp | -2pp | 2pp | -16pp | -8pp |
| 55-64 | 13% | 26% | 8% | 32% | 21% | 25% | 29% | 7% | 34% | 5% | 12pp | 2pp | 0pp | 2pp | -16pp |
| 65-74 | 10% | 17% | 9% | 19% | 44% | 18% | 34% | 8% | 32% | 9% | 8pp | 16pp | -1pp | 12pp | -35pp |
| 15-64 | 20% | 24% | 11% | 27% | 18% | 32% | 26% | 12% | 20% | 10% | 13pp | 1pp | 1pp | -7pp | -8pp |

*Source: own elaboration.*

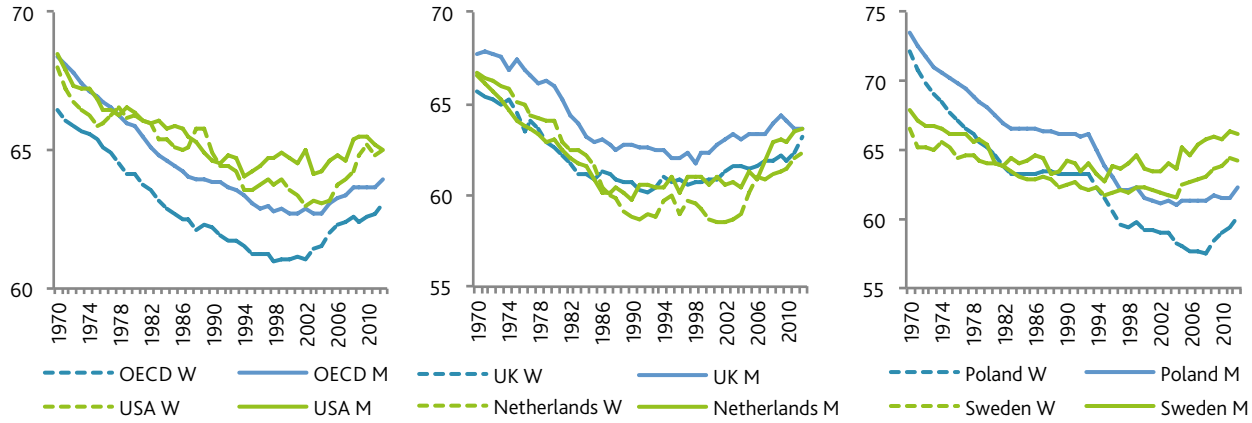
### Figure II.27. Projection of the structure of fields of education, 2012-2030 (%).




*Notes: The inner ring denotes the state in 2012, while the outer ring denotes the state in 2030.*

*Source: own elaboration.*

Figure II.28. **Average effective retirement age in selected countries, 1970-2012.**



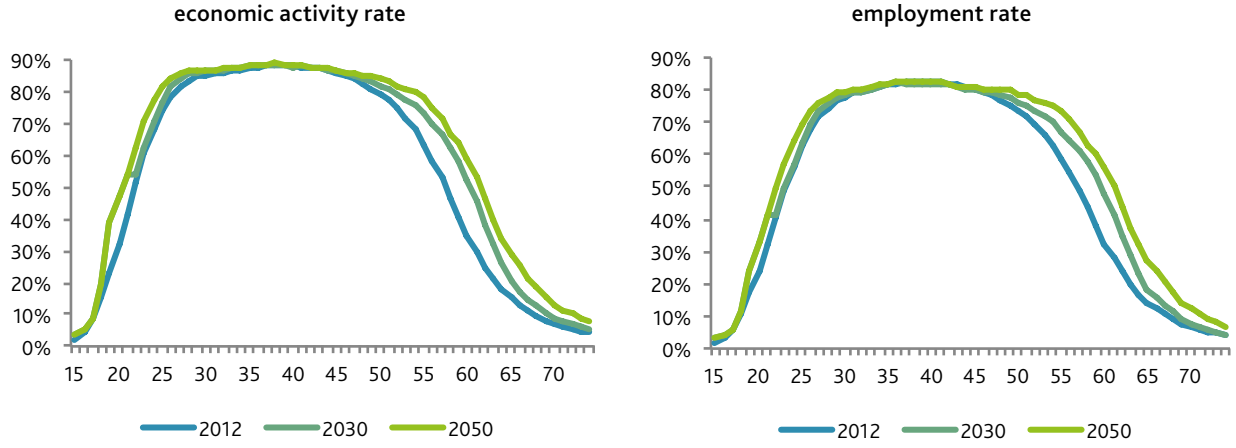

*Source: Own elabouration based on OECD data and estimations, http://www.oecd.org/els/emp/Summary_1970+values.xls.*

Cohort effects are another factor that will shape the employment of older workers. Younger cohorts, especially women, have higher profiles of economic activity in the life cycle, which will also be visible when they enter the pre-retirement age; total employment should increase. Cohort effects are the result of changes in the structure of qualifications between cohorts and also of the evolution of social attitudes to the economic activity of women in the labour market. In this projection, the educational change is the main factor that will determine the profiles of economic activity in the population in the future.

Economic activity of the population will rise due to changes in the structure of education, most of which will have been manifested by the end of the next decade. By 2030 the employment rate should grow from 60% to 64%, accompanied by an economic activity rate increase from 67% to 70%. The improvement in activity and employment will focus especially on the group above 50 years of age (cf. Figure II.29). In 2012, in the group aged 50-64, 51.2% were employed, while among the 65-74 year olds the employment rate was 9%. By 2030 these rates will increase to 59.9% and 15.6% in the baseline scenario. We expect that the improvement in employment rates will be greater for women than for men, due to the initially lower economic activity of older women in the labour market compared to men. The economic activity rates will also improve in younger age groups. The observed non-continuous change in activity in younger groups is a result of the lowering of the school age by a year.

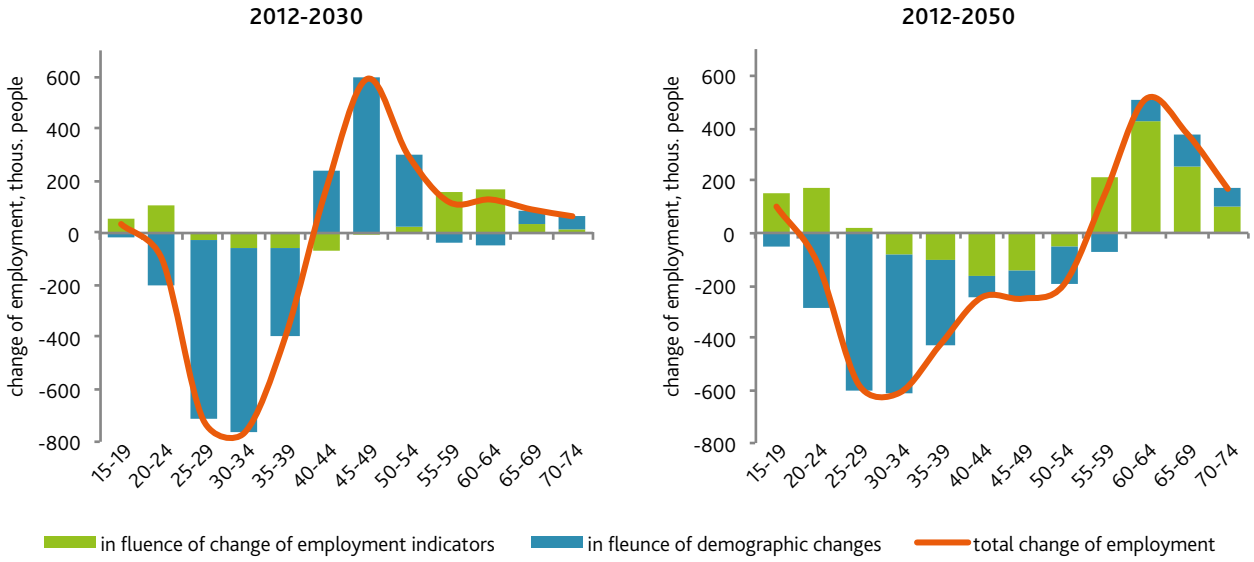
The increase in the labour supply thanks to the improved employment rate will be too weak to offset the negative effect of population ageing. Figure II.30 presents the results of a decomposition of the future changes in the number of employed in age groups into the effect of changes in employment rates in a given age group and into the effect of changes in the sizes of individual age groups. According to the projection, the change in employment clearly elevates employment in the youngest and oldest age groups, while only slightly decreasing employment among prime-age workers. The growth of the number of employed induced by the change in employment is 330 thousand people by 2030, according to the baseline scenario. This is counteracted by a decrease in the number of employed by 820 thousand people due to the adverse demographic trend. In consequence, the number of the employed will decrease from just over 16.2 million in 2012 to 15.5 million in 2030 to 14.1 million in 2050.

Figure II.29. **The projected economic activity rate and employment rate by age, 2012-2050.**




*Source: own elabouration.*

Figure II. 30. **Projected change in the number of employed by age group, 2012-2050.**

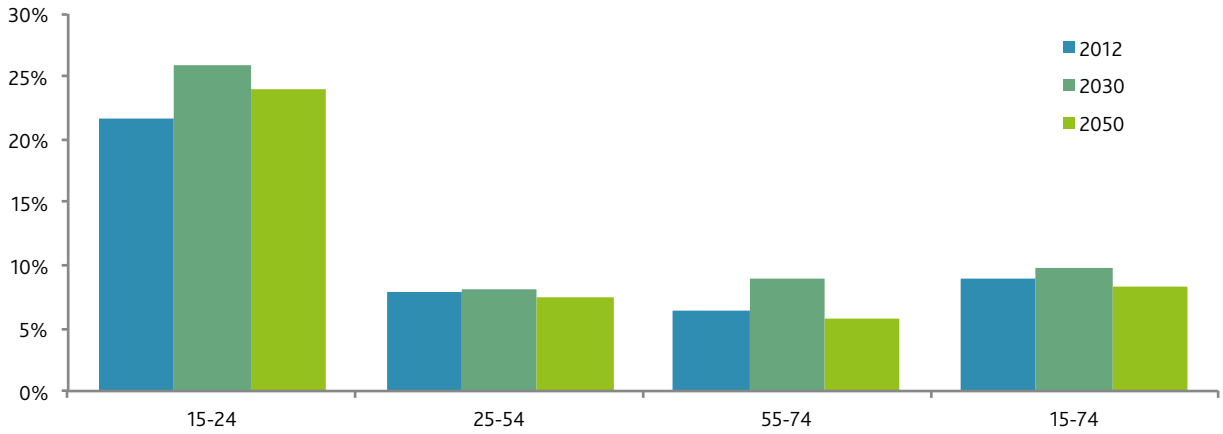



*Source: own elabouration.*

Another trend revealed by the projection of labour supply is the relative increase in the significance of older workers' labour. Due to the demographic change and the increased economic activity in the older age groups, the average worker's age will rise from 40.3 years in 2013 to 44.2 in 2050 (cf. Figure II.29). The share of employed aged 50 and over in the total employment will increase from 26% to 32% in 2030 to 36% in 2050. This means employers will have to tackle the issue of adapting jobs to the needs of older workers (cf. Part IV).

The unemployment rate is another indicator which can be deduced from the labour supply projection. According to the baseline scenario, the predicted unemployment rate in the medium term will slightly grow, but in the long term it will decrease. This expected evolution of unemployment rates can be explained by the same factors which will shape the employment rates. First, we expect increased economic activity by older workers. Previously, the unemployed in pre-retirement age often ceased to participate in the labour market. As the period of economic activity in a life cycle is going to extend, with one of the reason being a higher retirement age, it will force older workers to remain economically active. The problematic side of this will be an increased unemployment rate in the older age groups. Moreover, in the short period of time when the number of jobs in the economy is stable, an abrupt increase in labour supply due to the increased retirement age has to at least temporarily increase the unemployment rate. This effect of changes in the pension system has been identified in other countries (e.g. Cribb et al. 2014). The unemployment rate depends mostly on prime-age workers, and the total effect of ageing will be low, below 1 pp. On the other hand, the expected decrease in unemployment rate will also depend on the improved qualification structure of successive age groups and the following intergenerational change.

Figure II.31. **Projected change in the unemployment rate, 2012-2050, baseline scenario.**




*Source: own elabouration.*

Table II.6. **Projection of labour supply until 2050 by groups of occupations.**

| | | skilled mental | unskilled mental | skilled physical | unskilled physical | total |
|---|---|---|---|---|---|---|
| | 2012, thous. people | 5 745 | 3 197 | 6 197 | 1 206 | 16 346 |
| basic scenario | 2030, thous. people | 5 797 | 3 676 | 4 895 | 1 033 | 15 402 |
| | 2050, thous. people | 5 571 | 3 395 | 3 934 | 937 | 13 838 |
| | change 2012-2030, thous. people | 52 | 480 | -1 302 | -173 | -944 |
| | change 2030-2050, thous. people | -226 | -281 | -961 | -96 | -1 564 |
| | change 2012-2030, % | 1% | 15% | -21% | -14% | -6% |
| | change 2030-2050, % | -4% | -8% | -20% | -9% | -10% |
| optimistic scenario | 2030 | 5 872 | 3 810 | 5 169 | 1 114 | 15 965 |
| | 2050 | 5 665 | 3 499 | 4 262 | 1 022 | 14 448 |
| | change 2012-2030, thous. people | 127 | 614 | -1 028 | -93 | -380 |
| | change 2012-2050, thous. people | -208 | -311 | -907 | -91 | -1 518 |
| | change 2012-2030, % | 2% | 19% | -17% | -8% | -2% |
| | change 2012-2050, % | -4% | -8% | -18% | -8% | -10% |
| pessimistic scenario | 2030 | 5 725 | 3 606 | 4 871 | 1 040 | 15 242 |
| | 2050 | 5 448 | 3 302 | 3 949 | 953 | 13 652 |
| | change 2012-2030, thous. people | -20 | 409 | -1 327 | -166 | -1 104 |
| | change 2012-2050, thous. people | -277 | -304 | -921 | -88 | -1 590 |
| | change 2012-2030, % | 0% | 13% | -21% | -14% | -7% |
| | change 2012-2050, % | -5% | -8% | -19% | -8% | -10% |

*Source: own elabouration.*

In the projection of labour supply by profession, we took into account four types of occupation: high skilled non-manual, skilled non-manual, skilled manual and elementary occupations. The projection shows the increase in the number of workers prepared for non-manual professions. By 2030 in the baseline scenario, the expansion of high skilled non-manual occupations will include about 52 thousand people, while for the skilled non-manual it will be as much as 480 thousand people. In the medium term, there will be a decrease in the supply of people with skills corresponding to blue-collar occupations, where the supply of skilled manual workers will decrease by 1.3 million (e.g. machine operators in manufacturing, and agricultural workers) and the supply of elementary occupations. The optimistic scenario assumes a greater expansion of supply in white-collar jobs and a slower decline in manual occupations. In the negative scenario, unlike in the two previous scenarios, in the medium term we expect a slight (20 thousand) loss of people with qualifications corresponding to high skilled non-manual occupations. In this scenario, the growth in the group of skilled white-collar jobs is lower, and the decrease in the number of skilled blue-collar jobs is faster. Nonetheless, this scenario results in a slower drop in the supply of manual workers. After 2030, the negative demographic pressure will intensify, resulting in a lower labour supply in all four groups of occupations, regardless of the scenario. Thanks to the expansion of higher qualifications, the decrease will be lowest among high skilled white-collar jobs. All three scenarios agree that skilled manual workers will exit the labour market the fastest. Depending on the trend in labour demand, especially the ability to implement labour-saving technologies, the decreasing labour supply will exert pressure on wages.

# SUMMARY

Labour supply in Poland has been subject to significant changes in recent years, both due to the direct pressure of companies expecting new skills and qualifications, and due to changes in the attitudes and aspirations of younger generations. This has resulted in an increased proportion of tertiary educated people. The respective change in labour supply has been occurring relatively slowly as the change requires the replacement of older cohorts of workers with younger ones.

A shift of emphasis from vocational education to general education has brought many positive changes, such as increased civilisational competencies, increased elasticity and adaptability of workers, and enhanced urbanisation. Unfortunately these phenomena have also been accompanied by adverse consequences, such as the under-investment and lack of modernisation of vocational education, decreased quality of tertiary education and its unfavourable structure which inadequately meets the needs of the labour market. As graduates with tertiary education have sought jobs in large cities where labour demand is the highest, and companies have looked for professionals, the problem of unemployment among graduates has not reached dramatic levels and the wage premium for tertiary education has remained at a high level. The inadequacy of the structure and methods of teaching is reflected in employers experiencing problems finding workers with suitable competencies. This is a significant problem despite the very high assessment of their skills by the Polish workers themselves.

People who were already working in the period of transformation of the Polish economy participated in the educational boom to a lesser extent. A large proportion of them have tried to catch up through formal studies or passing the final secondary exam. However, it was not followed by any greater propensity to lifelong learning and continuous upgrade of skills; it was primarily meant to obtain formal qualifications. As a result, Poland is one of the last European countries in terms of participation in training and courses among the employed, especially among those over 50 years of age. This situation raises a number of risks in the perspective of demographic change, which is going to force the extension of careers, increase the importance of workers over 50 years of age and lead to a contraction of the labour force.

The Europop 2013 demographic forecast indicates that the Polish population will have decreased by 4 million by 2050, and the share of people aged 70+ will more than double. This demographic change will be accompanied by a strong increase in the enrolment rate at tertiary level. These changes will occur slowly but surely, and between 2012 and 2050 the proportion of people with higher education in the population of 15-74 year olds will almost double and will exceed 40%.

At the same time the number of people with lower secondary and basic vocational education will decrease significantly. The mere replacement of generations that have lower levels of qualifications with those better educated will be insufficient to overcome the effect of the ageing population. To ensure an inflow of workforce and balancing the negative consequences of demographic trends, the Polish government will have to implement an effective immigration policy. In this context, a question appears on how to encourage high-skilled immigrants to settle permanently in Poland and not treat our country as a transit point on the way to the richer countries of the European Union. One solution may be to use the migration potential of people of Polish descent living in countries of the former Soviet Union, just as Germany did in the second half of the 20th century regarding the so-called late displaced.

A key challenge for educational policy is the creation of financial and control mechanisms to improve the quality of tertiary education and eliminate the market competition for students resulting in lower requirements. There is a need to create financial incentives for universities so that the structure of education does not cause a strong mismatch between qualifications and the expectations of employers. Educational policy should promote interdisciplinary higher education by encouraging studies at several departments in order to acquire both technical knowledge and management skills needed in innovative business projects. In addition, vocational education at upper secondary level needs additional investment and a stronger connection with regional labour markets. In this regard, on-going works on the implementation of a National Qualifications Framework seem to be a necessary but still insufficient step in the right direction.

The increasingly older structure of employees will require adjustments in the business sector and public policy. The changing structure of the labour force will require the creation of flexible career paths, both inside and between companies. The decrease in the number of graduates coming into the labour market will create pressure for better utilisation of the available labour force. Thus, public policy should identify ways to effectively support the training and retraining of workers, including those over 50 years of age.

The Occupation Inheritance Survey, carried out for the purposes of this Report, suggests the existence of barriers to social mobility in Poland. The children of parents with primary education gain tertiary education much less frequently than children of better educated parents. If at least one of the parents has a university degree, the child almost always completes formal education at a secondary level. Reduced educational perspectives in families with a lower status also translate into the future career paths of the next generation. Limited opportunities

of work in the best-paid occupations are particularly evident in the case of those whose parents were agricultural workers. Obstacles to the social advancement of children in rural areas may significantly delay the pace of structural change in Polish agriculture.

In the case of prestigious professions - lawyers and doctors – we may observe an exceptionally strong occupation inheritance by the next generation. Apart from the inequality of opportunities it is difficult to assess the consequences of this phenomenon for legal professions. In the case of medical professions, the labour supply constraints may have negative consequences. Poland has a very low number of physicians relative to the population, their group is ageing faster than in other occupations, and the demand for health services reported by the ageing populations of Western Europe is creating strong pressure for the emigration of young doctors. This is an area where supply constraints may prove to be a strong impediment to ensuring at least the current level of health services. One way to mitigate this problem may be the wider opening of the Polish labour market to the influx of doctors from outside the EU and the creation a friendly system of recognising professional qualifications acquired abroad.

## BOXES



## TABLES



## FIGURES

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Employment in Poland Part III

# Labour in the green economy

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editor: Sonia Buchholtz

# INTRODUCTION

Human activity and environment are connected to each other, however nowadays we start to realize that we have upset the delicate balance allowing the co-existence of nature and humans. Climate change, water and air pollution and other environmental damage constitute a threat to our existence and the economy. Thus, it is time to take actions based on the idea of sustainable development.

Transformation from a resource-intensive economic growth model to an environmentally friendly one is a complicated and multidimensional process. Not only does it require technological development, but also changes in business processes. However, successful transformation enables greater efficiency with respect to the consumption of raw materials, value chain extension and the possibility to establish new branches of economy. Those will create new jobs or will contribute to the profile change of the existing ones. Green jobs – since this is how they are called in literature – constitute a relatively new and not fully recognized phenomenon.. Yet there is no doubt that this phenomenon will grow in importance, even though many studies present contradictory perspectives of their development. Thus we should get to know it and observe it.

Green jobs are beneficial not only for the environment, but for the economy as well. They are seen as an opportunity to reduce high unemployment and a chance for development for poorer regions of the country. Properly used investment efforts will facilitate the creation of attractive, safe and well paid jobs and shall become an impulse for innovation-based development. For this opportunity to be exploited there is a need for joint action of the society, entrepreneurs and government, creating the basis for green growth. What is particularly important in this context is ensuring that future green workers are properly qualified.

In this part we will take a look at structural changes in developed economies, which have already enabled essential changes in the field of energy intensity of the economy and its being environmentally friendly. It will be a pretext to examine the paths that Poland may follow, and their consequences for the labour market.

First chapter presents the analysis of the socioeconomic changes accompanied by the creation of green jobs. The second stage is their quantitative description which allows to clarify the scope of the phenomenon, indicate where green jobs are located in the economy and if they will be able to replace lobs in traditional, environmentally unfriendly sectors (so called „brown jobs"). It will be accompanied by a qualitative characteristic, which is especially important for the employee. However, for the green jobs' potential to become the a reality, and not a barrier to development, it is necessary to identify the qualifications required for the given jobs. The third chapter will be devoted to this issue.

# 1 ENVIRONMENT AND ECONOMY

## 1.1 HISTORY

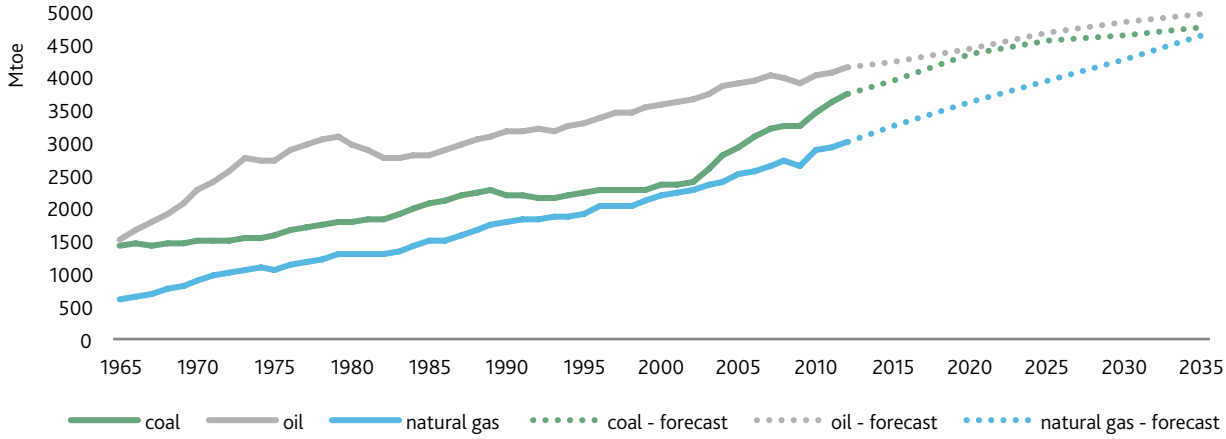
The impact of the environment on the economy has an incredibly long history. The Neolithic revolution, as a result of which nomadism has been replaced by sedentary lifestyle, has enforced a significant modification of life strategies. For the survival required paying attention to the quality of the environment, while the nomadic lifestyle did not punish for environmental degradation or instant depletion of available resources. In small populations individual care of the communities for the environment was bringing the desired result. Until the industrial revolution of the 19th century – when the high level of industrial concentration together with urbanization processes have led to the improvement of living standards, which in turn led to the increase in population dynamics. In the 20th century anthropogenic pressure, reflected in smog, soil degradation, decline in freshwater quality and the pollution of oceans, ceased to be the problem of developed countries only.

The war period at the beginning the 20th century, which naturally resulted in the industrialization of economies did not favour undertaking environmental actions out of concern for the future of the planet. This subject was not brought up until 1968 when the Swedish government of the Prime Minister Tage Erlander proposed an international environmental conference under the auspices of the United Nations. The argument for holding such a conference was the need to solve problems of global scope. A year later the idea of the conference gained acceptance of secretary general U Thant, as a result of, among other things, the report entitled *The Problems of Human Environment*. The report was prepared at his request and identified key threats for natural environment. Finally, the conference under the slogan „Only One Earth" took place in Stockholm in 1972. During the conference the role of the state in environmental protection and the issue of transnational waters protection have been discussed. The Stockholm Declaration[1] adopted at the conference and the introduction of the *United Nations Environment Programme* (UNEP) created the institutional framework for the environmental policy.

The same year the Club of Rome published the report *The Limits to Growth*. Its authors forecast that the first half of the 21st century would already bring a permanent slowdown of economic growth caused by the exhaustion of key fossil raw materials, the scarcity of food for the dynamically increasing world population and the destruction of the environment. Not to allow the scenarios to happen, they called for searching for the new sources of growth, decoupled from natural resources (Meadows et al. 1972). As opposed to food production and demographic forecasts, the authors' concerns relating to the competition for natural resources were justified, because in 20th century the production and consumption of the (non-renewable) fossil raw materials increased significantly (EC 2011) – between 1900 and 2005 the total extraction of coal, crude oil and natural gas increased more than twelvefold, from 968 to 11 846 million tonnes (Krausmann et al. 2009).

The operations conducted on the eve of the outbreak of the 1st oil shock were of political nature. The oil shocks (1973, 1979) gave energy policy a powerful economic tone. When the OPEC

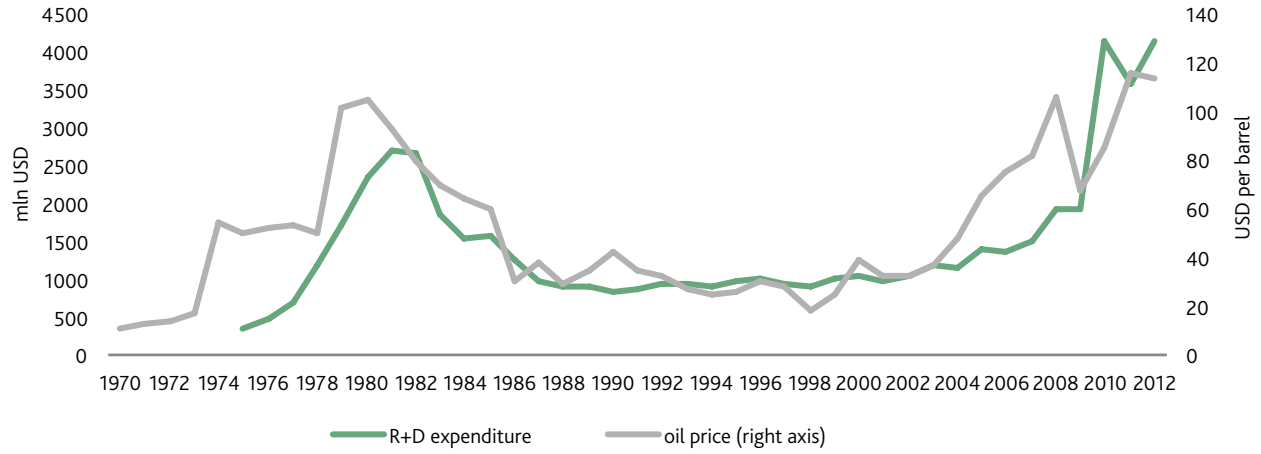
Figure III.1. **The consumption of coal, crude oil and natural gas worldwide; 1965-2035, Mtoe**




*Source: own elaboration based on BP Statistics.*

1 Full title: Declaration of the United Nations Conference on the Human Environment

Figure III.2. **Prices of the crude oil and the research and development expenses in RSE; 1970-2012**



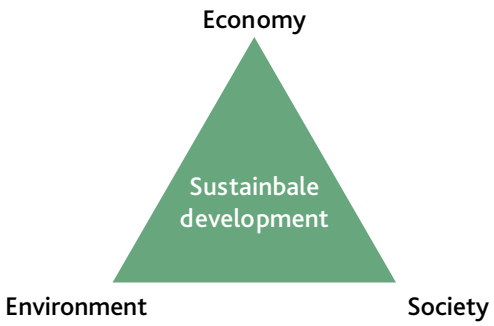

*Source: own elaboration based on IEA and BP data (2012)*

countries introduced an embargo on crude oil exports as a protest against the American support for Israel in Jom Kippur War, prices of crude oil in the world markets increased fivefold over 4 years (1970-1974). By then declarations quickly translated into action – numerous investments in exploration of new energy sources were undertaken, which contributed to the introduction of renewable energy sources and the rise of nuclear power. Much attention was also paid to the improvement of energy efficiency of buildings and cars. The stabilisation of crude oil prices at the beginning of 1980 extinguished the zeal for search. After more than a decade the prices of crude oil dropped to the level close to the pre-crises period and the raw material consumption returned to its growth path.

In 1987 the international community returned to the discussion on natural environment owing to the publication of the report entitled *Our Common Future*, that summarized the works of the UN World Commission on Environment and Development. Then the goal of sustainable development was formulated and it assumed meeting current needs of the humanity without limiting the resources for future generations. This definition covers three dimensions of development: economic, social and environmental, and each of them is of integral nature. At the operational level the signing of the Montreal Protocol, which focused on ozone layer depletion, was a significant event. Abandoning the use of CFCs, which constitute the key factor contributing to the creation of the hole in the ozone layer, is considered as one of UN's greatest environmental achievements.

Earth Summit organized in Rio de Janeiro in 1992 was a pretext for summarizing two decades of works for the climate. The *Agenda 21* was then adopted and it included proposals for the implementation of sustainable development policies, with respect to economic, environmental as well as social issues, e.g. the consumption, poverty or health care. At that time in Poland the National Fund for Environmental Protection and Water Management (special fund financing pro-environmental investment projects) began to operate. In 1992 as well the *United Nations Framework Convention on Climate Change* (UNFCCC) was established and it started the series of conferences[2], of which the most famous one was held in Kyoto and ended with adopting the protocol in which the decision on reducing the $CO_2$ emissions in 2005-2012 was made. The assessment of its implementation is ambiguous: although many countries significantly

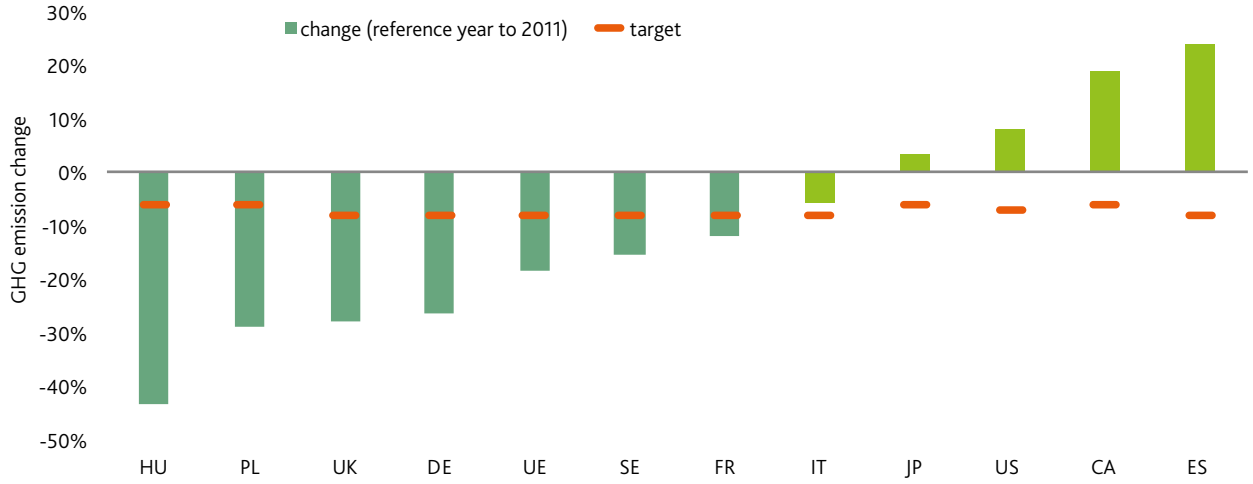
Diagram III.1. **Dimensions of the sustainable development**




*Source: own elaboration.*

2 Last one, organized in 2013, was held in Warsaw (COP 19)

Figure III.3. **Dynamics of greenhouse gas emissions; 2011**




*Source: own elaboration based on UN 2013*

exceeded their goals, the commitments did not include developing countries (significantly participating in world emissions, e.g. China), and not all of the developed countries eventually adopted the document (USA, Canada). In case of Poland the emissions were reduced by 33% in comparison to 1988 with the goal set at 6%. Also in 1997 the newly introduced Constitution gave high priority to environmental protection and sustainable development, and care for its condition became the obligation of the citizens.

The declarations made at the turn of the century were not followed by the implementation of their provisions with respect to climate and the environment: neither the Global Ministerial Environment Forum (which emphasized the fact that the actions undertaken are too little and too late), nor the UN Millennium Forum, the Objectives of which were achieved only partially. Around 2005 technological progress, which contributed to the increased global interest in renewable energy sources (RSE) in Europe, USA as well as in China, gave an impulse for changes[3]. The climate conference in Copenhagen[4] failed to extend the Kyoto Protocol.However, the failure of the summit became the incentive for the EU to undertake actions on its own. In the same vein the objectives for the Europe 2020 strategy, known as 20-20-20[5], were formulated. Four years later major emitters that insofar refrained from action against global warming (USA and China) vowed to undertake binding objectives concerning the reduction of emissions. This gives hope for signing a global agreement during annual UNFCCC climate conference in Paris, which will be held in 2015. National efforts are drifting: on the one hand Poland is blocking the EU plans referring to the emission reduction to 2050, emphasising the importance of coal-based energy production for economic growth and energy security[6]; and on the other it introduces a white certificate scheme aiming at reducing the energy intensity of the economy, these however are not very popular mainly due to the complicated procedure.

## 1.2 CHALLENGES UP TO 2050

International debate has not yet brought a significant impulse to reduce the human pressure on the environment. In view of the planetary boundaries concept (Box III.1), we are crossing the borders of the safe space for human activities, creating a threat to our further management. Only determined actions of the whole international community may reverse these unfavourable trends, if they are implemented in a consistent and coherent manner.

In view of the OECD report (OECD 2012c), the key environmental challenges within the 2050 time horizon focus on 4 areas: climate change, biodiversity, water availability and quality, as well as health and environmental issues. The present status of most of the abovementioned issues is bad or is systematically deteriorating, and the actions taken to date do not solve the problems in a satisfactory manner:

- Climate protection requires most urgent action. The maximum acceptable level of $CO_2$ in the atmosphere (350 ppm) has already been exceeded in 1990 (Stockholm Resilience Centre). Although the global agreement assumes that average world temperature at the end of 21st century cannot be allowed to exceed levels prior to industrial revolution by more than 2° C, the continuation of current trends will cause them to increase by 3-6° C within the 2100 time

3 In case of Poland green certificate scheme contributing to the development of RSE was an additional impulse.

4 COP15, 2009.

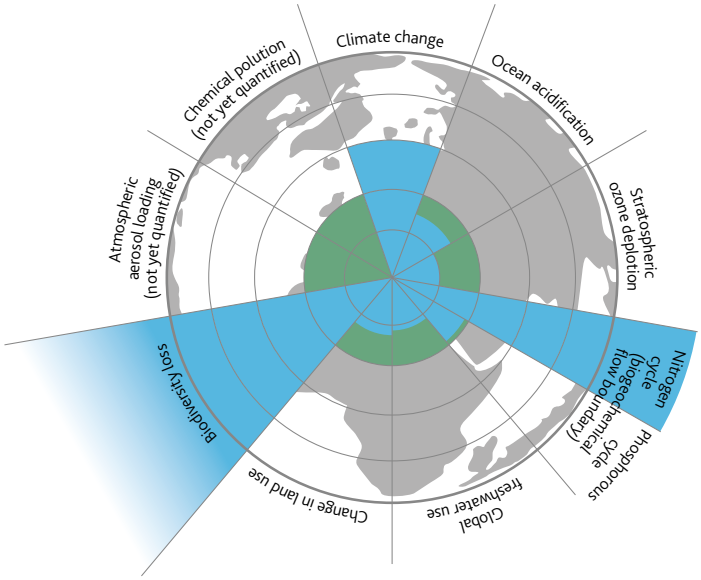
5 Reduction of the greenhouse gases emission by 20% as compared to the 1990 level, 20% share of the energy from renewable sources, 20% increase in energy efficiency

6 According to the plan presented by Donald Tusk in the interview for the Financial Times, full use of the existing EU resources of fossil fuels, including coal and shale gas, was supposed to be an element of the proposed energy union. Source: PPA news, 22 April 2014

## Box III.1. Planetary boundaries concept

In 2009 Johan Rockström of the Stockholm University and 28 other experts presented their concept of *planetary boundaries*. To avoid a disastrous environmental change the humanity shall stay within the established boundaries set for the basic earth processes.

Diagram III.2. **Planetary boundaries**




*Source: Stockholm Resilience Center, http://www.stockholmresilience.org*

Identification and quantitative establishment of the planetary boundaries which constitute the safe space for human activities are supposed to prevent the unacceptable anthropogenic climate change. If any of the boundaries gets transgressed, the security of other processes may also be subject to a great risk.

The boundaries were established with respect to 9 processes:

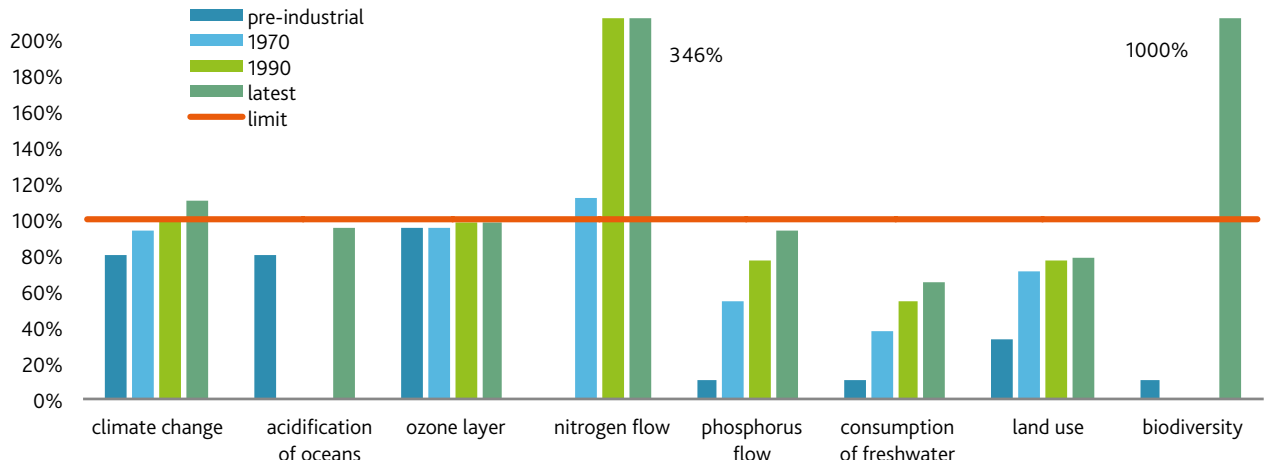
- Climate change
- Acidification of oceans
- Ozone depletion in the atmosphere
- Nitrogen flow
- Phosphorus flow
- Global freshwater consumption
- Land use
- Biodiversity loss
- Aerosol pollution of the atmosphere (the maximum amount has not been determined yet)
- Chemical pollution (the maximum amount has not been determined yet)

Currently there are three boundaries that have been transgressed:

- Nitrogen flow – biochemical nitrogen cycle has changed rapidly as a result of many industrial and agricultural processes conducted by humans. Present human activity transforms atmospheric nitrogen into compounds that affect plant growth and use this atmospheric element more than all other earth processes together.
- Biodiversity – *The Millennium Ecosystem Assessment* study from 2005 indicates that during the last 50 years changes in biodiversity on Earth caused by the human activity were faster than ever before in history, increasing the risk of sudden and irreversible changes in ecosystems. The factors causing such defects are relatively constant or they gain in intensity.
- Climate change – recent studies indicate that the Earth exceeds 387 ppm of carbon dioxide in the atmosphere and it already transgressed the planetary boundary. Such changes may lead to global warming and the sea level rise.

Box III.1. cont. **Planetary boundaries concept**

Figure III.4. **Percentage values of the planetary boundaries indicators as compared to the determined value of the indicator**




*Source: own elaboration based on Stockholm Resilience Centre*

Such advanced changes, in view of the planetary boundaries concept cause major changes in our life and management. Introduction and operationalization of the Rockström concept may significantly contribute to the resolution of problems connected with environmental degradation. For there is an urgent need to identify the thresholds for the strength of earth systems, to analyse the risk and uncertainty, and to apply precautionary principles to avoid crossing the thresholds. Rockström encourages the use of the solutions that will not negatively impact the people's living standards, but they will also not influence the environment in a negative way. He gives examples from Latin America, Sweden and Australia where the new, innovative farming practices and methods for using the environment have been introduced and they significantly influenced the production but did affect ecosystems in a significant way.

*Source: Stockholm Resilience Centre, http://www.stockholmresilience.org/*

horizon (OECD 2012c). No reaction will result in melting of glaciers and permafrost, and in consequence will lead to the ocean level rise. This will influence the quality of life of people living in coastal areas and will contribute to higher frequency of extreme weather events such as floods, droughts or hurricanes. It is estimated that the lack of action will result in losses comparable to permanent drop in the world consumption by 14% (OECD 2012c).

- Strong anthropogenic pressure, particularly the development of agriculture and forestry, and infrastructure deployment, creates a threat to biodiversity. These cause the reduction of natural habitats for animals and plants (both with respect to species and populations), including particularly precious primary forests. In this area the boundary defined as safe has been transgressed by 1000%. Especially high costs of biodiversity loss are borne by poor rural communities and indigenous peoples, which are particularly connected to the local ecosystems providing for their basic needs.
- Access to clean fresh water is a precondition for the functioning of people and ecosystems, but it also has its considerable economic importance in agriculture and industry. In view of OECD estimates (2012c), up to 2050 the water demand will increase by approximately 55% due to the increase in demand from industry, energy production and households. The competition for depleting ground water and its further pollution may pose a threat to the stability of ecosystems. According to forecasts, in 2050 the scarcity of clean drinking water will affect approximately 240 million of people, especially in sub-Saharan Africa, but also in rapidly growing cities in developing countries, where the infrastructure deployment cannot keep up with the pace of urbanization.
- Air pollution in cities, in view of OECD forecasts (2012c), will become the most common cause of death related to the environment. The number of deaths connected with this will exceed 3.6 million annually in 2050. Particularly bad situation in this respect is noticed in large cities in Asia, where the norms markedly exceed the standards of the World Health Organization. The exposure to hazardous substances still constitutes a significant threat, although to a lesser extent. In both cases there is a considerable potential for the improvement of the information policy.

# 2 GREEN JOBS

## 2.1 WHY GREEN?

Green jobs were defined in the 1970s (cf. Box II.2) and shortly after have proven to have many faces (Morriss et al. 2009). No binding definition has been adopted so far in literature or for the purposes of economic policy, which would allow for a precise differentiation of green jobs from other jobs. One of the most commonly cited definitions is the one created by UNEP, which assumes that those are jobs in agriculture, production, research and development, administration and services that significantly contribute to preservation or restoration of the environmental quality, including among other things, the protection of ecosystems and biodiversity, reduction of energy, resources and water consumption, and minimizing the generation of waste and pollution (UNEP 2008). In this context green jobs serve to curb the negative impact of human activity on the environment and attempt to adapt to these consequences (Martinez-Fernandez et al., 2010).[7] We can sometimes hear the opinions of experts claiming that this basic definition should be supplemented with social aspects connected with the quality of the work performed: appropriate working conditions, decent wages and social security, occupational safety and compliance with workers' rights (ILO 2011, EC 2011 and UNEP 2008).

It is worth noting that these definitions are quite imprecise – there is in fact a whole spectrum of colours defined as shades of green by UNEP, because they contribute to minimizing the environmental pressure to a varying degree. Thus, there are professions among those jobs which – when defined as green – might be controversial due to the concomitant existence of positive and negative externalities (Gulen 2011). Such is e.g. the case of a steelmaker manufacturing the parts for wind turbine rotors. Similar doubts refer to the nuclear energy sector employment being referred to as green, which is a subject of numerous discussions due to the risk of radioactive contamination of the environment (UNEP 2008)[8].

Green jobs connected mainly with areas such as renewable energy, improvement of energy efficiency, reduction of pollution, limiting the greenhouse gas emissions, recycling, natural resources protection, as well as education and raising social awareness with respect to environmental protection (Deschenes 2013), but they need to be approached horizontally: they may appear in almost any branch of the economy and in different business sectors.

## 2.2 HOW MANY GREEN JOBS ARE THERE?

The idea of *green utopia* (UNEP 2008, Martinez-Fernandez et al. 2010) might prove helpful in understanding the notion of green jobs. Green utopia is where human activity does not generate hazardous externalities in the form of emissions or waste, and the consumption of resources is effective to a largest possible extent.

**Box III.2. Collar workers**

For almost 100 years there has been a distinction of the job positions in American culture between blue- and white-collar workers. The blue-collar workers perform manual labour and white-collar workers – intellectual work, but at first those were mainly officials, only later this started to include managers as well. These notions are related to the colour of the clothing worn by the workers at the beginning of the 20th century.

Since the 1970s many „coloured" expressions referring to different types of work performed by the workers were created, but they were related to the actual colour of their clothing to a much lesser extent. Assigning a colour to a particular group was rather an attempt to draw attention to certain phenomena:

- grey collars – to the work of elderly persons,
- pink collars – to less prestigious jobs, often connected with taking care of other people, performed mainly by women (e.g. teachers, nurses and secretaries) and
- green collars – to the work for saving natural resources (back then mainly crude oil) and for the improvement of the environmental quality.

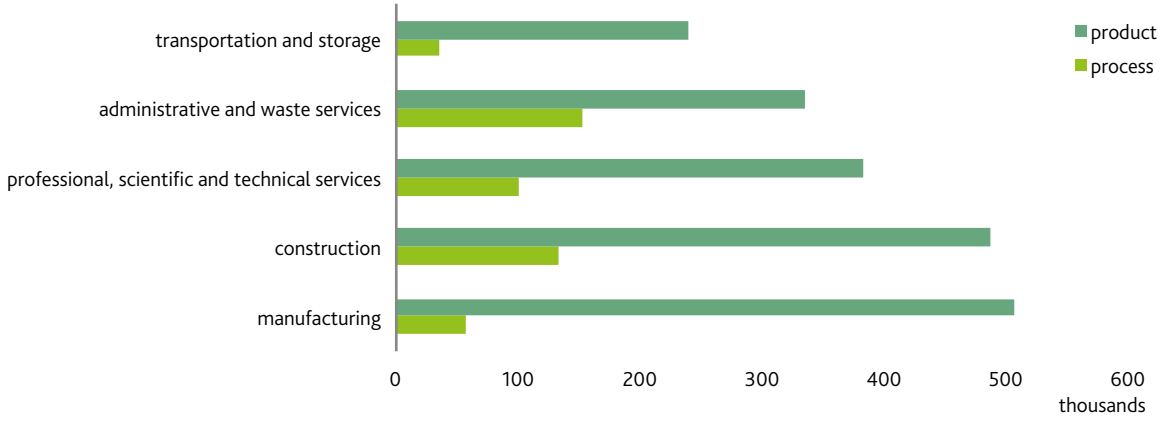
The development of energy- and resource-efficient technologies, and first renewable electricity installations that took place in 1970s resulted in the workers of these sectors being called green collars.

*Source: own elaboration based on Wickman 2012.*

7 This is a far wider category than only renewable energy. For example in Spain the share of this sector in green employment in 2009 was merely equal to 20% (ILO 2013).

8 For the purposes of this paper, nuclear energy jobs will be classified as green due to the fact that the technology does not cause any emissions and it is very safe (cf. Figure III.7).

Figure III.5. **Green jobs estimates in USA according to the product and process approach; 2011**




*Source: own elaboration based on BLS data.*

In this context green jobs are those, which help to fulfil this vision. It is worth noting that identifying certain profession as green job is not permanent – as economic activity's pressure on the environment is reduced, the professions formerly identified as green might lose their green status. What was previously environment-friendly, might no longer be so after the introduction of new, more economical or efficient technologies. As a consequence numerous problems connected with the collection and compilation of statistical data, and especially with their analysis (both in dynamic and spatial terms), are accumulating. Particularly, a green job in a developing country might not be identified as green in highly developed countries. Thus data obtained in different countries might be incomparable (OECD 2012).

In so far as the cited definitions make it easier to understand the green jobs concept, the estimation of their scope in the economy requires one to decide on a certain approach, allowing to classify a given position as green or not. Pursuant to the arrangements of the ILO Conference of Labour Statisticians[9], it is possible to identify the green components of the jobs by means of an analysis focusing on three aspects: the industry, the position and the production processes:

a) **the aspect referring to the type of industry** identifies the business types connected with environmental protection, the example of which might be European studies on environmental goods and services sector (EGSS).

b) **the aspect referring to the position,** which takes into consideration the positions that noted significant growth in connection with green modernisation: the positions that underwent considerable changes in the scope of tasks and required qualifications, as well as brand new ones.

c) **the aspect referring to the production processes** distinguishes the product approach and the process approach:

- **product approach:** assumes that green jobs have to be connected with the manufacture of products or offering services, which have positive impact on the environment, such as for example the work of a solar panel technician or of a recycling facility employee.[10]
- **process approach** also covers the professions which do not manufacture ecological goods, but contribute to the improvement of the environment: regardless of the destination of goods or services, the employees may apply processes limiting the use of raw materials, for example the materials from recycling, and material-saving and energy-efficient technologies (Stang and Jones 2011).

The natural consequence of the choice of definition is green employment statistics, which is more extensively discussed further in the chapter. The difference between those two approaches may be outlined on the example of the United States. In 2011 there were four times more green jobs identified according to the product definition than to the process definition. Among sections employing the greatest number of green workers the industrial processing sector is a leader with more than half a million of green jobs according to the product approach and nine times less according to the process approach[11]. Similarly large gap is seen in construction industry, which includes e.g. fitters performing thermal upgrading, and in professional and scientific services represented by employees of R&D departments. Comparably small is the difference between the number of jobs according to the product and process approach noted in administration services and waste management.

9 19th Conference of Labour Statisticians, Geneva 2013.

10 Eurostat, which has not developed a general definition of green jobs so far, provides statistical data referring to the persons employed in the sector of environmental goods and services, so the ones that have been produced to prevent, reduce, eliminate the pollution and other types of environmental degradation, as well as to preserve and maintain the natural resources. This definition represents the product approach, which means that the scope of this type of positions should be relatively comparable to the product approach applied by BLS.

11 For example, the worker manufacturing hybrid cars in a plant, the production hall of which is not energy-optimized and which sends the industrial waste to the landfill, shall be deemed a green worker only if the product approach is applied.

Among ten developed countries which had an official definition of green jobs 2012, the majority applies the product approach. Moreover, the estimates of the numbers of jobs in selected sectors of the economy are used for statistical purposes. Countries such as Austria, Japan or France apply the Eurostat definition, which does not describe the green jobs but solely employment in environmental goods and services sectors. The similar method, though based on national classifications, is applied by Korea and Spain. Pursuant to the recently adopted regulation (EP 2014), from 2015 the member states will be obliged to submit to Eurostat the statistics referring to the employment and GDP in the environmental goods and services sectors, and the expenditures on environmental protection. Definitely the most comprehensive method was utilized in the United States. Unfortunately, due to savings introduced by President Obama in public administration, the program of identifying the green jobs has been closed. Certainly, differences in approaches constitute an obstacle to international comparisons but the knowledge on the changing number of jobs is precious and that is why subsequent countries, including Australia, the Czech Republic and Denmark are working on developing their own definitions (OECD 2012b).

Nevertheless, this method of estimation, based on examining the employment in sectors considered as green, has numerous drawbacks:

- it includes persons employed in institutions that are not environment-friendly,
- it includes workers which (even though are working in certain sectors) do not perform the tasks that have positive impact on the natural environment, e.g. an assistant's job in a green sector does not directly contribute to the improvement in the quality of the environment,
- it neglects the workers who work outside the established sectors, but perform green tasks (OECD 2012a, OECD 2012b), just as in the case of R&D employees in FMCG sector, which is not directly associated with environmental protection (cf. Box),
- it neglects the workers whose main duties do not fit in the green jobs definitions, even though they perform such tasks as well. In view of WUPB study (2012), 35% of green companies in Podlaskie voivodeship assign the duties characteristic of green jobs to the persons already employed.

Even when using only one subject of measurement, it is hard to obtain a precise result. In view of the study carried out by Ecorys for 2000, 2008 and 2010, the range of estimates varies by min. 0.6 million of jobs, which equals to even 24% of the upper range of estimates. The differences result from different methods of solving the problems with the estimation of the number of jobs: there is an issue of double counting when two different methodologies partially overlap. The discrepancies are also a consequence of using new codes for NACE classification of economic activity. Moreover, the data using which the calculations are made, comes in part from the estimates from statistical offices which sometimes are updated after a long time or the method for their collection is modified. Ecorys study (2012) proves that the changes in calculation methodology, and also the use the more up-to-date data result in considerable differences between estimates, and, finally, subsequent values appearing in literature depend much on the estimation method.

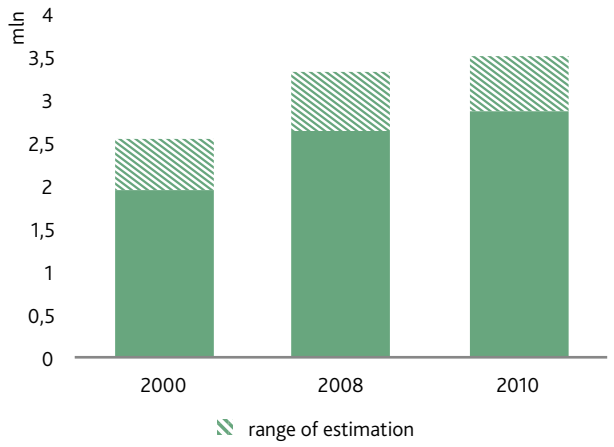
Currently, there is no official definition of green jobs in Poland currently and that is why current estimates of their number cannot be presented. According to a study carried out by Szwed and Maciejewska (2012), there were 190 thousand of jobs in 2011 (cf. Charts III.8 and III.10) - more than 1% of the total employment. It may not seem a lot, but it is a significantly higher number than miners. More than 25% of them were created in organic farming so far. When comparing this number with the employment in waste management (5 thousand) and RSE sector which in

Table III.1. **The comparison of green jobs definitions**

| Country | Conceptual scope |
|---|---|
| Austria | Definition based on Eurostat environmental goods and services. |
| Japan | The number of persons employed in environmental goods and services sector based on Eurostat definition |
| Germany | The green jobs are the ones meeting at least one of the following conditions: 1) they are in environmental goods and services sector according to Eurostat or 2) they are connected with the environmental operations. |
| Finland | The number of employees of the companies in chosen NACE sectors (3700, 3811, 3812, 3831, 3832, 3900, 35111) |
| Spain | Definition is based on the national classification of sectors. |
| South Korea | Definition referring to the jobs connected with the manufacture of goods and provision of services contributing to the low carbon growth and environmental improvement. Based on the Korean classification of professions and sectors, the green professions and sectors have been selected. |
| USA | Two definitions, product and process approach. |
| France | No official definition, the Eurostat classification of environmental goods and services is used for statistical purposes. |
| Portugal | No official definition, although there are surveys conducted among entrepreneurs, in which there is a question about the number of employees spending most or part of the time on activities connected with environmental protection. |
| Hungary | No official definition, however the statistics are carried out with respect to:<br>1) the number of jobs in environmental sectors,<br>2) the number of jobs created as a result of the environmental investments made. |

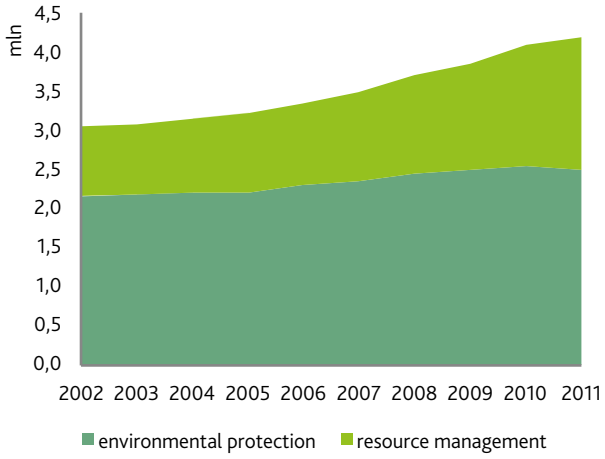
*Source: own elaboration based on OECD 2012b.*

Figure III.6. The number of green jobs in EU-27



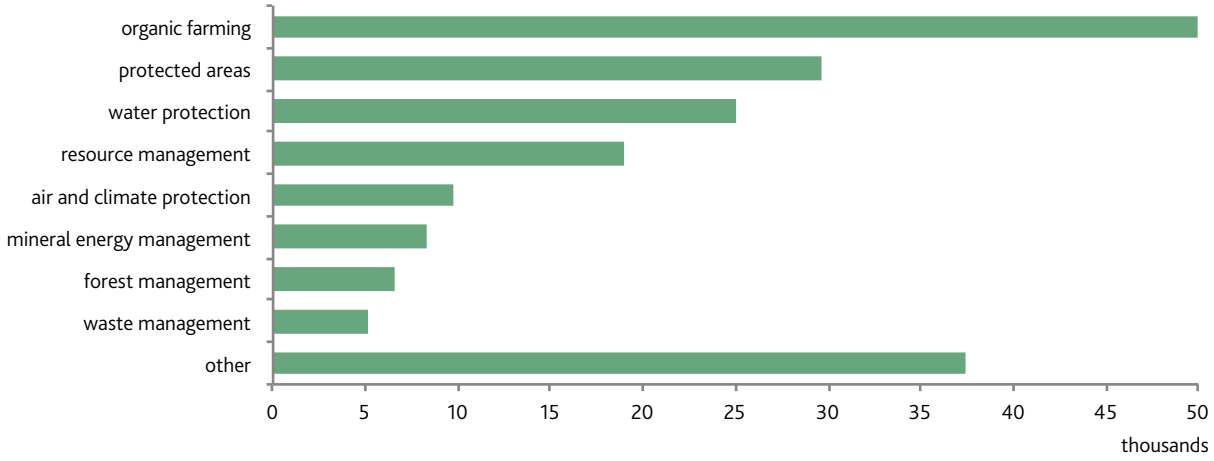

*Source: own elaboration based on Ecorys (2012) and Bilsen 2009*

Figure III.7. The number of persons employed in the green products and services sector in EU-28; 2002-2011



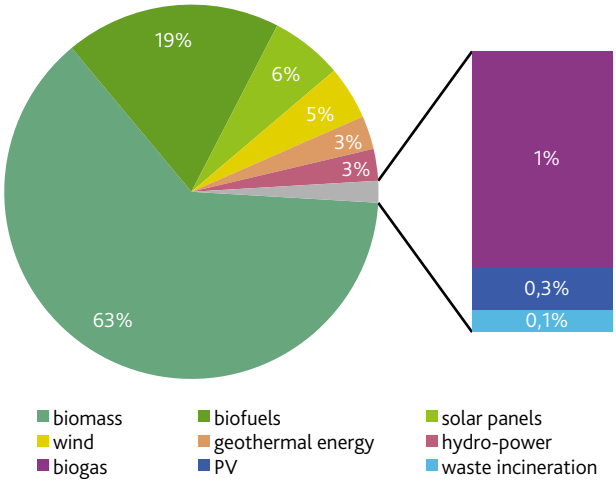

*Source: own elaboration based on Eurostat data.*

Figure III.8. Green jobs in Poland; 2007



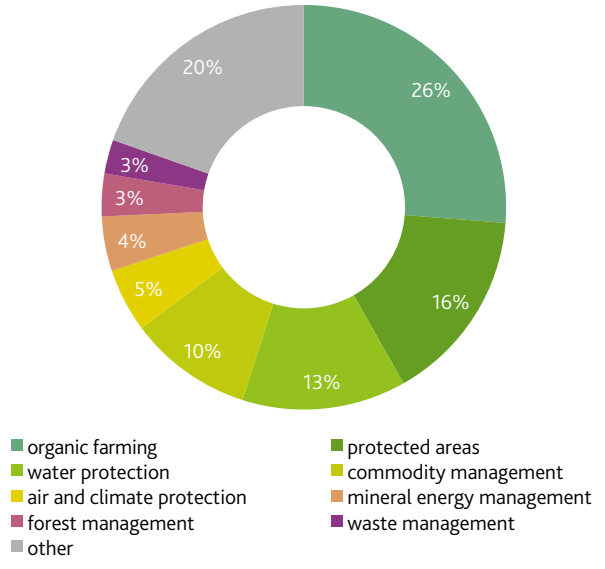

*Source: own elaboration based on Szwed, Maciejewska (2012)*

Figure III.9. The number of jobs in RSE sector in Poland; 2011




*Source: own elaboration based on Eur Observ'ER (2012).*

Figure III.10. The share of respective areas in green employment in Poland; 2007




*Source: own elaboration based on Szwed, Maciejewska (2012)*

2011 was equal to 21.8 thousand. (cf. Figure III.9) it turns out that there are more green jobs created in agriculture than in the sectors more commonly associated with this phenomenon. In renewable energy in turn, the highest employment is noted in the biomass sector. Poland is currently at the initial stage of green transformation and we can expect a considerable increase in the number of jobs and significant shifts in their industry composition.. Final number will depend on the scale and type of investments undertaken. The tool for forecasting employment growth caused by modernisation actions is a MEMO2 model whose results are presented further in the report.

## 2.3 WHAT ARE THE FEATURES OF GREEN JOBS?

In view of the definition, green employment is supposed to meet the basic aims of sustainable development. This means the concomitant positive impact of the work on the quality of the environment, but also the implementation of the concept of high quality employment: safety, adequate remuneration and a friendly environment. In reality, when it comes to the issues of productivity, durability and quality of green jobs, the consensus has not been reached yet. This is largely because (apart from positive externalities for the environment) these kinds of jobs are not much different from non-green ones.

Thus, in their whole diversity we can find jobs characterised by higher and lower productivity (e.g. a manual worker in a sorting plant and the engineer working in a construction of a photovoltaic power plant), or by high and lower quality (e.g. waste management and work in R&D department; UNEP 2008, ILO 2011 and ILO 2012), as well as permanent or temporary jobs. Let's take a closer look at this issue.

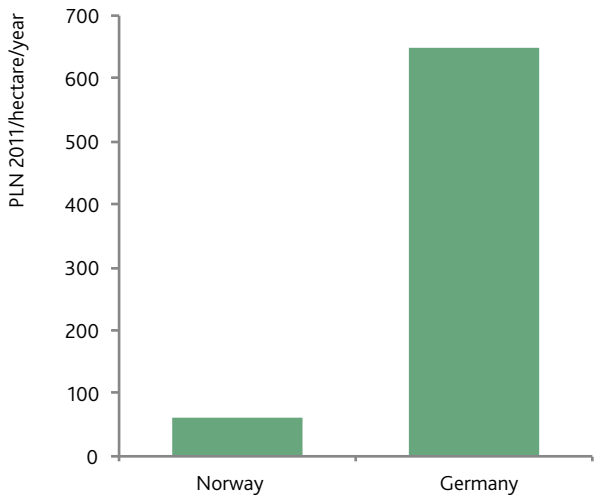
### 2.3.1 PRODUCTIVITY OF GREEN JOBS

Productivity is a measure of efficiency and it presents the product made by one unit of effort (labour or capital). In particular, the labour productivity is a gauge of the efficiency of a worker. Capital also influences labour productivity: it is easy to imagine that better-trained workers are more productive, but this is the case with the ones working on modern, computerised positions as well. Another factor influencing productivity is the place of production in the value added chain: in case of green goods the biggest share of the added value goes to their inventor and vendor, and definitely smaller to the manufacturer or fitter.

Ideally, added value is measured not only on the basis of the market value, but also the social one – its element is the valuation of the natural environment, for which those jobs were created. Market component is relatively easy to evaluate – some considerable problems occur when we want to determine the value of the environmental resources. In practice, this problem is resolved using interviews, in which the respondents declare the values of the respective components of the ecosystem. For example, the respondents answer questions on material value of the existence of these resources or a declared sum that they would be likely to pay for using the resources, e.g. a visit in the national park.

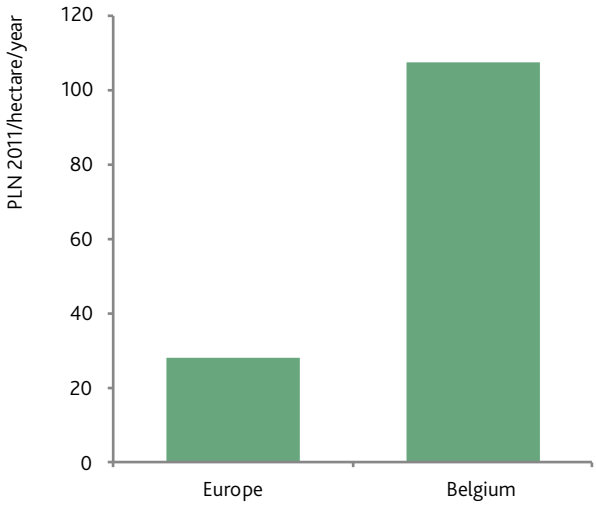
As it turns out, the declared sums are very diverse. This is partially because of the specificity of the research, but the relative rarity of the selected elements of the ecosystem is of key importance. For example, swampy areas for the persons living in their proximity may not be of great value, but at the same time it may attract many tourists from abroad. Moreover, the individual perspective of the respondents influences the results: one of the examples are the beavers which are protected in many European countries – for many people watching these animals

Figure III.11. **Discrepancies in the valuation of genetic diversity value in Germany (1990) and Norway (1991)**




*Source: own elaboration based on Nijkamp et al. 2008*

Figure III.12. **Discrepancies in the valuation of meadows in Europe and Belgium in 2006 expressed as hectare per annum**




*Source: own elaboration based on Ruijgrok and Groot 2006*

## Box III.3. Subsidising green technologies

Many researchers, including among others Morriss et al. (2009), Alvarez et al. (2009), think that green jobs are inefficient due to subsidies. This may be true, provided that the value of subsidies is higher than the sum of economic added value generated by this kind of work and the value of the preserved natural environment (the reverse situation is presented in Figure III.3).

Diagram III.3. **Efficiency condition for subsidised green jobs if a subsidy is present**


*Source: own elaboration*

Many elements of the green transformation are currently the subject of different subsidies – it is not only about using different forms of support for the generation of electricity from renewable sources. However, the support for consumers is even more important, for example in the form of premiums for implementing modern energy-efficient technologies, which often – due to their high technical parameters and scarcity – are more expensive than the mass technologies. This refers to the modern, low--energy construction, comprehensive solutions for thermal upgrading and energy-efficient household appliances and machinery. The arguments in favour of subsidising the improvement of energy efficiency (Transue and Felder 2010, Linares and Labandeira 2010) indicate that it is more effective than increasing the energy prices and contributes to the promotion of modern and effective technologies, among other things by reducing initial outlays for the buyers. At the same time, the market for these goods is expanding, which also causes an increase in demand for labour. Different types of grants and subsidies enhance competition on these markets – they attract subsequent entities to enter, which is why the drop in the prices of green goods occurs faster than in the case of non-subsidised sectors.[12]

According to some authors (among others Hughes 2011) newly created jobs increase employment to the detriment of its productivity, and lower productivity means lower wages. Studies concerning the newly created green jobs prove that many of them are office and administrative positions, which should be viewed as additional cost of the pro-environmental investments and not a profit (Morriss et al. 2009). Different conclusions are presented by WISE's *Low-emission Poland* (Bukowski (ed.) 2013), where investments in renewables and energy-efficient solutions and appliances are classified as a positive productivity shock for the entire economy. In turn, new jobs are an additional positive externality of the new, green investments which have to be implemented in the first place, and then maintained. Additionally, Frankhauser (2008) emphasises the advantages of green jobs in research and development, which apart from the improvement of productivity will be characterised by high quality. Potential benefits of technology exports for the economy are invaluable.

However, it is worth noting that subsidies are usually a result of reallocating funds that were initially earmarked for another, possibly less productive purpose. Here, one should consider subsidising the electricity consumption by the end-user (e.g. through energy bonuses). Will such a subsidy be more productive from the point of view of the economy than supporting the reduction of energy consumption by improving the energy-efficiency of the buildings that will actually lower the costs? In both cases subsidising the end-user generates benefits for other entities – in the first case, the companies producing and selling energy ensure the demand for their services, and in the second case, the company producing construction materials and the workers performing the upgrading are the beneficiaries.

*Source: own elaboration*

in their natural environment generates a considerable added value, however the estimated added value will drop significantly in case of fish farms owners which are at risk of devastation because of the activity of these animals.

In 1991 in Norway genetic diversity was valuated with the use of conditional assessment simulation method at PLN 62.8 per person annually. The same survey conducted a year earlier in Germany, carried out on the basis of declared preferences method was completed with a result of PLN 649.2 per person annually, so 10 times higher (Nijkamp et al. 2008). This material difference in valuation also influences the assessment of productivity of green jobs, which focus on maintaining this diversity. If workers' wages in both countries are at the same level, then the jobs in Germany will still be characterised by higher productivity because of significantly higher declared value of protected resources. It is also worth noting here that in view of the environmental Kuznets curve hypothesis, these differences

12 at 2011 prices

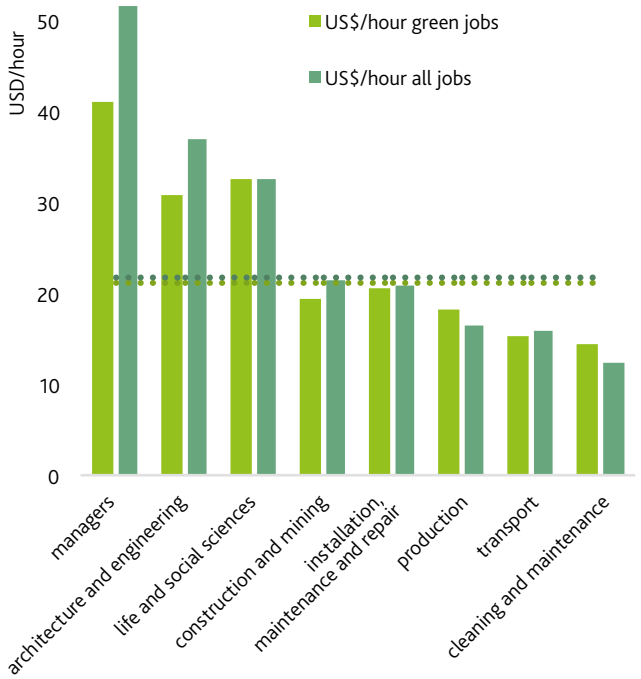
remain minor in countries with similar level of development. If this experiment was repeated in the countries with different levels of development, the dispersion should be much greater.

At the source of the majority of discrepancies between the estimates of productivity of green jobs lay the differences in the observed environmental values and its respective elements and great internal diversity of the green jobs. It is easy to imagine that organic farming and research and development of energy storage technologies are very different when it comes to labour and capital outlays, required qualifications, and in consequence –productivity. What is more, the discussion on productivity is relatively often limited to directly measurable effects, while forgetting about externalities (World Bank 2010) that they create. In case of environment-friendly economy, clean environment or better health of the society might constitute externalities, even though it is not always reflected in the companies' balance sheets. On the other hand, companies that damage the environment usually do not bear the costs of their activity (Kassenberg, Śniegocki 2014). Ultimately, the subsidies constitute the subject of the dispute (cf. Box III.3).

Some researchers (e.g. Bowen 2012, Frankhauser 2008) think that, at least in the short-term, green jobs will be characterized by low productivity due to their labour intensity. This is particularly emphasised with relation to the energy sector, where it is possible to compare conventional fossil fuel plants with renewable energy sources (cf. Figure III.14). Available data prove that renewable energy production is more labour-intensive, however it decreases with the economies of scale and the concentration of diffuse sources (cf. Kassenberg and Śniegocki 2014). The issue of labour intensity is still subject to debates: Morriss, Bogart et al. (2009), while criticising ineffective use of labour force, remind that its soothing role during high unemployment spells is often seen as an advantage of green jobs (Pollin et al. 2009), despite the fact that higher labour intensity is a symptom of low productivity that, in turn, leads to lower earnings and reduced profits A pivotal example in this context is organic farming. However there are no accurate sector estimates and that limits the discussion to extreme assessments of the productivity.

Statistical data does not settle the productivity debate, either. Value added per employee remained systematically higher by ca.25% relative to EU-28 average or similar, as in the USA (approximated by the level of salaries). Their assessment may be influenced by the structure of the performed tasks. Both in the absolute and relative approach, the greatest differences are visible in case of the persons employed in executive positions (which might constitute an element of the companies' CSR). From the wide spectrum of the positions the employees of the green companies are at an advantage in comparison to their colleagues basically only in the area of production, and cleaning and maintenance.

Figure III.13. **Hourly wages in green companies (process approach) and in general in the USA; 2011**




*Source: own elaboration based on BLS*

Figure III.14. **Changes in the added value per employee in EU-28 in the environmental goods and services sector and in general; 2002-2011**


*Source: own elaboration based on Eurostat data*

### 2.3.2 QUALITY OF GREEN JOBS

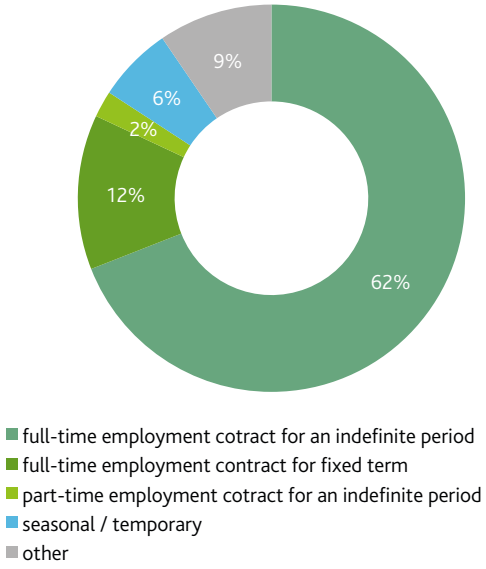
Quality of work has various dimensions, only a few of them has been described using statistical data and with respect to green jobs. Taking these weaknesses into consideration, we take a look at green jobs from the perspective of durability, safety and flexibility.

#### DURABILITY

As in most sections of economy, the demand for goods and services is decisive of the durability of jobs. In case of green consumer goods, durability of jobs depends in brief on whether the consumer's interest will translate itself into stable demand in the long term, for capital goods the restitution rate is very important.[13] However it is hard to precisely define the period of time after which the job becomes durable. Widespread use of civil law contracts and fixed term employment contracts with respect to jobs that are effectively durable is another obstacle. Considering the lack of a better point of reference, the indefinite period employment contract constitutes the most accurate approximation of job durability.

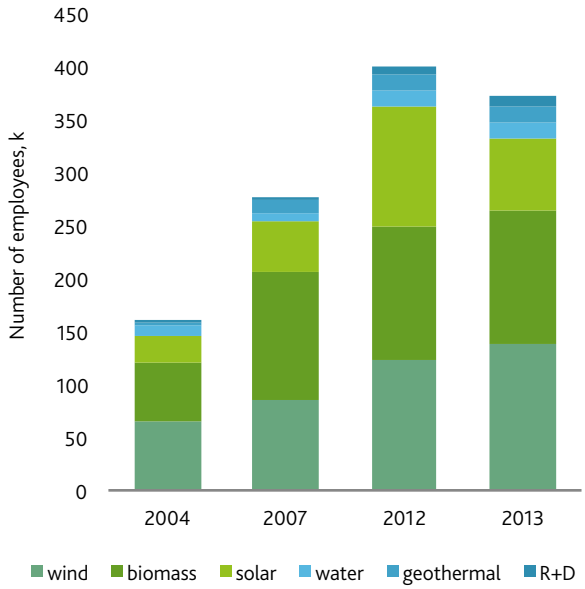
In light of WUPB surveys (2012) conducted in Podlaskie voivodeship, one third of enterprises decided to hire employees for the purpose of reducing human ecological print and adapting to its effects. The majority of them is employed on the basis of full-time contracts (cf. Figure III.15). A total of 64% of them have

Figure III.15. **The structure of the employment forms in the companies in green sectors in Podlaskie province (voivodeship) in 2012**




*Source: own elaboration based on WUPB 2012*

Figure III.16. **Employment in the RSE sector in Germany**




*Source: BMWi (2014)*

**Box III.4. Stability and quality of green jobs according to the Employment Agency**

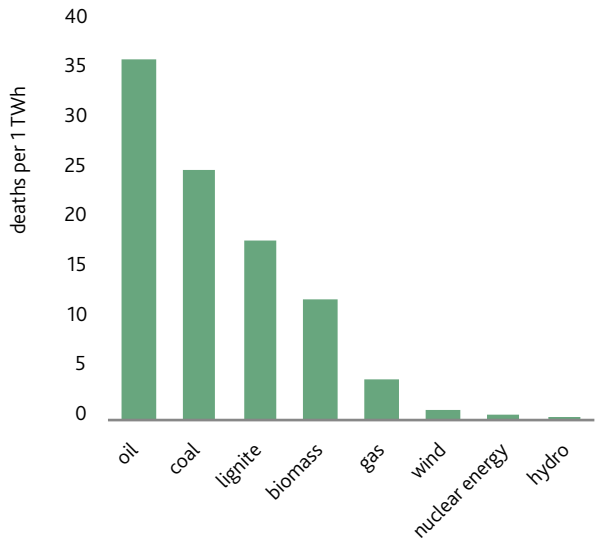
The Employment Agency workers in counties (powiats), in which green technologies are being developed, are aware of the green jobs phenomenon. There are trainings and courses organised, aiming at teaching the unemployed the skills needed to take up a job in the developing sectors; often these activities are co-funded by EU funds. The companies in the environmental sector have a minor but positive impact on the labour market in the region: there are 800 green collars employed in Suwałki and Suwalski county (powiat) and the companies search for employees among local labour force, also through employment agencies.

However according to the representative of the Employment Agency in Suwałki, job offers are not very attractive; the companies propose a temporary position, shift system and low salaries. Persons with higher education have difficulties in finding adequate employment in green sectors. Additionally, there is a certain mismatch between qualifications of the unemployed with the required skills, and the participants of the trainings have difficulties with finding proper jobs and using the acquired knowledge in practice. The reason for this is the fact that the sector is relatively new and its position on the labour market is not stable.

*Source: own elaboration based on individual interview*

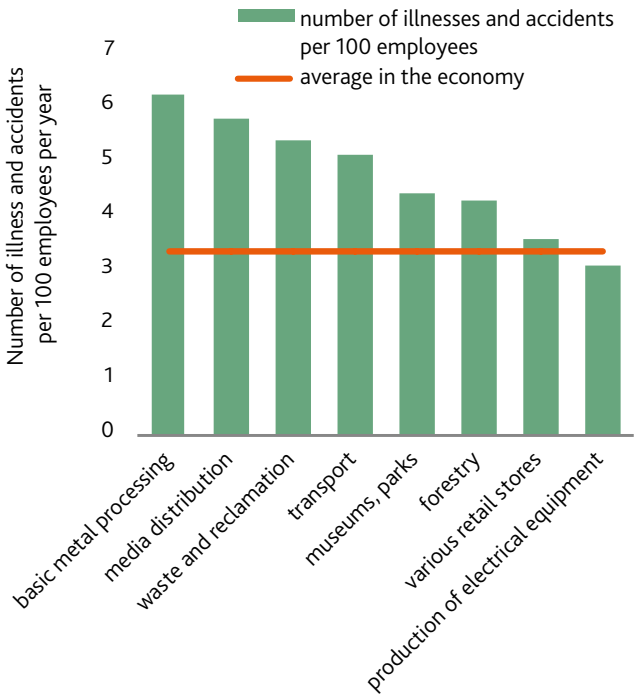
13 In other words, gradual exchange of assets for new ones will create a stable labour demand.

Figure III.17. **Deaths per 1 TWh of the energy produced in the EU**




*Source: own elaboration based on Starfelt and Wikdahl 2011*

Figure III.18. **Diseases and accidents at work in the USA in branches where green jobs constitute more than 10%; 2012**




*Source: own elaboration based on BLS data*

indefinite period contracts, 8 percentage points below the national average (72.7% according to Labour Force Survey data).

The jobs created as a result of public interventions are particularly at risk of becoming temporary. When investments are accumulating in a short period of time - many people are able to find work in the sector – often with incomplete set of skills (this issue is discussed in the next chapter). This is what happened in Germany, when the dynamic development of the PV technology in 2012 created jobs for more than 100 thousand people: mostly working at the construction of new photovoltaic plants. Nevertheless, the number dropped twofold next year already due to the limiting of investment caused mainly by the unexpected cut in the PV energy objectives (BMWi 2014, cf. Chart). Instability is one of the arguments against green jobs raised by Alvarez et al. (2009). For this situation not to repeat itself in Poland, green transformation must be made a transparent, strategic programme, planned for decades ahead. Then a proper arrangement of investments over time would smooth out labour demand, allowing labour market participants to gain or update their skills.

## SAFETY OF GREEN JOBS

The existing statistical data does not enable to formulate unambiguous conclusions concerning the safety of green jobs. On the one hand, energy recovery from crude oil and coal remains much less safe than from any other environment-friendly sources. The highest risk of a fatal accident is connected with work in crude oil plants; there are 36 such accidents for every 1 TWh delivered by the power plants in the EU. Coal power is regarded as slightly safer (25 deaths for 1 TWh for hard coal and 18 for brown coal). This, however, is incomparably more than in the case of hydroelectric, nuclear and wind power plants. Fatal accidents rate per terawatt hour does not exceed 1 there.

However when focusing on illnesses and accidents in green jobs, this picture is not that positive. In view of the statistics on the American economy, most of the branches are characterised by lower level of safety than the average.[14] The work in waste management and land rehabilitation sectors, with the greatest share of green collars (86.6% in 2013), is connected with significantly higher risk as compared to the average – the rate of diseases and accidents per 100 workers was equal to 5.4, while on average it doesn't exceed 4. Against this backdrop, branches contributing as much to improvement of environmental quality, such as: basic metal processing (6.2), supply of utilities (5.8) or transport (5.1), score only slightly better. In case of other branches, exposure, morbidity and accident rates fluctuate around the average value in the economy.

The adequate training of employees can reduce some of the risks in the workplace. A bad example is Australia, where the unemployed were hired to work in a wide programme of thermal

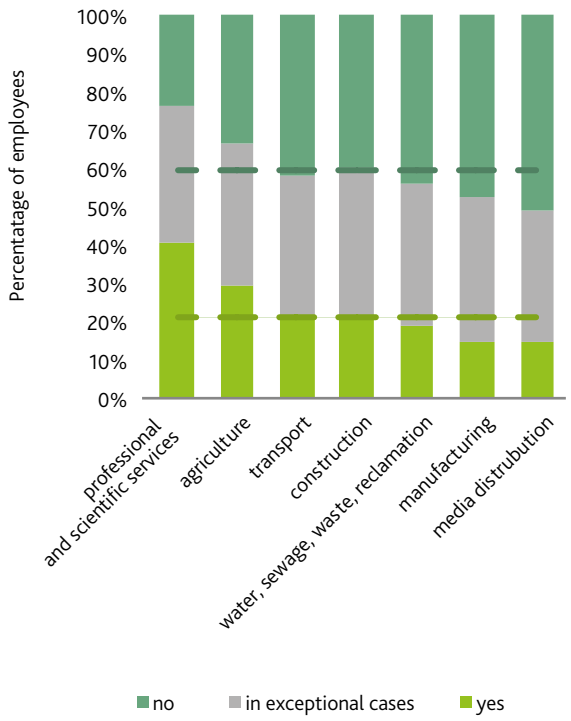
14 The optimal exercise would be to compare the safety of a job position with its traditional, brown counterpart. There are no adequate data.

upgrading of buildings under the anti-crisis package. As a result of inadequate training, 4 fatal accidents were noted as well as several hundred of situations when human life was put at risk (including approximately 200 fires) – all of which directly contributed to the suspension of the programme (ANAO 2010). Some dangers are a permanent element in the green jobs landscape, even though they don't have to materialize. Such is the case of organic farming, characterised by high labour intensity requiring physical prowess – it is possible that negative health consequences of such work (if at all) will occur after a longer period of time. On the other hand, one cannot assuredly exclude the possibility that such job might be less harmful than occupations that need to be performed sitting at all times.

### FLEXIBILITY

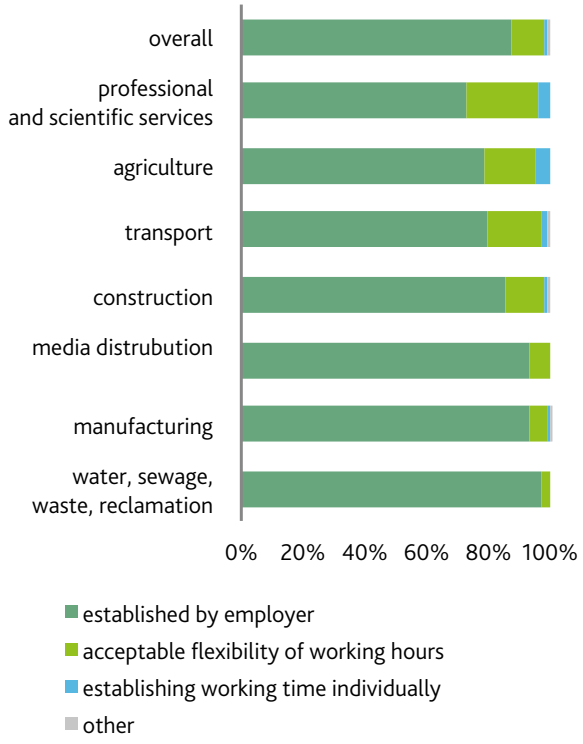
Polish labour market is dominated by working time rigidity - according to GUS, 88% of the employed work according to the schedule imposed by the employer. Every tenth employee has

Figure III.19. **The possibility to change working hours due to family responsibilities in Poland; 2010**




*Source: GUS 2012*

Figure III.20. **The organisation of working time in Poland; 2010**




*Source: GUS 2012*

**Box III.5. Quality and safety of green jobs in waste management sector**

The hypothesis concerning strong variations of the standard of work within green sectors is confirmed by the interlocutors in personal interviews. In case of waste management sector the highest quality of work is a feature of the supervisory staff, which is required to be adequately educated and experienced. Relatively high requirements concerning the skills and certifications for handling the equipment imposed on the machine operators, result in the fact that they can feel relatively safe at their positions and they work on the basis of employment contracts. The situation of manual workers seems to be much worse. Their working conditions are much more severe and the salaries are below the average. The companies are mitigating the health risk through vaccinations, protective clothing and OSH trainings, and also they try to improve the working conditions, including among other things, investing in new equipment, however the rotation of manual workers is sometimes considerable, especially if they are hired on the basis of contracts for a definite period of time.

Despite the bad opinion about the industry, below-average salaries and lack of in-work benefits, none of the two surveyed companies declare problems with finding workers. This is caused by high unemployment on regional labour markets of the Zachodniopomorskie and Subcarpathian provinces (voivodeships), which is why the availability of the potential labour force is high.

*Source: own elaboration based on individual interview*

a certain quota to reach daily or monthly, but the beginning and end may be set by themselves, and 2% of the employees may set their working hours by themselves (cf. Figure III.20). Although the employers make their approach more flexible in case of family responsibilities, 40% of Poles have mandatory (fixed) working hours. Few green industries are characterized by higher flexibility. Professional and scientific activity is one of the exceptions (27% of employees may set their working hours or working time). In other types of business activity this freedom is much more limited. This particularly refers to the sectors dealing with the generation and supply of electricity, water and gas, where less than half of the employees may change their working hours due to their family responsibilities, and those concerned with water supply, waste and sewage management, and land rehabilitation, where 94% of the employees have their working hours and working time determined in advance (GUS *[Central Statistical Office; CSO]* 2012). These results must be interpreted with caution – the industry breakdown only partly reflects the division between green and brown jobs, and job flexibility on a given position, similarly to earnings, will be associated with one's responsibilities.

## 2.4 CONSEQUENCES OF GREENING THE ECONOMY FOR THE LABOUR MARKET

### 2.4.1 SUBSTITUTION OR COMPLEMENTARITY?

Green investments positively influence the quality of life through the improvement of environmental quality. Low-emission sources of electricity and heat (especially distributed) lower the level of the suspended particulates emission, and the electric and hybrid vehicles, apart from lower emissions, generate less noise. The change on the labour market will not be unconditional. The transformation towards the resource-efficient economy or the economy based on renewable energy gives a chance to the entities that are able to adapt quickly to the new conditions. However there will always be groups that will feel threatened by such change (cf. the Luddites described in part 4 of the report) and thus they will defend the ineffective *status quo*. We deal with such case with respect to the low-emission transformation as well – decreasing the share of dirty energy based on non-renewable sources may be seen as a threat to the existence of „brown" professions in the meaning they had so far, especially miners or steelmakers.

The gross effect of the green transformation, i.e. limited solely to the new jobs created by the development of the green branches of economy will certainly be positive, but its strength will depend on the state's policy – mainly with respect to supporting the new, resource-efficient technologies and including them in long-term development strategies. The place of companies in the value chain and the demand for labour and qualifications connected with them will depend, among other things, on these decisions. Clear and long-term plans for restructuring and modernisation of the economy, which will be accompanied by a sensible policy of acquiring and updating qualifications, are preconditions for the green transformation (which will be discussed in Chapter 3). Its success will be reflected also in the labour market, expressed in a positive net number of jobs.

The changes on the labour market may be classified into 4 categories (EC 2011):

1. Employment substitution – development of new sectors may result in layoffs in traditional energy-intensive sectors,
2. Elimination of tasks – some jobs may be eliminated due to a complete change of some of the technologies (e.g. particular types of packaging),
3. Change in the nature of employment – many currently existing professions will require the acquisition of new skills, necessary to perform the work (this refers mainly to construction workers and plumbers),
4. Employment creation - new jobs will be created in new plants producing environment-friendly products and in the services used to handle them.

It is worth bearing in mind that creating the jobs will take place not only in the new sectors. The second order effects will also occur: the jobs created by the suppliers and affiliates of green plants, but also in others fields of economy, through the demand reported by the employees of both categories. The importance of indirect or induced channel will increase in the areas where the development of energy production based on renewable sources will become a significant stimulus to the development of the region and owing to the growth of the purchasing power of the inhabitants. Additional jobs will usually not be green but they will become one of the positive externalities of the investments in the environmental quality improvement (Wei et al. 2009).

### 2.4.2 NET EFFECT ON THE LABOUR MARKET

In the literature the impact of the greening of the economy on the number of jobs, especially in the final view (net), is a subject of many discussions and disputes (cf. Table III.2). The findings of the studies are divided nearly equally between the negative and positive effects. Most optimistic are estimates presented in the Greenpeace report (2009). They indicate that by 2030 the modernisation of the energy production and support for the use of renewable sources will allow to create 2.5 million more jobs worldwide than in the reference scenario[15]. Meanwhile, in the pessimistic scenarios provided by Alvarez et al. (2009) it is calculated that an average new green job leads to more than two traditional ones being destroyed.

15 Reference scenario: 11.3 trillion dollars investments, 42% in RSE, another 40% in fossil fuels; alternative scenario: investments at the level of 15 trillion dollars globally, 62% in RSE.

In many reports the effect size is conditioned on a range of assumptions: Lehr et al. (2012) use the German example and Lavecchia and Stagnaro (2010) use the Danish case to emphasise the role of technology exports, especially in the longer run (see the Box). Other assumptions include limited changes in energy prices (Ragwitz et al. 2009) or solving e.g. labour market inefficiencies (world Bank 2012). In this context green jobs cannot substitute, but rather complement policies supporting employment. As Babiker and Eckhaus (2006) emphasise, labour market policies may constitute an important part of the green transformation – although in their analyses the impact on the labour market is negative, but after applying appropriate policy tools (e.g. subsidising salaries) it may be mitigated.

Eventually, difficulties with estimating the number of green jobs are caused by:

- difficulties in distinguishing the green jobs from traditional ones, which due to the market reality had to be greened (Gulen, 2011). For example, the position of an energy--efficient hybrid bus driver may be created, but it is also possible that the work will simply be performed by the current driver of a traditional vehicle.
- erroneous assumptions concerning the steadily growing number of temporary jobs, for example assembling renewable energy installations. It may drop due to the professionalisation of the temporary workers or government incentives (USA, Spain) to create permanent jobs.
- opportunity cost – it is very hard to estimate whether the amount of money intended for green investments was spent in the best possible manner. For example, the construction of a waste incineration plant will result in the creation of new jobs, but it is possible that spending the same amount on a completely different investment, for example on public communication, could create even more jobs.

More complex conclusions are delivered by general equilibrium models that estimate the impact of the current policies (here: concerning energy and climate) as compared to the reference scenario (BAU), assuming the continuation of long-term trends. In WISE's *Low-emission Poland* project (calculations based on dynamic MEMO2 model), as well as in the assumptions to the *Resource-effective European Union* (Bukowski (ed.) 2013; EC 2011), negative impacts on total employment occur during the first few periods the green transformation begins. The negative effect is caused by the mobilisation of capital necessary to

Table III. 2. **The impact of green jobs on net employment in the source literature**

| country | Net impact on jobs | the scope of impact | authors |
|---|---|---|---|
| Spain | negative | Creating 1 green job results in the destruction of 2.2 jobs on average. | Alvarez et al. (2009) |
| generally | negative | | Gulen (2011) |
| USA | negative | | Michels, Murphy (2009) |
| UK | negative;<br>additionally: creation of unproductive jobs | | Hughes (2011) |
| Italy, comparison: Germany, Denmark | negative,<br>possible positive impact for the technology exporters | The amount needed to create 1 job will be enough to create 4.8-6.9 jobs in other sectors. | Lavecchia and Stagnaro (2010) |
| Poland | Initially negative, then positive | The destruction of 40 000 jobs in 2016-2020; additional 71 000 in 2012-2025 as compared to the reference scenario. | Bukowski (ed.) 2013 |
| EU | positive (to a minor degree, the estimation refers to RSE) | | Ragwitz (2009) |
| generally | positive provided that the growth of energy prices is limited (RSE) | | Ragwitz et al. (2009) |
| globally | positive, provided that there are favourable reforms on the labour market | | World Bank (2012) |
| Germany | positive, provided that there is an export of technologies | | Lehr et al. (2012) |
| generally | positive | | EC 2011 |
| USA | positive | USD 1 million is enough to create 16.7 jobs in green energy or 5.3 in traditional one | Pollin et al. (2009) |
| globally, Poland | positive | Environment-friendly investments may create additional 2.5 million of jobs until 2030 in energy sector globally, and in Poland – 190 000 | Greenpeace (2009), Greenpeace (2011) |

*Source: own elaboration.*

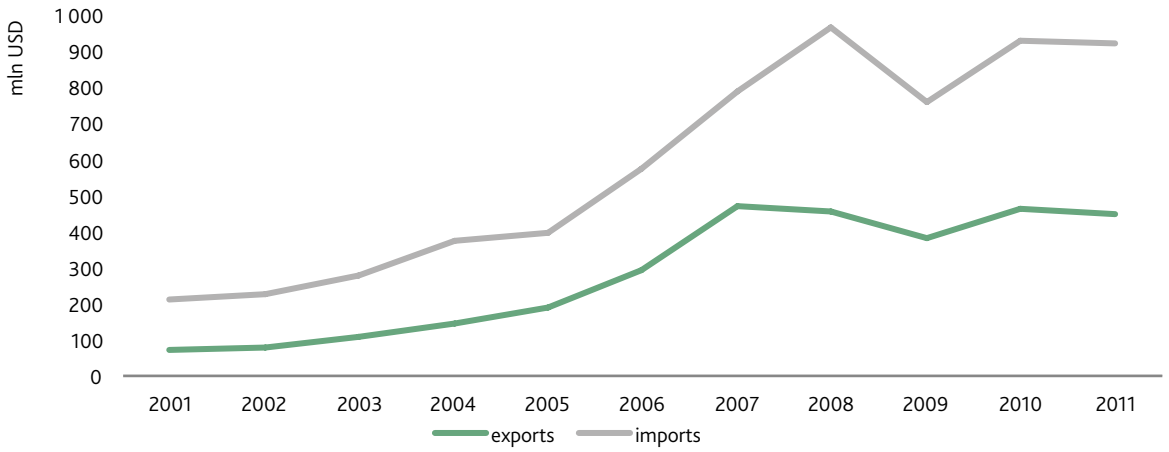
## Box III. 6 Exports of energy-related technologies

The greening of the economy benefits the environment, while offering tangible economic and social gains, of which most notable are healthier surroundings or high-quality green jobs. Although in the long run resource scarcity or technological solutions to this challenge will be of utmost importance to global demand for green goods, the short run prospects of green job numbers will be dominated by one's competitiveness on the green goods market. In other words, growing domestic demand can be additionally boosted by green technology exports. Countries, where the potential of technologies had been promptly noticed and their applications immediately developed, became net exporters of technology, thereby increasing the supply of green jobs. Such was the road German renewable energy industry took.

The situation on the market for energy technologies is unusually dynamic. Keeping one's competitive advantage is becoming increasingly difficult, because technology diffusion has never been so fast, thanks to globalization. This phenomenon is well illustrated by geographical shifts in solar panel production. Until recently, the UE has been its biggest producer. Now, however, after an almost decade-long transformation global leadership was passed on to China. The Middle Kingdom's increasing interest in green technologies (growth rates reaching 80% per annum) could lead to a situation when the country becomes not only the biggest producer of equipment but also a technology exporter. For China, this offers an opportunity to stop being perceived as a cheap manufacturer only and gain the reputation of an innovator (EC 2011).

Poland, despite its industrial base, fares poorly in international trade of environmental protection goods. Despite significant PV exports and specialization in offshore wind farm construction, small domestic market leads to a persistently negative, or even widening in recent years, foreign trade deficit (0.5 bn USD in 2011). To create a competitive advantage, one must first successfully identify areas of competition and mobilize its resources: capital and labour along with skills.

Figure III.21. **Exports and imports of goods related to environmental protection in Poland; 2001-2011**




*Source: own elaboration based on UN Comtrade, commodity codes according to Ecorys (2012)*

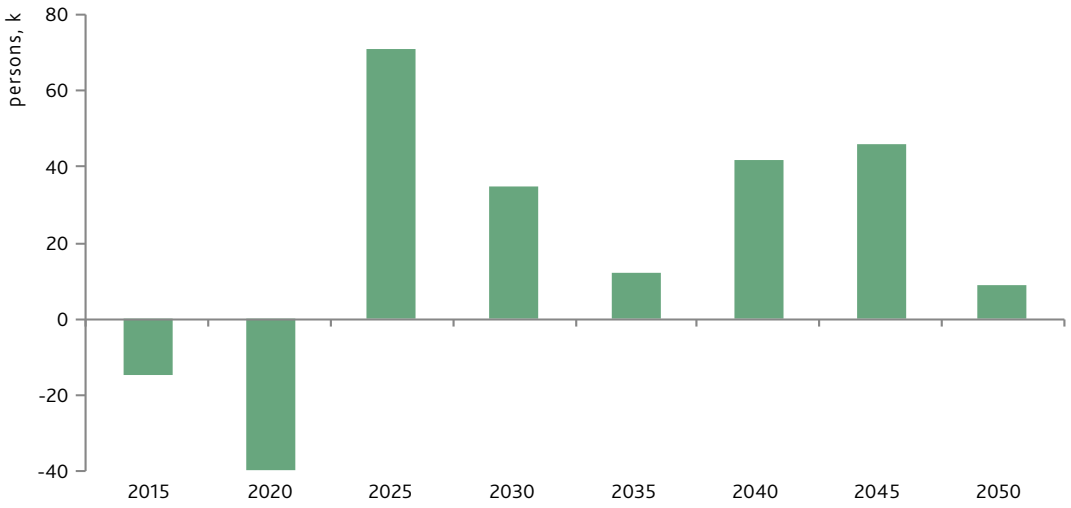
*Source: own elaboration based on personal interviews.*

carry out the investments at the cost of jobs. However, the situation changes after 2020, when investments are financed and productivity rises, (Figure III.22). The low scale of additional employment is a result of increased labour demand being absorbed through higher salaries. Minor changes in employment are accompanied by increase in welfare, because unchanged working time allows for a higher level of consumption.

Expenditures on raising energy efficiency impact GDP in the long run and, in consequence, employment in the whole economy, not only in green sectors. These changes occur both during the implementation of the investment (when initial expenses are borne), as well as later – as a result of boosting productivity in the economy. In case of some investments (e.g. in energy efficiency of buildings), the savings appearing in the long term can be spent by households on, among other things, current consumption which will positively impact GDP.

For example, to establish a waste incineration plant requires hiring a certain number of persons for its construction, and later it requires permanent and temporary employees. However, an operational waste incineration plant decreases demand on workers in the local landfill, and the expenses incurred on the investment could be spent in an alternative manner, also contributing to job creation. These kinds of dependencies are invisible in the micro scale and that is why the macroeconomic model covering the whole economy is needed for their estimation.

Figure III.22. **The impact of the low-emission modernisation on employment in Poland compared to the reference scenario; 2015-2050**




*Source: own elaboration based on Bukowski (ed.) 2013*

Figure III.23. **The impact of the whole package of investments on the employment with different variants of state reaction, CCS scenario**

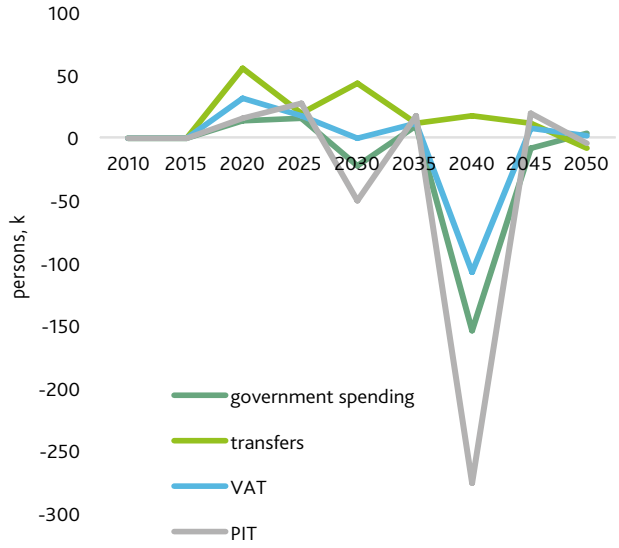
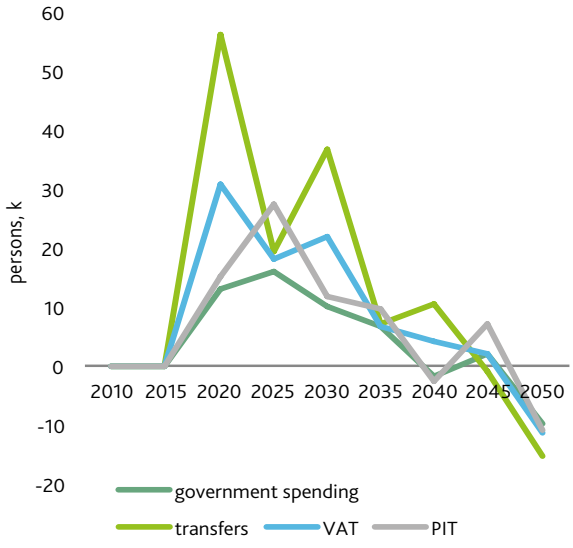



Figure III.24. **The impact of the investment on the employment with different variants of state reaction, no-CCS scenario**




*Source: own elaboration based on MEMO2 model estimates*

The impact of these expenses on GDP and employment can be assesses owing to a multi-sector model of DSGE class[16]. The MEMO2 model allows to estimate changes in employment and product in subsequent periods, up until 2050, caused by a reforms package or single interventions carried out at a given time. However, one should remember that the number of jobs depend on the scale of investment: for example, the more buildings are insulated, the higher the demand on the fitters performing this kind of work. The scale of indirect effects will then increase as well. The results presented below should be interpreted as a number of jobs, provided that the intervention is carried out on a certain scale. The model estimates the intervention-induced change relative to a reference scenario, in which the lack of intervention and certain structural changes are assumed[17]. Finally, the additional number of jobs in a given year is a difference between total employment in the intervention scenario and BAU.

16 Dynamic stochastic general equilibrium

17 The growth of the employment ratio to approx. 70% and a decline in the population from 2020 to 35 million in 2050, as well as decreasing GDP dynamics

The impact of the interventions depends on their type and duration, but also on the government's actions: since public expenditures and revenues will be changing as a result of investment, the government will be adjusting its budget by changing tax rates, public expenditures or transfers. Assumptions regarding the cost of technologies which cannot be precisely assessed well in advance are also important. Thus, the CCS technology, which according to the findings of the model is not much profitable, may prove more beneficial if there is a technological breakthrough. The final impact on the jobs depends to a large extent on the financing path. As Figure III.23 presents, total impact of the whole package on employment differs significantly depending on the type of adjustment. The greatest differences occur in 2040 – then, in the scenario when the whole package is implemented, the expenses on industrial CCS

Figure III.25. The impact of the investments on the employment within respective areas, scenario with CCS

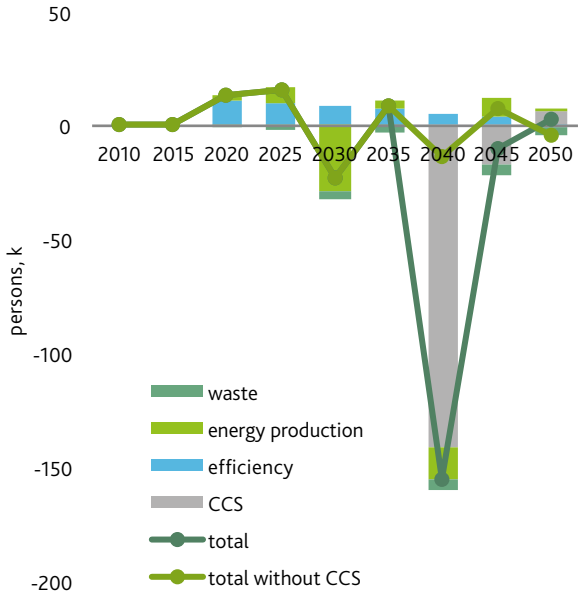
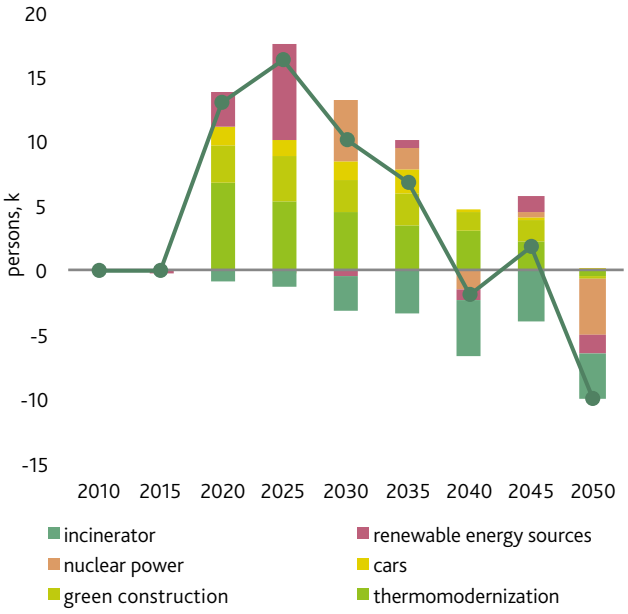



Figure III.26. The impact of the investments on the employment within respective areas, scenario without CCS




*Source: own elaboration based on the MEMO2 model estimates*

*Note: The intervention package in MEMO2 model in modernization scenario is described in the Appendix*

Figure III.27. The impact of the whole investment package on the GDP with different variants of government's reaction, CCS scenario

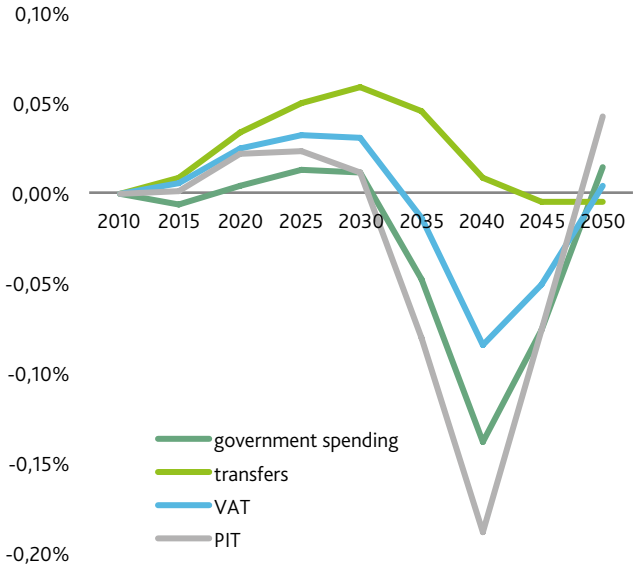
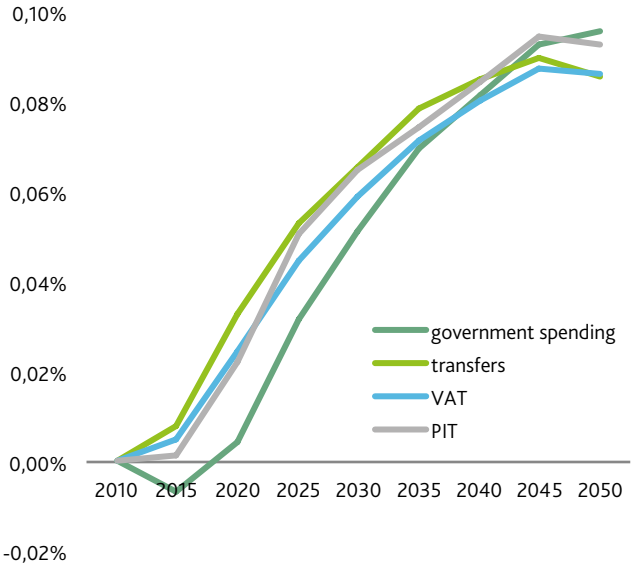



Figure III.28. The impact of the investments on GDP with different variants of the government's reaction, no-CCS scenario




*Source: own elaboration based on WISE MEMO2 model estimates*

technology will be incurred. To a large extent, these are responsible for the negative net employment. The adjustment through the transfer channel is the most favourable from the point of view of the labour market, and the changes in labour taxation, i.e. personal income tax, are said to be the least favourable choice. This kind of result is compatible with the economic expertise: limiting social transfers that have a disincentive effect should influence employment much strongly than increasing labour taxation. In a scenario where not very profitable CCS (both in industry and energy sector), we obtain more comparable results. Here the adjustment through transfers is the most favourable one for job creation.

Interventions in the model are grouped into four areas:

1. CCS in the industry, i.e. in steelworks, refineries, cement factories and in the production of ammonia,
2. efficiency, including the thermal upgrading of buildings, new energy-efficient buildings, fuel-efficient passenger cars and hybrid cars,
3. Energy: nuclear, wind (onshore and offshore), distributed PV and coal with CCS,
4. waste sector: construction of waste incineration plants.

Industrial CCS, despite the limited assumed scale of intervention (one system for each type of plant), has a strong, negative impact on GDP (regardless of the way the state budget is adjusted) and employment, with the exception of adjustment through transfers. This happens because of high cost of investment and the fact that this technology does not create any savings and only reduces emissions (the essence of CCS technology is presented in Box III.7). A clear and negative effect is seen in 2040 – this is when the scenario assumes CCS costs to be incurred.

Figure III.26. presents the scenario where CCS in industry and energy sectors is excluded from the reform package, while it is assumed that the government will be adjusting the budget through change of the expenditures. Employment in 2020-2035 is higher by several thousand in comparison to BAU. Generally, the proposed package will create 16 000 new jobs in the peak year 2025. They will primarily be created due to support for energy-efficiency of buildings, enewable and nuclear energy. Thermal upgrading of buildings and new energy-efficient buildings have a permanent and positive impact, and the investments in renewable energy sources cause a one-off increase only around 2025. Construction of a nuclear plant around 2030 will create nearly 5 000 jobs during its construction, however, after it is finished nuclear energy will negatively influence the total number of jobs. Investing in waste incineration plants during the

**Box III.7. Clean coal technologies**

Coal is the most common energy source in the world. Its emissivity is a disadvantage as it leads to undesirable climate change. It is one of the reasons of the intensive work on the so called "clean coal technologies", which would allow to recover energy from coal and at the same time significantly reduce emissions of carbon dioxide, sulphur,nitrogen oxides, and particulates.

*CCS*

Carbon capture and storage is a technology aiming at significant reduction of carbon dioxide emissions to the atmosphere. It may be applied both in the energy sector and in industry. The technology consists in capturing the emitted gas and injecting it to a leak-proof reservoir. There are different variants of this technology: capturing may occur before or after incineration, and the storage should consist in placing $CO_2$ underground, in proper geological formations (Haszeldine 2009).

Currently CCS technologies are at the experimental stage. Until now their commercialisation was not successful and they function only in experimental installations. The potential barrier to their development is the high cost of the technology and, additionally, the decline in the performance of the installations. In Great Britain it is planned that until 2030 there will be CCS-upgraded power plants with the total capacity of 12 000 MW. At the same time, two projects in Poland were abandoned for economic reasons (Szczepański and Derski 2014). This decision is compatible with the findings of the *Low-emission Poland 2050* report, which indicates that among different technologies of emission reduction, CCS is characterised by the lowest cost-benefit balance and decreases the savings from the reform package by EUR 8.9 billion in 2050 (Bukowski (ed.) 2013).

On the other hand, the development of the technology may cause significant reductions in CCS costs in the future. CCS may prove to be needed for political reasons. It is always connected with coal, of which Polish politicians are very supportive. Moreover, it may help in implementing EU climate targets. Due to the fact that MEMO model does not take into consideration the ETS emissions trading scheme, the additional, but here invisible advantage is the reduction of ETS charges unfavourable for the economy.

*Clean coal technologies*

Another technology allowing for a significant reduction of carbon intensity is IGCC (*integrated gasification combined cycle)* –. It consists in gasification and then purification of coal, and it also allows to control the incineration process or use chemical reductors, thereby helping to reduce emissions. Many of these solutions are already used in power plants, for instance in the USA. New units currently under construction in Opole power plant on the basis of this technology will be characterised by $CO_2$ emissions lower by 25-30% as compared to old units.

*Source: own elaboration based on Haszeldine 2009 and on the materials from the Polish Ministry of Treasury*

whole studied period lowers employment. Introducing energy-efficient cars, including hybrid ones, will have a positive, but minor, impact on employment, not exceeding 2 000 persons on a national scale. The positive effect on employment will be maintained until 2035, and in 2050 it will drop below zero. This is a consequence of completing investments: the last ones in the scenario are in 2040.

As we have shown, the positive impact of CCS on the emissions is not associated with savings. Its introduction will not reduce the beneficiary impact of investments on Polish GDP, unless the state covers their cost by lowering transfers. On the other hand, the no-CCS scenario shows a definitely more favourable effect of the intervention: GDP will be higher than in the BAU scenario, and the difference will get bigger reaching almost 0.1% GDP in 2050. In this case the type of adjustment on the government's side is not important.

# 3 GREEN SKILLS

## 3.1 DELIVERING GREEN SKILLS

The emergence of new job types is associated with changes in demand for skills. The ICT revolution is a good example: in a few decades completely new jobs were created – ones that required new fields of teaching and complete makeovers of many existing ones. The situation of the green jobs is analogous. Its dynamic development will strongly impact declared demand for skills.

The literature identifies three channels through which the environment-friendly investments influence the demand for skills:

- decreasing labour demand in traditional, energy-intensive sector with simultaneous demand growth in green sectors,
- creating new jobs,
- changing traditional jobs into green ones,

while the third channel may have the greatest influence on the labour market (Bowen 2012).

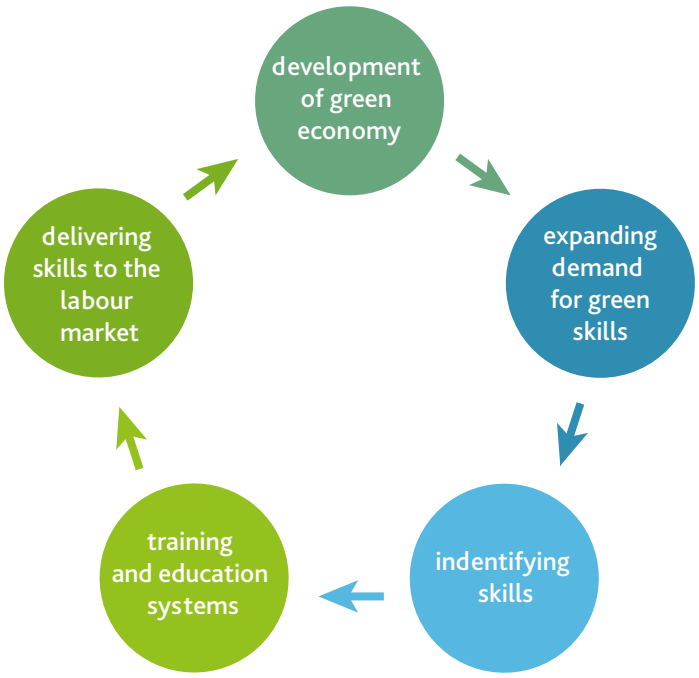
For the green transformation to progress without obstacles, signals of increased labour demand in green sectors must be accompanied by an analysis of skills required on vacant posts, and further on – by the verification of the extent, to which formal and informal education is capable of filling the identified skill gaps, and how. The procedure is presented on Diagram III.4. As one may infer from it, the supply of the so called green skills, i.e. qualifications required to adapt products, services or operations for the purpose of stopping further climate change, adapting to existing effects of climate change and complying with requirements and regulations associated with it, is a necessary condition of developing the green economy.

## 3.2 IDENTIFYING QUALIFICATIONS

From the perspective of labour market institutions, identifying skills consists in qualitative and quantitative assessment of the supply of workers necessary to fill vacancies in particular occupations, within a given timescale (shorter or longer). A thorough assessment of the structure allows for determining in which areas and to what extent we are struggling with the issue of skill gap. Abandoning such an analysis makes public intervention in the areas of labour market and education somewhat random or, at best, intuition-based.

Shortages of certain workers have been the green transformation's impediment to growth since the beginning, but the problem seems to be growing over time (UNEP 2008, ILO 2011), raising the costs of adjustment (Lavecchia and Stagnaro 2010). The sources of undershooting are different, from general ones, concerning (to a smaller or larger degree) the entire economy, such as underestimating growth rates of certain

Diagram III.4. **Process of supplying new skills to market**




*Source: Own elaboration based on ILO 2011*

sectors or a general shortage of engineers, to more specific, e.g. lack of trainers in areas critical for the development of the green economy. Particularly the latter is considered (OECD and Cedefop 2014) as one of the most important challenges of green growth, as efficient and precisely directed active labour market policies will be necessary to shift workers from brown to green jobs (Bowen 2012). Sometimes, however, the shortage is associated with the way an occupation is perceived – green jobs are commonly seen as "dirty", which can increase resistance against employment in this sector. Then, despite the fact that adequate skills are abundant on the market, vacancies remain unfilled.

Reviews of scarce green skills in the sectors of the economy are carried out or systematically (e.g. annually, like in RSA), *ad hoc* (Germany) or never. In light of Cedefop's report (2013), countries that implemented green stimulus packages in response to the economic crisis of 2008-09, have allocated little funds, or even none at all, to the identification of competences. However the problem lies on both sides of the labour market: with high likelihood employers do not properly signal demand for green skills, assuming that they will find them in the market when unemployment is high. Particularly small and medium-sized enterprises seem to be short-sighted when it comes to future needs of green skills and the impact of the regulations of their industry, which is why their investments in green trainings are very often limited (OECD 2012).

Against this backdrop, France offers good practice since it created a complex system of monitoring and forecasting the demand for skills on the labour market. A network of observers has been created within the system. The said observers conduct qualitative and macroeconomic analyses, as well as surveys on different levels of economy (ILO 2011):

- the entrepreneurial level – each enterprise employing more than 300 persons has to implement a human resources management system, which serves to plan the demand for skills and labour,

**Box III. 8. International examples of skill barriers in a green economy**

Green skill gaps are hampering the achievement of green economy goals - more environment-friendly and resource-efficient solutions – by preventing labour market benefits of green modernization to be fully exploited. It is not difficult to imagine that an insufficient number of mechanics will lower the total number of LPG installations in cars, while a shortage of fitters will limit the number of solar thermal and PV installations. It is worth noting, however, that a shortage of skilled workers could also contribute to a negative feedback: demand for PV panels will decrease with insufficient number of skilled technicians, because the price of their services will increase and waiting time will lengthen. In turn, low demand for panels will not encourage potential fitters to get training and employment, thereby creating a closed loop (CSIRO 2008). In construction, the skills and knowledge of technologies possessed by the contractors influences energy use (predominantly heat) in a building over several dozen or even over a hundred years. Perception of a job as temporary and low willingness to attain and update skills (especially in the area of innovative technologies) could therefore be a factor limiting the scale of green transformation.

For a few years skill barriers for the green economy have been hinted at in the literature:

- In 2007 the German renewable energy industry already suffered from the shortage of skilled workers, which – according to entrepreneurs – slowed down the development of the sector (Cedefop 2010b). The damage to the economy related to the skill gap was estimated at €3.3 bn (Cedefop 2012b)
- Insufficient supply of skills and training courses regarding micro-generation is a principal obstacle to the development of these technologies in Great Britain (GHK 2009).
- China introduced a rural electrification programme based on renewable energy: PV, small hydroelectric and wind plants. However, the shortage of skilled electricians is a barrier to its development or even maintenance (World Bank 2012).
- The reputation of PV panels was destroyed in Canada as a result of a lack of skills among the fitters in 1970-1980 (ILO 2011).
- The programme of house insulation, introduced in Australia in 2009, despite initial interest far exceeding supply, collapsed in a short period of time, when a third of investments turned out to be performed faulty as a result of too low skills of the employed, their insufficient training and bad management.

Also in Poland the lack of necessary skills is becoming an obstacle to green modernization in some sectors. In 2009, 29% of Polish manufacturers of environmental technologies reported staff shortages as a barrier to development (GreenEvo 2010). The case of nuclear power plane (we elaborate in that issue in Box III.9) revealed an extreme example of this deficit. This diagnosis is confirmed by the monitoring of scarce and abundant occupations: among 50 most scarce occupations in 2012 in Poland we can find e.g. thermal insulation fitters (the number of job offers exceeded the potential number of employees by 800) and ecological teacher (9 job offers per every unemployed) (The Ministry of Labour and Social Policy 2013).

*Source: own elaboration*

- the level of sectors – each sector has to maintain an observatory of forecasts regarding employment and training,
- the regional level – at the level of regions there are many different institutions that are supposed to identify the demand for trainings and employment; in the context of green tasks those are regional observatories that play an important role in forecasting the skills,
- the central level – at the national level there is a planning commission, which carries out studies measuring the development of qualifications, and new standards of qualifications are established at the governmental (ministerial) level together with their modifications, so that they conform to the requirements of the labour market insofar as possible.

In this case inclusion of many perspectives has its merits, however, the benefits may not be fully used due to the lack of coherence, duplication of competences at various levels and problems with information exchange (ILO 2011). Additional obstacles are created by a licensing system of professions. The qualifications necessary to obtain the license are established at the ministerial level, which prolongs the process considerably, often foregoing benefits from precise and early planning of demand for. The example of this kind of ineffectiveness was the 3-year period of modification of the electrician license covering the renewable energy (Cedefop 2010c).

A multi-layered system is also present in Great Britain. However, contrary to France, focus is put on incentivising the private sector to launch own initiatives rather than encouraging to subscribe one's activity to strategic priorities worked out by the public. The programme consists of the following (Musset and Field 2013):

- the central level – the Commission for Employment and Skills, directed by commissaries recruited from large and small entrepreneurs, trade unions and non-governmental organisations, whose strategic goals include (1) providing labour market analyses that would allow citizens and enterprises to make correct decisions, (2) cooperation with firms aimed at developing market-based solutions leading to higher investment in skills and (3) maximization the impacts of labour market and human capital policies. The Commission conducts e.g. annual audit of strategic skills, orders forecasts of labour market trends and finances private sector's projects,
- the level of sectors – a network of 19 independent, directed by employers, industry skill councils, covering 90% of British labour force. Each year, these bodies compete in the Commission for Employment and Skills for public financing for the development of new occupational standards and update to existing ones,
- the enterprise level – since 2012 there has been a pilot programme that offers companies an opportunity to compete for funds for the development of innovative training programmes, offered by the Commission for Employment and Skills.

An interesting solution is the Irish Skillnets programme, supervised by representatives of the relevant ministry, employers' and employees' organizations. It collects groups of companies and stakeholder on the level of regions or sectors, and helps to create training networks. Their members provide finance for activities serving to develop skills in a region or industry. Such an approach ensures the participation of entrepreneurs and social partners (ICK GHK 2014).

In Germany labour market information is disseminated on a continuing basis predominantly through the dual system of apprenticeship that divides learning between school-based and employer-based (ILO 2011). Occupational and employer organizations define the content of occupational exams and teaching programmes of vocational schools, which are encouraged to employee private sector employees as part-time teachers (Fazekas and Field 2013).

For a change, in Spain the integrated system of identifying the demand for skills was not established. Here, different market entities forecast the demand on their own. Public entities carry out studies and engage in a wide spectrum of initiatives, however the private sector rarely uses them – it usually conducts its own research or uses expert studies (ILO 2011).

In Poland voivodeship and county (poviat) employment agencies deal with identifying the demand for skills. In light of OECD's recommendations (2011), the regional level should in an optimal way perform identification and systematization of green skills. Unfortunately they possess only fragmentary data on job vacancies, which are reported to the agencies (10-20% of total vacancies) (Tyrowicz 2013). Moreover, the level of cooperation between these kinds of institutions is low, which impedes the assessment of labour force mobility nationwide. The monitoring of scarce and surplus professions conducted since 2005, based on the balance of the unemployed and new job offers inflow does not deliver useful conclusions because of a very short time scale. Thus, of all above mentioned European examples, the Spanish one is by far the closest to Polish reality: when information is imperfect, analyses and reports fill the gap. The Voivodeship Employment Agency in Białystok has taken up to explore the issue of green jobs. The project, entitled "Partnership for the development and promotion of green jobs", was co-financed from the Human Capital Operational Programme. The research report created as part of the project, whose recipients included, among others, representatives of county employment agencies, deals with the topic of green sector in Podlaskie voivodeship and attempts to analyze demand for relevant skills.

The territorial scope of the study is restricted to the Podlaskie voivodeship. Not everywhere is the level of awareness of the effects of green modernization so high. Interviews conducted by WISE indicate that there are places in Poland, where green investments are being developed fast, yet representatives of local labour market institutions have never heard of the phenomena such as green jobs or green skills. In such circumstances HR departments in enterprises can be a useful source of information

regarding the demand for skills (OECD 2011). Their perspective would be extraordinarily helpful if employers' conclusions were confronted with thoughts of representatives of labour market institutions. The room for improving the system if identifying and forecasting skills (green or otherwise) in demand on the labour market, is provided by the Knowledge Education Development Operational Programme (2014-2020). In light of its assumption, the process of identifying and forecasting professional needs is to be improved by creating new institutions: Programme Board and sector competence boards, which are supposed to cooperate with entrepreneurs in order to estimate the demand for specific professions. This will allow for the educational system to significantly adjust to new trends in the economy, in particular – the green modernization.

### 3.2.1 GREEN SKILLS

The demand for green skills need not herald a revolution in the areas of education and labour market. In this vein Martinez-Fernandez et al. (2010) indicate that the green transformation will create demand for knowledge and qualifications previously unknown (which should be a incentive to develop rare areas, such as e.g. as the knowledge of materials, or the ability to assess carbon footprint or environmental impact), however, such jobs will draw on from the skills already present on the labour market. This means that there is a necessity to deliver to the market an increasing number of people with traditional qualifications, e.g. engineers, who will be employed in newly created professions thanks to modular training (ILO 2011) or training within the enterprises.

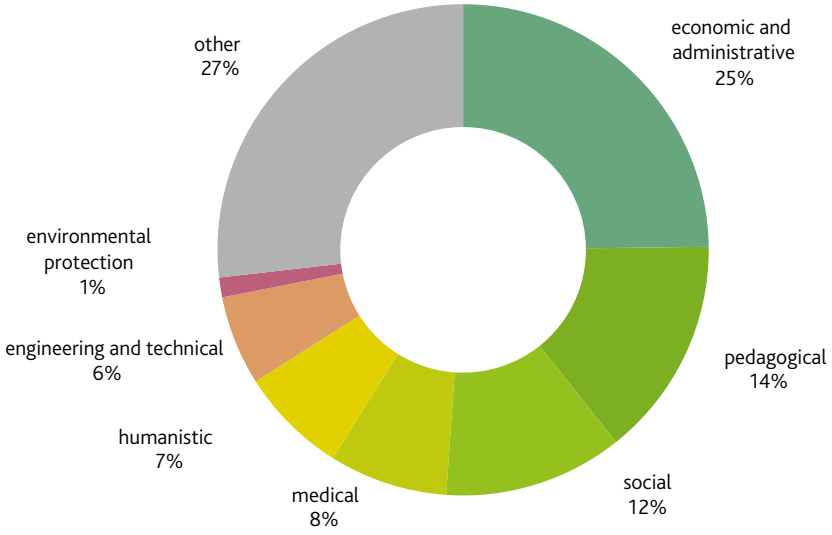
Technological innovations, which have a special role in low-emission transformation, typically require advanced scientific skills, sometimes collectively called STEM (science, technology, engineering, mathematics) (ILO 2011): the ability to think logically, to process data and find relationships, to identify problems, deconstruct and solve them (Bowen 2012). These are highly priced skills, especially in the face of a deficit in science and engineering graduates. In the academic year 2012/2013 they constituted only 6% of all graduates of Polish universities , but we are not an exception in Europe in this respect.

The shortage of science and engineering graduates was revealed during the construction of the first Polish nuclear power plant (Box III.9), although – as it is easy to notice – developing a unit also requires business and management tasks (or from the area of HR), as well as maintenance and security work on the structure (C.f. Graph III.30). Because of that entrepreneurs, when asked about green skills, did not limit themselves to STEM qualifications. The long list of expectations included skills obvious today, such as knowledge of foreign languages and use of computer, but also: management skills (strategic, marketing or risk analysis), psychological skills (communication and negotiation), personal predispositions (entrepreneurship, adaptability, interdisciplinarity) and general awareness of the environment and sustainable development (ILO 2011).

Apart from STEM skills, reports from OECD, Cedefop (2014) and ILO (2011) emphasize that as tasks and industries converge to each other, the need for an interdisciplinary approach increases, since working out solutions to new problems demands a systemic thinking: the increasing complexity of ecological innovations might require understanding the process on many levels and still treating it as a coherent whole. Because of that even managerial staff might require technical knowledge. Thus, the recommendations from the reports strongly highlight the issue of interdisciplinarity in teaching green skills on all levels. This might take the form of modular training on different faculties.

The example of Build up Skills programme, active in 20 EU countries, can attest to how wide the spectrum of skills required be

Figure III.29. **Graduates according to the faculties in the academic year 2012/2013**




*Source: own elaboration based on GUS 2013b*

## Box III.9. Green jobs in nuclear energy

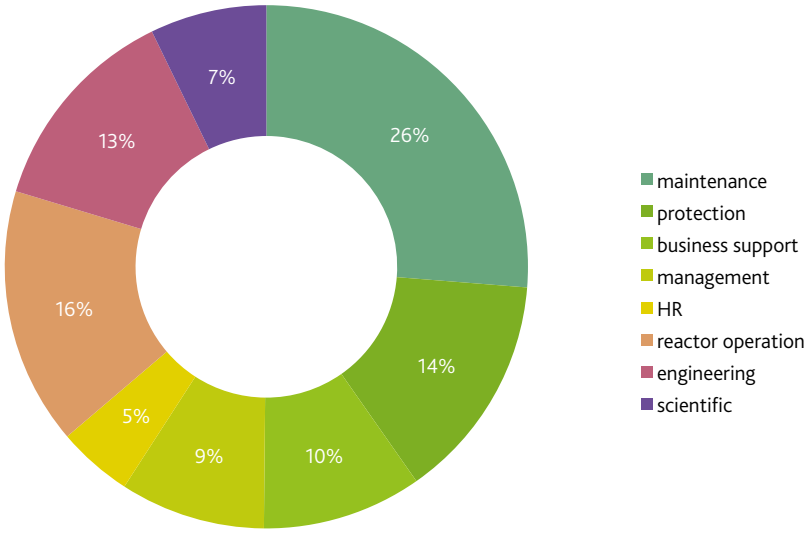
In the literature there is no agreement whether working in nuclear energy can be considered green. Proponents of including nuclear into the classification are, among others, Global Insight (2008), Cedefop (2010a) and The Brookings Institution (2011). However, there is no shortage of opponents of this notion. In their view, nuclear energy – due to its potential danger to health, environment and safety – cannot be a part of the green jobs classification (UNEP (2008), also Bowen (2012) and Greenpeace (2009)). In our view, because of high externalities of current energy sector based on traditional coal power, jobs in nuclear energy in Poland will be attractive, durable and safe, while their low emissivity will contribute to increasing the quality of the natural environment.

It is especially worth looking into in light of plans to build the first nuclear power plant in Poland. The first unit with the capacity of 1500 MW is scheduled to be constructed in 2019-2024 and two power plants with total capacity of 6GW should be operational by 2035 (MG 2014). A power plant of that type was under construction in the 1980s but the construction was put on hold due to popular protests. The reactor that was supposed to be installed in that plant, is still operational in Finland.

Building and operating a nuclear power plant will create jobs for many professions: technicians, engineers and specialists. Construction of one unit requires employing 3-4 thousand people and the staff will include workers, architects and engineers. Polish enterprises have little experience in that area and specialists employed in the Żarnowiec project are nearing retirement (MG 2014). Once the power plant is operational, around 700 people will be employed in one unit, or 1000 in two. Not only will they be specialists and scientists, but also people of completely different educational profile and skills, i.e. managerial staff or security (IAEA 2011, c.f. Graph III.30). Taking into consideration the government's plans to build two power plants (two units each), this translates into ca. 2000 new permanent jobs by 2035 (MG 2014). Today there is a lack of properly trained staff in Poland.

In recent years Warsaw University launched a new faculty, Nuclear Energy and Chemistry, directly related to the planned construction of nuclear power plants. In addition, most technical universities have faculties and specializations connected with nuclear energy, but apart from theoretical knowledge, practical experience is also relevant. For that purpose, Poland intends to cooperate with technology suppliers, international institutions and countries that have their own advanced nuclear programmes. Agreements with four countries have already been signed.

Figure III.30. **Occupational structure of jobs at a power plant (2 units)**




*Source: own elaboration based on IAEA 2011*

Some experience can be drawn from the National Centre for Nuclear Research, where the country's only experimental nuclear reactor (named Maria) is in operation, and where over 1000 people are currently employed. The area of research includes nuclear physics, studies on nuclear fuel and on the safety of said installations. In the Polish nuclear programme the Centre will play an important role of organizing technical support. The Centre also conducts research in particle physics as part of cooperation with CERN and produces isotopes used for cancer treatment in Poland and worldwide.

*Source: own elaboration based on materials provided by the Warsaw University and the National Centre for Nuclear Research*

## Box III.10. Green jobs in FMCG sector in Poland

P&G (Procter & Gamble) is a corporation with a global outreach, founded in the United States in the first half of the 20th century. Today it is present in almost every country in the world, and P&G products are bought by 5 billion people every day. Poland is an important country on the P&G activity map, both with respect to production, as well as to the market. There are 4 factories and 3 offices here, and a Distribution Centre, and many products are leaders in their product categories.

In 2007 P&G adopted a sustainable development strategy at a global level to mitigate the impact of the company's activity on the environment. The first phase of the strategy implementation was completed in 2012. All stages of the company's activity were covered by the programme, from design, through production process, distribution and waste management, to the improvement of energy efficiency and the reduction of paper consumption in offices. Next phase of the strategy implementation until 2020 assumes, among other things, increasing the share of the RSE energy and further reduction of the number of transports. 2 activities deserve special attention- the reduction of energy intensity of the production and elimination of untreated waste.

**The decrease of the energy intensity of production**

Energy is an essential factor in the production – it not only supplies power to the machines, but also maintains appropriate temperature and lighting, and it also cools the castings. Even though the activity developed considerably, which was reflected in the production growth by nearly 50%,; the energy intensity per production unit decreased by 20%. It translates into lower greenhouse gas emissions into the atmosphere – in a fiscal year 2012/2013 total $CO_2$ emissions were reduced by approximately 54,700. This would not be possible without undertaking numerous actions – among other things, the free cooling technology, modernisation of the chilled water system, machinery operation optimization and energy-efficient lighting (LED).

**Elimination of untreated waste**

Poland is a second country in the world with at least two P&G factories, in which all the production units and P&G distribution centre obtained the *zero waste going to landfill* status. This does not refer to production waste only, but also to the leftovers from the canteens. To obtain this status many actions were undertaken, including the retrieval of raw materials at the production sites, processing of raw materials into everyday objects, waste water treatment in the cosmetics factory.

Figure III.31. **Production and energy intensity dynamics in P&G factories in Poland; 2008/2009 – 100%**

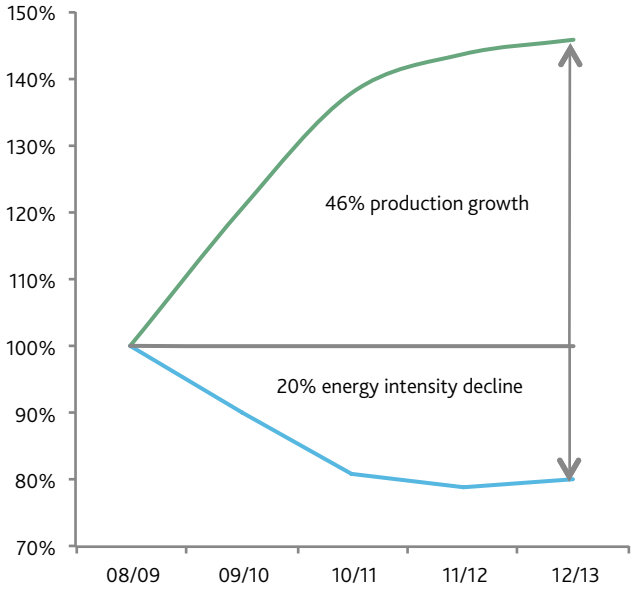
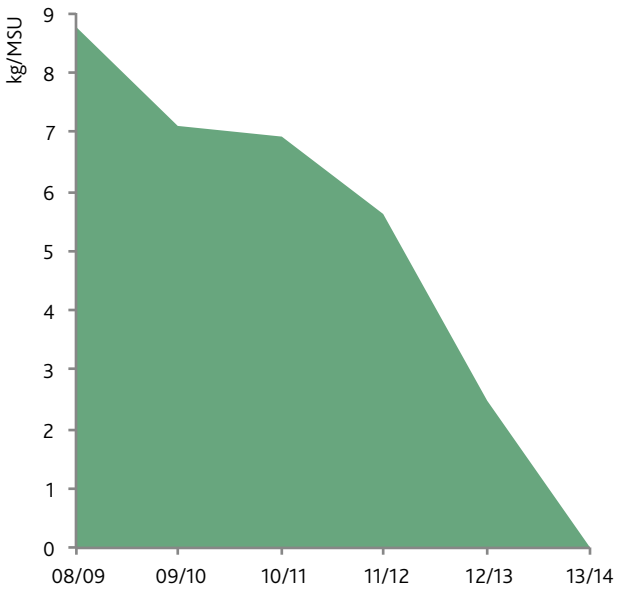



Figure III.32. **Untreated production waste in P&G units in Poland; 2008/2009-2013/2014**




*Source: own elaboration based on P&G data*

14 specialists control the everyday implementation of the sustainability strategy, and for three of them this is the main task. Their activity is focused on the reduction of water and electricity consumption, CO2 emission and waste production. Reduction targets are established by a global team. International cooperation is also an essential part of the exchange of ideas: the solutions used in some of the factories are re-applied in others, and the employees of the sustainability units all over the world participate in regular teleconferences. Apart from technical improvements of the processes and equipment modernisation, an important area of activity of these teams is building the environmental awareness among employees.

**Box III.10. cont. Green jobs in FMCG sector in Poland**

The majority of the employees in sustainability teams have finished postgraduate or engineering studies. Professional education is listed among desirable qualifications, and the skills include both, soft skills, such as engagement and openness to changes, and hard skills: engineering knowledge, project management skills and the knowledge of the environmental law. P&G representatives note that it is difficult to find the candidates with adequate qualifications and experience. Not only P&G employees are engaged in activities concerning sustainable development, but also external companies, to which more complicated projects are outsourced. There was no essential impact of the sustainability strategy on the total number of employees or the employment structure.

The example of Procter & Gamble corporation shows that green collars do not have to have large share in the labour force, but the results of their work cause considerable effectiveness, which is beneficial both for the company, and the environment. It is also worth to look at the holistic and international approach to the problem. The exchange of ideas and global targets limits the costs of the pro-environment actions and increases their effects. The fact that the impact of the specialist sustainability teams on the total number of employees was not observed, may indicate that in a microeconomic scale (from the point of view of the enterprise) the impact of the green jobs on the employment is not visible and these effects may be revealed only across the whole economy.

*Source: own elaboration based on P&G data and individual interview*

the green transformation can be in practice. The programme aims at developing the skills in construction companies, which are essential from the perspective of low-emission transformation. Four groups of skills were distinguished:

a) engineering and technical skills needed to develop and introduce new, innovative, energy-efficient building techniques,

b) teaching and training skills: it often happens that young people have no incentive to acquire high professional qualifications (including specialisations). Appropriate knowledge of teachers is necessary for the young employees to develop the skills needed in sustainable construction,

c) managerial skills, allowing the companies to gain advantage owing to effective implementation of technologies instead of reducing the costs,

d) administrative skills, connected with the implementation of norms, establishing standards, adjustment of law,

which clearly illustrates how diverse green jobs can be in just one sector.

Apart from skills, the attitude of the employees is also important. For example, well-trained Irish engineers weren't initially very open to changes and new solutions. In Poland the low environmental awareness of people is seen as the barrier to the development of the green economy. It is blocking the changes, especially in the SME sector, where managers do not see the pro-environmental attitude as a priority, which leads to limited supply of relevant trainings (OECD 2011). It is different in large international corporations, which on the one hand see resource efficiency as the means of significant savings, and on the other hand, it is an element of company's CSR (cf. Box III.10).

## 3.3 EDUCATIONAL SYSTEM

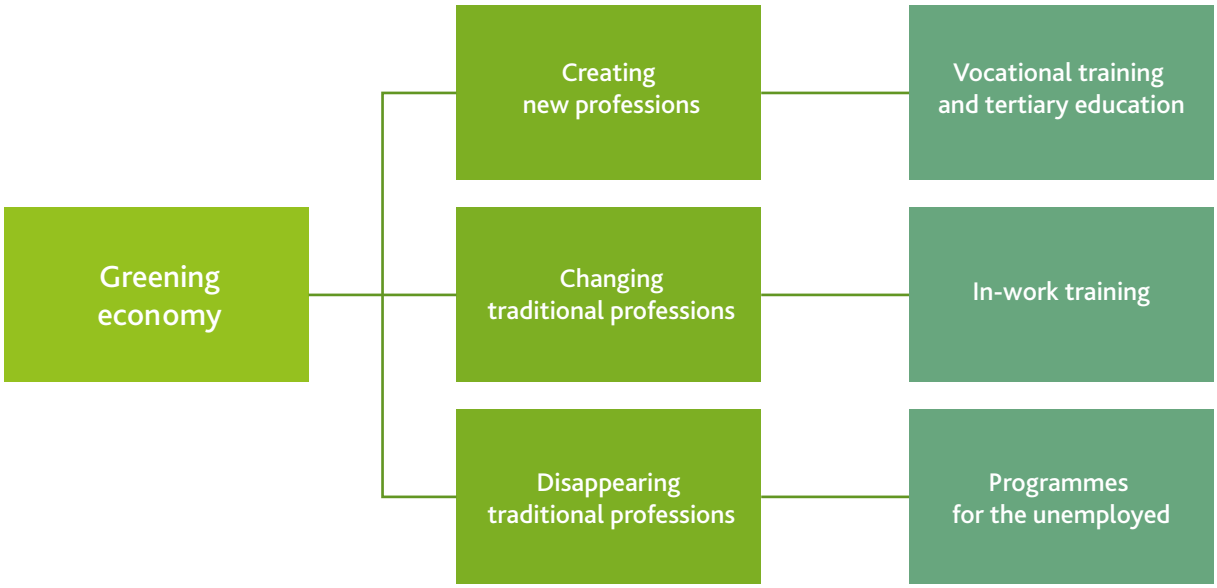
Gaining skills connected with the greening of the economy takes place on various educational levels. Basic competences are acquired during primary education, as time goes by the role of general education diminishes in comparison with building specific competences (vocational schools, universities) or job-specific skills (trainings). The classification by Bowen (2012) cited above remains in force also with respect to educational activities: filling newly created occupations takes place mostly through formal education, some adjustments in existing occupations may be fulfilled via trainings, while the unemployed due to destruction of brown jobs are being offered trainings and internships by the means of active labour market policies.

### 3.3.1 FORMAL EDUCATION

#### PRIMARY EDUCATION

Apart from Bowen's (2012) classification, in the modern literature there is a consensus on the role of primary education for the green transformation. Above all, in this phase (but not only) attitudes are formed, and the attitude towards the natural environment habits as well as practical application of sustainable development rules in adulthood depend on habits formed then (BlueGreen Alliance 2001). In case of developed countries this means for instance shaping wise consumption. These conclusions are confirmed by Agenda 21, of which key postulates include the reorientation of contemporary educational systems in order to comply with sustainable growth and broadly understood development of social awareness. This is the case of Green Schools and Environmental Education programme (BlueGreen Allance 2001) – one of the ideas was to create Fund for the Improvement of Education dedicated to construction and reconstruction of energy efficient Green Schools and high-quality air in classes. The idea, although very distant, emphasizes the practical dimension of changes in education oriented on the support for pupils' preparation to participate in the future economy.

Diagram III.5. **Greening economy from educational perspective**




*Source: own elaboration based on Cedefop 2010a*

On lower levels of education the fact of transferring environmental knowledge seems to be as much important as the way it is performed. Significant become classes conducted outdoors, which have positive influence on the attitude towards natural environment in adulthood. Actions along this trend generate externalities: teaching based on experiments led to higher science test results, stimulation of creativity, critical thinking and improvement of children's behavior during classes (BlueGreen Alliance 2001). Complementary results were delivered by the research of Californian Department of Education, which proved that system based on the test results curtailed teaching programme, sacrificing disciplines like ecological education or arts. It leads to a postulate indicating that teaching about environmental issues should gain more importance than it had before.

Although teenagers' expectations regarding knowledge are rising, influencing attitudes does not lose its value. On this level teaching should emphasize personality development, allowing students to learn to be decisive, react fast, know ethical rules as well as taking responsibility for his/her decisions (Barth et al. 2007). It remains an element of a wider vision indicating that the educational process should be based on 3 components: orientation on skills, orientation on the society (issues of sustainable development among it) and focus on individualism, as ca. 70% of personal knowledge comes from informal education (Overwien 2005).

From a practical point of view, general education is the only chance to systematically and accessibly implement elements of science, the lack of which seems to be responsible for disproportions in structure of science graduates on the university level, analogically – the knowledge of foreign languages and ICT skills, which in fact are not as developed as we used to think about it (for more details look at Part IV of the Report). Systematical didactical work allows for developing other competences which are identified by employers as crucial. Gaining them should have positive effects also outside green sectors.

### HIGHER EDUCATION

Formal education has various characteristics, which are perceived by employers as barriers. They apply not only to green skills, but have a horizontal character. Once they are solved, skills will match needs reported in the whole economy better. In light of individual in-depth interviews employers point out to:

- too theoretical courses,
- lack of flexibility in the programmes,
- poor cooperation between schools and businesses,
- weak ties between classes and on-the-job skills (which in fact collides with demand on versatility),
- poor association between education faculties and the needs of the local labour market.

Solution to this problem requires some modifications connected not only with educational process (increasing its practical dimension, co-operation with businesses, modern teaching methods), but also with management, financing and ensuring proper staffing. According to the Conference of Rectors of Academic Schools in Poland (2010), it is essential to reform the academic career path and the remuneration system in order to encourage high-quality scientific research and education. The system of university management should be updated. In the context of green skills costs of technical studies borne by universities are especially worth mentioning. As a result, they prefer to open faculties cheaper in maintenance, which do not require e.g. laboratories. Better motivation to open more expensive technical faculties will support the development of green economy.

Some Polish universities have implemented courses in the green economy, but to a small extent as of today. It partially results from the lack of adequate knowledge among academic staff. In

year 2011/2012 little more than six thousand Polish students graduated from environmental studies (which amounted to 1.3% of all graduates). For engineering and technical faculties the number of graduates was 29 thousand (5.9% of total). It seems that the positive trend in the number of graduates of mentioned faculties observed in the last years (GUS 2013b) may be partially ascribed to the success of ordered faculties, but also to growing awareness of attractiveness of employment in technical professions, which may be developed using vocational counseling (Box III.11)

## VOCATIONAL EDUCATION

Vocational education in Poland also faces challenges when it comes to educating staff for the green economy. The need to adjust the teaching programmes to the needs of local labour markets is voiced even more often than in case of university education. Sometimes schools design education programmes on the basis of their own capacities (staff etc.) rather than labour market demand, and there is little information on the needs of employers regarding skills (PL Europa 2011). Green jobs, being a new and still developing phenomenon, may not be noticed by schools which do not treat labour market trends as a priority.

Due to the practical dimension of vocational education one ensure that students gain competences desired by employers. Co-operation with companies is particularly important in this context. It may take the form of organizing internships and apprenticeships or conducting classes by employees. Unfortunately, as the survey conducted by the National Centre for Support to Vocational and Lifelong Education (2013)

### Box III.11. Development of STEM skills

Acquiring STEM skills (*science, technology, engineering, mathematics*) is an important factor for the development of human resources in Poland. Filling the deficit of science graduates may occur through incentives intentionally created in the education process: initially serving to discover predispositions for performing scientific and engineering tasks, and then to obtain a diploma in this field.

**Vocational counselling**

Career guidance and job counselling conducted in schools at different levels of education help students make the right career choices consistent with their competences. In this kind of classes or meetings students learn about different professions, competences required to pursue them and, based on diagnostic tests, get to know their skills – ones that could be developed in the future by choosing the faculty or profession. Moreover, the person conducting the classes should present the prospects of employment on the regional and national labour market.

In Poland this system is not functioning perfectly. There are not many career guidance professionals in schools, and their classes are assessed very poorly. This state of affairs may be the reason for considerably large group of graduates with a diploma in education (cf. Figure III.29) at the expense of a deficit, among others, in the sphere of STEM skills.

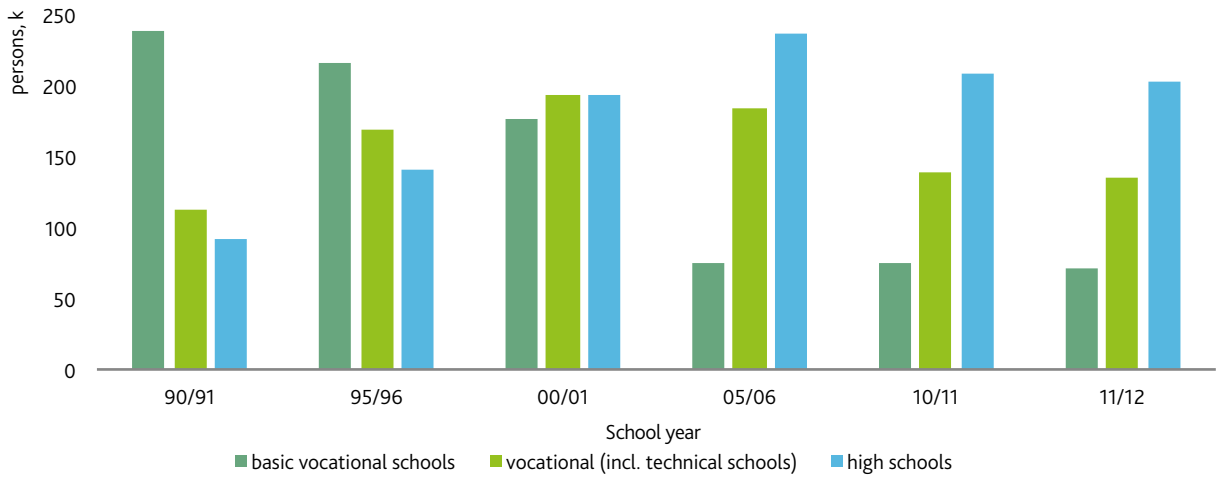
**Government-ordered faculties**

Government-ordered faculties programme was supposed to encourage choosing one of the scientific faculties (including IT, construction and environmental protection) that were considered critical for the competitiveness of the Polish economy in the future, through increasing educational supply and scholarships for the students. The programme started in Poland owing to EU structural funds in the academic year 2009/2010. Government ordered faculties' students receive a scholarship in the amount of PLN 1000 a month, additional free courses, compensatory classes, as well as internships and job placements, and the institutions taking part in the programme received higher financing per student.

According to the Ministry of Science and Higher Education, the programme has reversed the unfavourable structure of high school graduates' choices, encouraging them to choose the promising science faculties instead of massively more popular humanities or social sciences. In 2011/2012 construction was chosen by the students most often, and in comparison to the situation before the implementation of the programme, government ordered faculties became much more popular, sometimes even twofold. One cannot exclude that the growing popularity of technical faculties would happen even if the government ordered faculties programme was not launched. The observed market saturation by the persons with a degree in humanities, education or social science could additionally make the sciences and technical studies more attractive. Even before the programme was launched, construction and IT, also included in the programme, were fairly popular. However it is worth remembering that the choice of studies between humanities and technical studies depends to a great extent on student's predispositions and this kind of decision is often made as early as at the beginning of high school. What is more, when the government ordered faculties started, a transfer of potential students between the universities probably occurred. Universities offering government ordered faculties, which give the possibility to obtain additional scholarship, are probably more popular than the faculties on universities which did not receive governmental support.

*Source: own elaboration based on the materials of the Ministry of Science and Higher Education, Górniak (ed.) 2014, Bukowski et al. 2012 and Czepiel 2013*

Figure III.33. The number of graduates of basic vocational schools, technical schools and high schools in Poland




*Source: own elaboration based on GUS 2013a*

proves, as much as 90% of contacts are established as a result of schools' initiatives. It means that employers treat co-operation only in terms of short-term profits. Good practices in this matter are offered by the energy sector company, PGNiG TERMIKA SA, which has signed contracts with two schools – their co-operation consists of e.g. forming classes of energy technician profile, specifically for employment in the company, so to hire graduates of these classes (KOWEZIU 2013). Similar programmes created on businesses' demand should become a widespread phenomenon, which requires the elimination of a belief that vocational schools are responsible for delivering staff and increasing companies' activity in this field. One of the solutions employ to tighten the co-operation is financial incentive in form of tax reliefs or subsidies (however, their effectiveness is limited, as international examples show) and creation of adequate legal provisions (PL Europa 2011).

Taking care of quality of vocational education is also revealed through good staff training and professional career counselling for pupils (PL Europa 2011). The latter may play an important role in the context of green jobs, as counselors will inform pupils of junior high schools (gimnazjum) about the probability of being employed in this sector. Better employment prospects, as well as vocational education promotion should lead to increasing popularity of this kind of schools, which struggle with low interest for more than decade (Figure III.33).

### 3.3.2 INFORMAL EDUCATION

#### ON-THE-JOB TRAININGS

Formal educational system is characterized by conservatism and low flexibility with respect to labour market needs. Universal nature of education is often maintained at the expense of shortages of skills that are tightly associated with a job. Training courses serve to fill that gap, i.e. to match qualifications with specific demands linked to a particular industry or a job. In particular, this can pertain to skills of those employees, whose method of carrying out their responsibility changed because their jobs are becoming more environment-friendly. Among typical barriers to training three most common are outlined:

- lack of trainers (OECD 2011) which reminds of arguments regarding the development of formal education,
- dominance of basic trainings when companies due to their needs should focus on specialized trainings (OECD 2011) – a textbook example of the effective transition from traditional economy to the low-emission one is the case of ex-employees of the shipbuilding industry, who were fired from unprofitable and failing plants in Pomeranian province (voivodeship), employed to manufacture the ships and assemble offshore wind farms,
- limited financial resources – as surveys carried out in Podlaskie voivodeship indicate, over 25% of surveyed entities expect financial support and the main disadvantage of green solutions is their cost. EU programmes are the second most important way of financing ecological investment in the region (WUPB 2012). Limited financial resources command that training in SME sectors should be concentrated in areas characterized by high professional opportunities (OECD 2011).

Polish examples are rare, however in Germany from the pre-war times there has been a developed system of vocational training, and the responsibility for the trainings with respect to green skills was assumed by the state and it is executing it in cooperation with the enterprises. Through the education system it is possible to acquire basic qualifications in environmental protection and green economy. Due to the great importance of green transformation new professions were developed and the existing programmes were extended by necessary skills (Cedefop 2010b). Because of the wide scope of the green economy development, the access to high and specialist qualifications plays a significant role in its development. In subsequent years many

existing faculties were modified, but there were no purely green faculties created but environmental issues were included in the disciplines such as power industry, engineering, life and social sciences (Cedefop 2010b).

The companies actively participate in this system, but some of them went a step further. They establish their own training centres, like e.g. Siemens in Brema, where future employees are trained in the field of wind energy. Another form of companies' activity is a co-operation with universities (Cedefop 2010b). In France the enterprises may initiate the trainings' plan for the employees or grant them a leave on request (Cedefop 2010c). Big corporations in Spain actively participate in introducing the green skills into the market through trainings for their employees. Upon identifying the demand, the courses for the employed are organised and they are carried out by experienced employees or professional trainers (ILO 2011).

### 3.3.3 LABOUR MARKET POLICIES

One of green jobs' critics – Hughes (2011) – points out that the adequate skills are a prerequisite for the expenditures on green modernisation to be reflected in the short term increase in jobs. However, to note a net increase in the number of jobs, adequately qualified unemployed have to exist, so that they could be employed. To illustrate this hypothesis Hughes uses the example of North-Eastern England, where the main obstacle for the development of renewable energy is the lack of appropriate skills among the unemployed. Because of a small share of industry in the local economy, qualifications required for work in green sectors became inadequate. To tap into the potential of pro-environmental investment, one needs to tap into the stock of unemployed and provide them with necessary skills. Such is the role of active labour market policies. In this context, the results of ICF GHK document (2010) are scarcely surprising and indicate that sectoral and regional initiatives (usually organized as a public-private partnership) exert a bigger influence on the labour force than on projects on the level of firms. One of the reasons for this advantage is the ability of avoiding bottlenecks in labour force, thanks to social dialogue with stakeholders – especially in the EU countries, which are affected by the sudden green structural changes (UNEP, 2008).

Numerous examples, e.g. from Spain, France, Great Britain confirm the benefits due to the active role of local administration in successfully updating the unemployed's skills. This is mainly because, although some of the sectors disappear due to green structural changes, very little skills become actually redundant (ILO 2011 using case studies from the developed nations. For example, in the Philippines finding well-qualified workers for the production of biofuels turned out to be relatively easy, since the processes used were similar to those in sugar production. On the other hand, in RSA, many skills used in co-generation were transferable from the mining industry and even wider – from the heavy industry. Table III.3 presents the examples of transferring

Table III.3. **European examples of transferring the qualifications for green jobs**

| Country | Profession | Main training | Update | New profession |
|---|---|---|---|---|
| Denmark | Industrial electrician / Energy technologist | Professional training / higher engineering education | Knowledge of energy sources, capacity to integrate energy systems, project management | Renewable energy manager |
| Denmark | Industrial operator / industrial electrician | Professional training / secondary education | Assembly, installation of parts, use of tools | Wind turbine operator |
| Estonia | Construction worker | - | Knowledge of energy systems, data analysis, project management | Energy auditor |
| France | Recycled waste sector worker | Certificate of Professional Qualification [CQP - certificat de qualification professionnelle] | Methods of sorting and collection, knowledge of conditions and storage | Recycled waste operator |
| France | Product design and services | 22 initial courses with different degrees of specialisation | Integration of environmental criteria in the design process, integrated assessment and analysis of the life cycle | Ecodesigner |
| Germany | Electronics technician / mechatronics technician | Initial vocational education | Electronic and plumbing systems, safety procedures, operation and services | Wind turbine service technician |
| Germany | Plumber / electric and heat installator | Initial vocational education | Technical training, knowledge of administration procedures, entrepreneurship training | Entrepreneur / solar energy installation designer |
| United Kingdom | Energy sector engineer | Higher engineering education | Installation and maintenance of low-emission technologies, customer service skills | Intelligent energy expert / manager |
| United Kingdom | Commodity trader / broker1 | Higher education | Practical skills concerning the functioning of the emissions market, understanding of trading tools | Carbon trader / broker |

*Source: own elaboration based on Cedefop/ILO (2010)*

**Box III.12. The example of active labour market policies with respect to green jobs**

ILO report (2011) draws attention to the case of Spanish community in Navarra, the economy of which declined at the turn of 1990, when high prices of oil limited the competitiveness of a local Volksvagen factory – the only large industrial plant (Fairless, 2007). Until 1994 Navarra did not have installations generating energy from renewable resources, and in 1993 the unemployment rate reached the peak at the level of 13%. In response to the initiative of entrepreneurs, region authorities implemented industrial policies aiming at the development of renewable energy, mainly by means of employees' trainings. As a consequence renewable energy generation in the region reached 65%, which owing to 993 MW of wind energy and nearly 100 MW of solar energy, became its sixth biggest energy producer in Europe.

In 2003 unskilled employees constituted merely 9% of the employment in the sector, and 42% of enterprises reported inability to fill the vacancies due to the lack of a qualified labour force (Faulin et al., 2006). In order to overcome this limitation, a year earlier region authorities started executing its Environmental Training Plan, first by identifying the deficits of skills, and then by creating, together with employers' organisations, the Renewable Energy Training Center CENIFER (Faulin et al., 2009). CENIFER offers wide scope of courses concerning renewable energy, ILO (2011) mentions intensive training on the maintenance of energy installations. The course is intensive and it is conducted for 15 persons for 10 days, 8 hours a day. The trainers are specialists in the sector and are not part of the CENIFER key personnel. As a result from 2002 to 2006 more than 6 thousand of jobs were created in Navarrese renewable energy, which increased the employment in the sector by 183%, and the unemployment rate in the region dropped to 4.8%.

*Source: own elaboration*

skills to green professions in the EU countries – as it turns out, even skills connected with the production of goods banned for environmental reasons, do not become redundant, but may be used, sometimes even by the same persons, in other sectors and professions, provided that they were additionally updated. Reuse of skills is supported by skills frameworks that allow for validation and certification of skills gained outside the educational system.

Although national skills strategies are usually coordinated with labour market policies, they are still often insufficiently compatible with the publically promoted environmental policies, posing a threat of limiting the effectiveness of both (OECD/Cedefop, 2014; Cedefop, 2013). The example of the complementary ALMP implementation in the green jobs area may be the case of Spanish Navarra (Box III.12). Some success was also noted in Bulgaria, where enterprises associated with environmental projection were affected by legal provisions promoting subsidized employment. Employers that proved to hire the formerly unemployed for green jobs could count on the cost of employment to be paid for twelve months. In 2011 785 persons found a job because of that way, in 2012 – additional 376 (EEO 2013). The final shape of labour market policies must be assessed through the lens of its impact on various spheres of the economy, as some proposals may have strong side effects: Kraten and Sommer's simulation (2014) for Spain proved that the labour market reform proposed by them, including subsidized employment and introduction of shorter working hours, could reduce unemployment even by 5 percentage points, however, at the cost of lower GDP. Godin's proposal (2013), on the other hand, suggest employment guarantees for all the jobless and contracting them to perform tasks associated with the green economy, which would lead to inefficiencies on a grand scale.

# SUMMARY

Human activity was always the reason for changes in the environment, however only in the second half of the 20th century the international community became aware of the dangers caused by unsustainable economy. From that time the actions influencing global awareness are undertaken, as well as attempts for international agreement, the aim of which is to counteract disastrous consequences. Due to the large scope of this kind of activities, they will impact the whole economy, and the result will be the creation of the so called green jobs.

The strategy adopted by the European Union, commonly associated mainly with the greenhouse gas emission reduction, is primarily supposed to improve the competitiveness and innovativeness of the community's economy and achieve independence from fossil fuels that are becoming more and more expensive. Modern, material-, resource- and energy-efficient technologies will reduce the costs of running a business and will positively impact economic growth, which is connected with growing employment. What is more, in case of Poland, the transformation towards a green economy may help avoiding the middle income trap in the future.

Green jobs are present in many sectors of the economy, not only the green ones. Because of relatively short period over which they are classified (not to say exist) as a labour market category, they are neither precisely defined nor studied yet. What is particularly problematic, is the fact that these are jobs very similar in characteristic to others, and the main factor distinguishing them is their aim, i.e. the improvement of environmental quality and rational use of available raw materials.

It is difficult to clearly determine whether green jobs are more or less productive in comparison to other jobs, labour- or capital-intensive and durable. One may attempt to estimate those phenomena, however due to a lack of comparable statistical data and the focus on hand-picked and specific sectors (e.g. recycling) in existing studies, the results of the assessments may be inadequate and exhibit a significant margin of error. In case of job security in most sectors, it will be similar, however in the energy sector green jobs (both in the case of nuclear as well as renewable energy) are much more secure than the jobs in coal based energy generation sector. The attractiveness of green jobs depends to a large extent on the sector in which they are created. The quality, security as well as wage levels vary between sectors strongly. It may be assumed that new jobs will not be less attractive than the existing ones and thus they will be an opportunity to reduce unemployment.

The net employment increase caused by green investments will to a large extent depend on the scope and course of the transformation and restructuring policy. Green employment will depend on whether there will be incentives to create technologies and produce green goods in the country, if they will be imported from abroad and Polish employees will be limited solely to their sale, assembly and service. This condition is often emphasised in the literature as a requirement for the growth of net jobs in economy. The method of financing investment will also be important: through the tax and transfer system the government may encourage or discourage work. Development of green sectors will also mean a decrease in employment in some of the traditional enterprises unfavourable for the environment. The policy concerning the dismissed employees will also be significant – the lack of opportunities or strong incentives to change qualifications may exclude them from the labour market permanently.

The success of the transformation towards the green economy depends to a large extent on the development of skills. In order to maximise economic benefits the country has to export technologies. This requires not only a range of financial incentives, but also investments in the development of adequate staff capable of creating new products, proving their effectiveness, patenting them and implementing into production. Choosing this path of development, it is necessary to focus to a large extent on the development of competences in science – mathematical and engineering. However, new jobs will require various qualifications – not only technical but also business knowledge, and soft skills as well. Persons with different levels of education will find a job there: scientists as well as technicians. In case of education it is worth remembering that many years pass from the moment the action is taken until the effects are obtained. Some of the professions require skills similar to other economic sectors, but there will be some completely new professions. Currently in Poland the enterprises have assumed the responsibility for employees' trainings. As opposed to countries like Germany or France, state administration supports these actions only to a minor extent: both the education system and the labour market institutions are not very flexible.

The rise of the green economy offers development opportunities for many regions in Poland that are located in the periphery of current energy system, including rural areas: this is a solution of both the problem with energy supply and high unemployment. As far as the destruction of large number of jobs in brown sectors is concerned, an attractive programme allowing those people to acquire new skills would be essential. Structural funds may prove to be helpful in this case.

## FIGURES

## TABLES



## BOXES



## DIAGRAMS



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Employment in Poland 2013 Part IV

# The Time of Technology – Labour and Labour Market Institutions in the 21st century

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# INTRODUCTION

In Part 4 of this report we are going to focus on the challenges faced by the labour market in Poland as a result of development of information and communication technologies (ICT). A review of historical experience of other countries, as well as of the possible future opportunities and threats, is meant to facilitate development of public policy recommendations aimed at making Poland better prepared for the changes that can be expected in the next few decades. Considering the nature of the issue, and in order to obtain a long-term perspective and a viable diagnosis, a somewhat more general approach should be taken. Therefore, we need to analyse global trends (also hypothetical ones) and take a close look at the United States, where the technological processes are most advanced, and which has been the subject of research for the longest period of time.

Part 4 consists of four chapters. The first chapter will focus on the impact of new technologies on the labour market. It contains a description of the latest applications of robots and computers, which are likely to play key roles in the labour market transformation. These inventions, and the correlated changes will be presented in a broader historical context, taking into account the influence of breakthrough innovations on the labour market. Apart from focusing on the advantages of the future changes, we will also analyse their possible disadvantages, which will be discussed in the next two chapters.

The second chapter will focus on technological unemployment. We will also try to assess whether the ICT shock will trigger long-term qualitative changes of the labour market, or rather quantitative changes of yet unprecedented magnitude. The study is meant to offer us a more comprehensive view on what can be expected in Poland when our economy becomes permeated with new technologies that are already spreading out in more developed countries. In order to understand the progressing automation of jobs better, we have used an assessment model developed by the WISE Institute to evaluate over one hundred different jobs in terms of the probability of replacement of human workers by machines. This will allow us, on the one hand, to pinpoint those jobs where workers will need to be retrained most urgently (or stopped to be trained), and, on the other, to determine which jobs might benefit from the change process, and might be worth investing into. Finally, based on other countries' experience, we will try to indicate public policy tools that would address the labour market needs, in the context of labour reallocation during new wave of technological revolution, and to determine the course of actions that the state should take to overcome the future challenges.

The third chapter will contain an analysis of the frequently discussed issue of growing income inequalities which has been already linked by some researchers with the ICT revolution. This phenomenon is manifested, on the one hand, by a slow increase of the income median, and on the other, by a fast increase in prosperity of the most affluent labour market participants. The issue will be illustrated based on the most detailed US figures, and OECD data that includes Poland. A number of hypotheses explaining income inequality increase will be presented and analysed in order to reliably assess to what extent it is attributable to the ICT shock.

Inequalities and technological unemployment manifested by retraining obstacles are the key problems in the most developed countries related to the technological revolution. In Poland, these threats will also be accompanied by a demographic change i.e. the growth of the mean age of the employed, which triggers the urge to transform towards the so-called silver economy. Unlike the more developed EU countries or the US, Poland also lags behind in the process of adoption of new technologies, in both corporate and social contexts. Hence, we should ask ourselves how to make Poland better prepared for all these challenges. In this context, we will try to analyse the most viable political strategies, with a particular focus on an education and innovation policies.

# 1 THE ICT SHOCK

## 1.1 CREATIVE DESTRUCTION

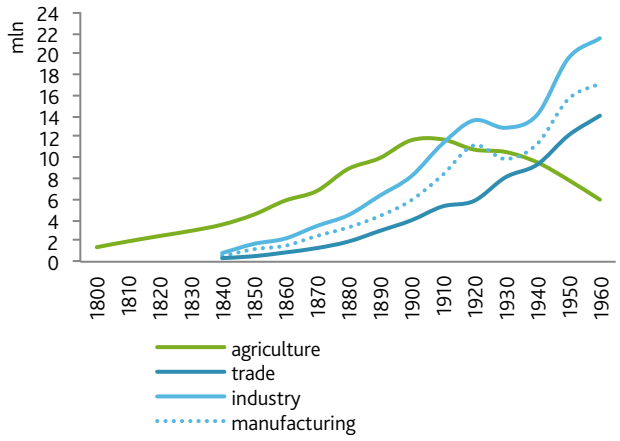
Until the 18th century, economic growth, as it is construed nowadays, had been virtually non-existent – the global economy expanded mostly due to the population increase. In other words, although modernising food production enabled to feed the growing number of people, the resources were too scarce to raise their living standards. According to Maddison (Figure IV.1), average economic growth per capita in the years 1-1500 used to range between 0.02-0.06%, which was ca. 50-100 times less than over the past 50 years. Hence, people used to live in almost exactly the same way as their forefathers.

However, the unchanging living standards were accompanied by a sense of stability. Whereas before the industrial revolution the world had been full of hazards that are almost unknown today – such as, in particular, threats to human life caused by violence (cf. Pinker, 2011) – unemployment was not one of such hazards. Farming work was always in abundance. On the other hand, not many alternatives were available – farming jobs dominated both in terms of added value and employment, while industrial development was motivated by political (as a tool helping to increase military power) or fiscal objectives (in accordance with mercantilist approach, it enabled gathering bullion obtained from the foreign trade surplus). In this context it was difficult to uncover industry's productivity and its innovative potential and, as a consequence, the correlations between innovation and development.

Figure IV.1. **Economic growth in the selected countries; 1-1500**

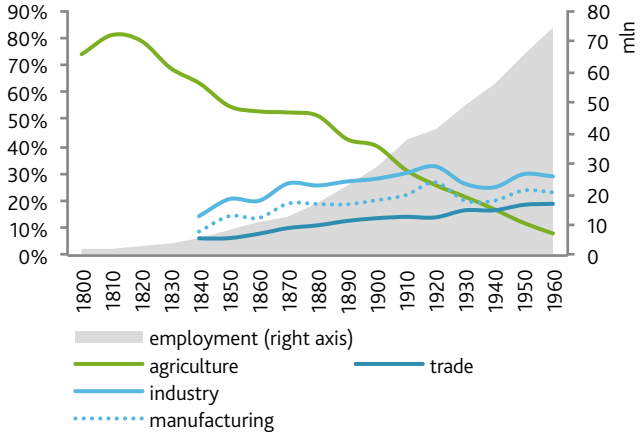

*Source: own elaboration based on Bolt, van Zanden (2013)*

Figure IV.2. **Employment in the selected sectors of the US economy; 1800-1960**




*Source: own elaboration based on Lebergott, 1966*

Figure IV.3. **Employment in the selected sectors of the US economy (%); 1800-1960**




*Source: own elaboration based on Lebergott, 1966*

**Box IV. 1. The Great Discoveries - GPT**

The inventions that change our world quickly and dramatically are the combination of breakthrough innovations and less prominent discoveries. Even though minor discoveries are also important, it is the so-called general purpose technologies (GPTs) that affect our prosperity and quality of life in most substantial and long-term way.

According to Bresnahan and Trajtenberg, in order to be classified as a GPT, an invention should conform to the following three basic criteria:

- it should be omnipresent i.e. used in the majority of branches of the economy,
- it should allow for introducing future technological upgrades leading to cost-reduction and improving accessibility of new technologies and
- it should be complementary to other inventions, thus enabling creation of new goods and manufacturing methods.

A GPT differs from a common invention by having a broader range of applications, evolutionary mode of development and capability of generating side-effects. Hence, a GPT is an invention whose development has contributed to a number of subsequent inventions, and which can be a robust driver of economic growth and development in a long-term perspective (Jovanovic 2005).

Domestication of plants and animals which took place 9-7 thousand years B.C. was regarded as the first GPT, and subsequent pioneering technologies included bronze and iron processing, and a medieval discovery of a water-wheel. The most famous modern GPTs are the steam machine, electricity or the Information and Communication Technologies – (ICT). Meanwhile, a laser is an example of an invention which, although used for different purposes, does not fulfil the criteria formulated above and has not exerted any economic impacts on a large scale.

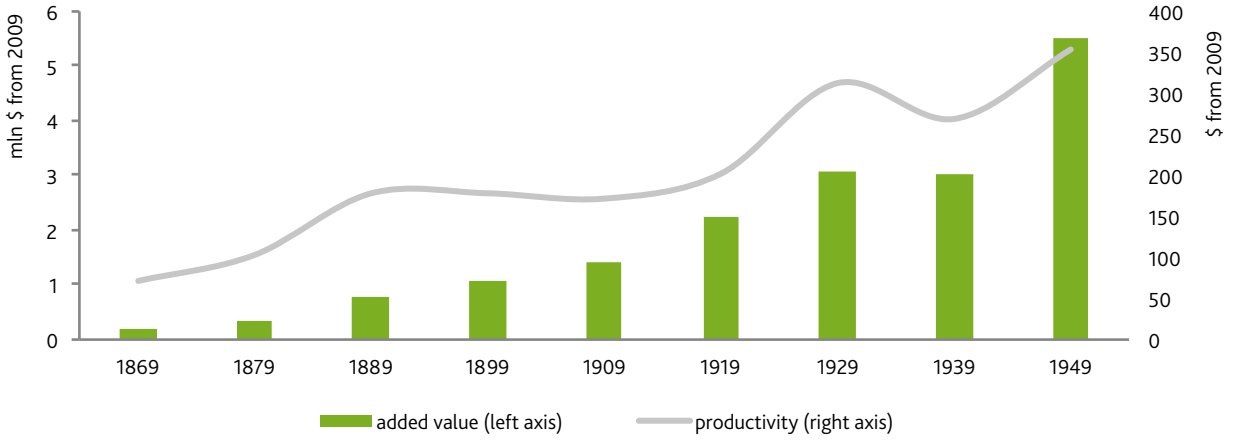
It should be noted, however, that the number of GPTs has increased over time, and thanks to the past discoveries. As compared to the 18th century when only one GPT was reported, there occurred four GPTs until the end of the 19th century, and seven in the 20th century. The GPT has more to do with offering new possibilities, rather than with supplying specific goods. However, revolutionary changes are rare and extremely risky, and often turn out to be more resource-intensive than less radical modifications.

*Source: own elaboration based on Bukowski, Buchholtz and Śniegocki 2014*

The invention of a steam engine by James Watt in 1781 was a turning point, when innovation started to be associated with economic growth. The engine was the first example of a classical *GPT* (cf. Box IV.1), which initiated the so-called first Machine Age. Although steam power used to be in the focus of interest even in antiquity, the first turbines emerged only in mid-16th century. Subsequent 230 years had to pass before a machine that was practical and effective enough to be mass produced was developed. As opposed to the steam engine, the balloon which was invented at the same time, was lacking such attributes as: increasing economies of scale thanks to multiplication, or mass applications that would motivate subsequent improvements. Meanwhile, the steam engine achieved spectacular success founding use in nearly all branches of economy.

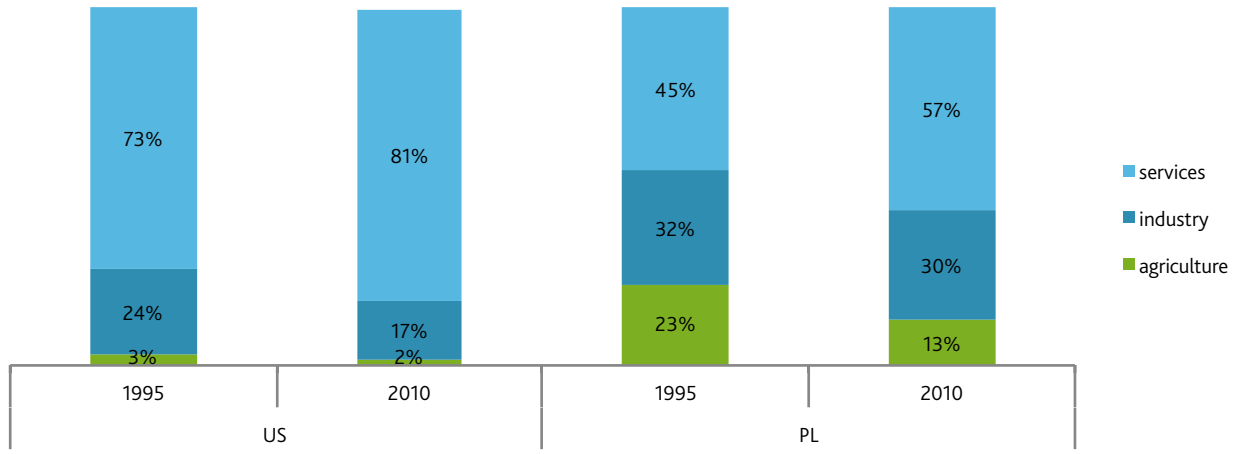
Correlations between inventions (innovation) and economic growth have been ignored for a long time. In fact, the traditional growth concept was based on capital and labour inputs, and

Figure IV.4. **Real added value and productivity in the industrial processing sector; 1869-1949**




*Source: own elaboration based on McDougall (1966), GGDC (2009) and Williamson (2014)*

Figure IV.5. **Employment in specific sectors in the US and Poland; 1995 2010**




*Source: The World Bank and Local Data Bank of the Central Statistical Office [GUS]*

innovation was not considered as an opportunity to make production less resource-consuming. The pivotal role of innovation in the context of growth and development was recognised by Schumpeter at the beginning of the 20th century. He perceived innovation not only in terms of inventions, or brand new technologies, but also as something that could be successfully sold on the market. In other words, technological solutions should be commercially viable as well. This idea was in line with the contemporary observation that invention that increase productivity the most are the easiest to put on the market, since companies buy them for profit. From a macroeconomic perspective, such inventions are main source of economic growth. But this comes with side-effects of far-reaching social destabilisation.

Innovation disrupts an old economic structure and replaces it with a new one i.e. some occupations or industries give way to others, which is sometimes referred to as creative destruction process (Schumpeter, 1995). Over the eighty-year period (1869-1949) the added value of the industrial sector increased 31 times, whereas its productivity grew fivefold (Charts IV.2-IV.4). Such a rapid growth would not be possible without reallocation of workforce – the workers whose jobs so far involved mainly creating production power could, over the years as saturation with steam engine technologies progressed, be transferred to other tasks.

At present, agriculture plays just a marginal role in the developed countries, the role of industry (with just few exceptions, such as Germany) is also decreasing, while the leading branch is the service sector (Figure IV.5). Workforce reallocation, resembling that which occurred two centuries ago, will not repeat but the three sectors will be subject to a restructuring process. These changes will be attributable to the new wave of inventions. Poland, in addition, will also need to confront the challenges related to its still incomplete transformation process, which are likely to further intensify the changes (Figure IV.5).

## 1.2 A NEW WAVE OF INNOVATION

The forecast formulated in 1965 by Gordon E. Moore, according to which the number of transistors in microprocessors was to double annually in the years to come, turned out to be surprisingly correct (cf. Box IV.2). The growth of computing power resulted in a rapid development of new technologies. Therefore, we may, without much oversimplification, confidently use such terms as computerisation, robotics and algorithmic approach, to describe the changes that take place (mainly) in the following three areas:

- controlling machines,
- algorithms recognising patterns and schemes,
- information processing and transmission.

While all these three areas are closely interconnected and supplemental, each of them heavily relies on the growth of processing power. It is the factor affecting algorithms that stand behind self-manageability of robots, database exploration in search of unobvious interdependencies, or remote communication.

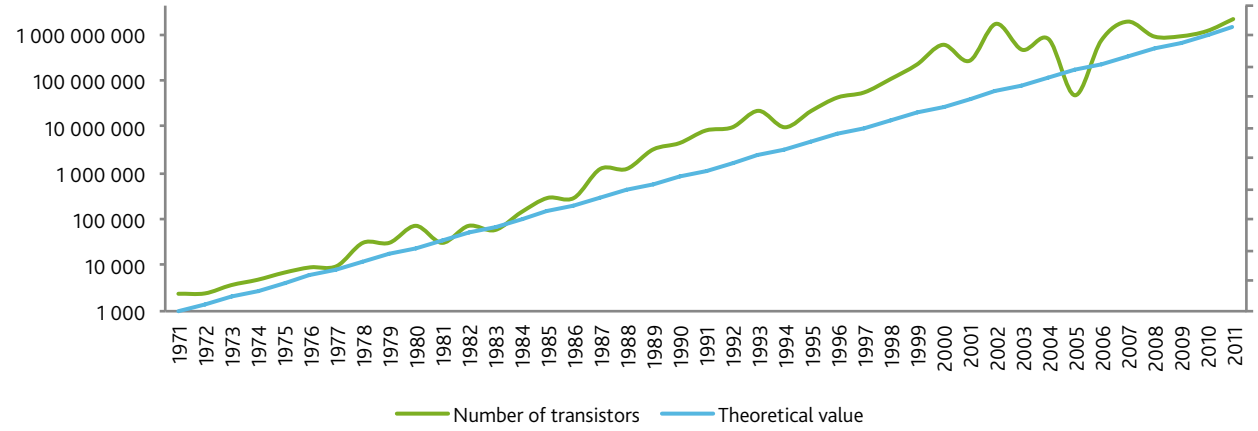
If digital technology continues to develop (in accordance with Moore's law) in an exponential mode, its impacts upon the labour market in the next 40 years will not only be more extensive than in the past four decades, but may be even more abrupt than during the first or second industrial revolution. Such changes will be experienced by each generation, which means that workers will need to adapt to the new conditions. Hence, such rapid digitalisation and automation may be adequately named as the ICT shock, generally denoting a shock caused by the new future-oriented technologies.

Rapid technological advancements that have occurred over the past decades, and the changes they have made in our surroundings, prompt us to think about the future. But is this possible to

**Box IV. 2. Moore's law**

In 1965, the founder of Intel Corporation – Gordon E. Moore presented his forecast (Moore 1965), in which he made an observation that the number of transistors in microprocessors in the coming period would double each year. This calculation, subsequently labelled as *Moore's law,* proved to be almost exact i.e. every 1.5 years number of transistors approximately doubled. Moore's law was also extrapolated to describe increases in hard drive capacity, computer network capacity or RAM size – i.e. computer processing power in general, which has been increasing by 50% per annum since 1940 (Nordhaus 2002).

Figure IV.6. **Moore's law- theory vs. experience**




*Source: Wgsimon (2011)*

The growing capacity of computers does not have to involve the increasing number of transistors, which explains the differences between the reality and forecasts. The smaller number of transistors can imply that new methods of production of amplifiers or microprocessors have been developed to ensure that the same processing power and speed can be attained by using fewer transistors. As a consequence, the deviation reported in the years 2001-2005 is not attributable to the lower supply of computers, but is a proof of their increasing technological complexity.

However, it should be emphasised that an important trend in constructing of more and more efficient integrated circuits is their miniaturisation that is only limited by the atomic size and the speed of light (i.e. transistor size and data transfer speed). This explains for example why the time needed for accessing memory or network decreases very slowly, despite exponential growth of capacity. In 2006, considering the fact that technology gradually approaches this boundary, Gordon Moore claimed that in the nearest future (2-3 generations), his 'law' might no longer hold.

*Source: own elaboration*

imagine the world even more penetrated with technology than it is now? Taking a closer look at pioneering inventions that can play leading roles a dozen or so years from now can be helpful. There exist certain technologies, which are not yet discussed outside narrow circles, but which are the first harbingers of the landslide expansion of robots. These include, in particular (Brynjolffson, McAfee, 2014):

- self-driving cars such as Google Chauffeur and drones, whose supply will lead to a decreasing demand for human pilots, cab or truck drivers, and is likely to revolutionise the logistics processes.
- recently developed computers capable of gathering structured knowledge. IBM Watson's spectacular victory over its human competitors in *Jeopardy!* TV quiz (2011) proved that the machine is capable of processing enormous loads of data, and use algorithms in finding unobvious correlations. Currently, the use of IBM Watson is being considered in the area of health diagnostics, based on a number of articles published in leading medical journals. Dissemination of such tools would result in the reduction of costs connected with diagnostic procedures, and in reallocation of labour in the case of medical professionals.
- 3D printers which are now commercially available, yet on a small scale. UV-cured liquid plastic enables prototyping in a much shorter time than ever before, and testing solutions that would otherwise be risky. Its industrial or medical uses give room for ongoing optimisation processes and searching for new functionalities – also including those regarded as unethical such as e.g. production of weapons, which reminds us that growing automation is a challenge also to the regulatory framework.
- word-processing software – currently used to write simple reports, such as stock market or sports match reviews. The

growing popularity of such software will decrease demand for journalists, analysts or junior clerks. It may also contribute to flattening of the hierarchy of intellectual workers.

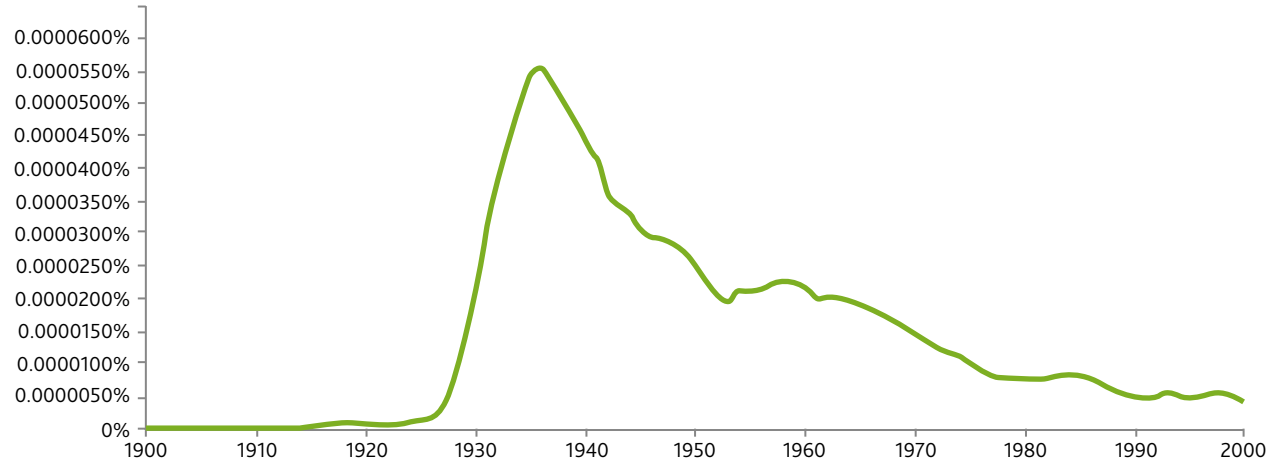
- knowledge- and resource-sharing communities – although they are commonly known, their importance is correlated to the increase in the number of users and computer capacity. Their range of uses is diversified, starting from sharing knowledge about the world, thanks to Wikipedia, on-line courses held by lecturers (e.g. MIT, Columbia University) or on-line repositories (Amazon, R), through the optimisation of costs (e.g. comparing prices, booking of services on-line) or products (e.g. Quirky, where newly invented products may look for producers). Apart from standard commercial transactions, the Internet also allows for targeting support at those who need it (e.g. Kiva micro-credits offered to citizens of developing countries). As it may be easily observed, although digitalisation of knowledge is expensive, the marginal cost of its multiplication is almost none. This phenomenon may result among others in reducing demand for lecturers or teachers.
- *big data* – big and unstructured datasets whose statistical processing will enable creating an overview of a given phenomenon (e.g. use of a product during its entire life cycle), often in real time, which for example allows for better tailoring of products and services to users' needs. Analysing such data is complex, and their short-term mass used to be limited, due to the processing obstacles. However in the future, according to Bukowski, Buchholtz and Śniegocki (2014), *big data* will be categorised as another GPT. The labour market impacts of *big data* are likely to be very extensive; at first, different types of intermediaries may find themselves at risk, due to *big data's* ability to reduce informational asymmetry.

## 1.3 WHY SHOULD WE BE AFRAID OF MACHINES?

Just a short list of inventions presented hereinabove suggests that many professionals are going to be replaced by machines, either partly or entirely. On the one hand, this means that workers will be capable of producing new goods, thus expanding the economy, yet, on the other hand, rapid automation may aggravate social problems (especially if the workforce reallocation process is rapid). The fear of social consequences of automation of jobs had accompanied humanity long before the industrial revolution took place, being one of the major hindrances of the process (Acemoglu and Robinson 2012). The history also provides us with many examples of how authorities deliberately tried to stop technological progress out of fear of its social consequences. Tiberius, a Roman emperor, ordered to kill a man who showed him shatterproof glass. When one of his successors, Vespasian, heard about a brand new method enabling transportation of stone columns to Rome, he banned it claiming that he wants to avoid unemployment and impoverishment of thousands of his subjects. A century and half afterward, the same argument was used by Elisabeth I who did not grant William Lee a patent for a knitting machine.

All in all, such attitudes were quite rational, at least from the rulers' point of view. First of all, they were truly concerned with the possible impoverishment of the society as a result of introduction of an invention. Secondly (which was admitted less frequently) they also feared that the citizens who would become more prosperous thanks to new technologies may deprive them of their political influence. While the first concern did not affect the rulers directly, an increase in prosperity and aspirations often gave rise to revolutions which resulted in overthrowing governments. However, luckily enough, starting from the Glorious Revolution of 1688 in England, subsequent countries stopped hindering of technological progress, which paved the way for the industrial revolution and yet unprecedented increase in prosperity.

Figure IV.7. **Publications devoted to the issue of technological unemployment; 1900-2000**




*Source: own elaboration based on Google Books Ngram Viewer*

The first significant rebellion that occurred during the industrial revolution took place in 1811 when the English Luddites started to systematically destroy Jacquard looms, which they blamed for the disappearing of jobs. However, it later turned out that launching of industrial machinery eventually increased the labour demand, by changing the structure of employment. To commemorate this event, economists nicknamed the theory of permanent destruction of jobs by technology as the Luddite Fallacy.

Even though the so-called technological unemployment does not spur as many controversies as it used to - cf. Figure IV.7 showing the numbers of publications touching the issue - the problem is still valid, especially in the context of an oncoming new wave of automation. The greatest enthusiasts of modern technologies predict that the majority of workers are going to be replaced by machines in the next 20-30 years, emphasising that due to its exponential nature, the process at some moment will yield instantaneous results. More conservative authors point out to the end of 21st century as the turning point. However, what is being contested are the timeframes of omnipresent robotisation that would utterly transform the labour market, rather than the fact of its eventual occurrence. Hence, the next chapter will be devoted to the question of technological unemployment.

# 2 DISAPPEARING LABOUR MARKET

## 2.1 ARE WE AT RISK OF TECHNOLOGICAL UNEMPLOYMENT?

A key notion which gathers all anxieties connected with the analysed changes is the so-called technological unemployment. The term was coined by John Maynard Keynes (1930) to name "unemployment due to our discovery of means of economizing the use of labour outrunning the pace at which we can find new uses for labour". The definition itself allows us to distinguish between three types of technological unemployment, depending on an interpretation of Keynes's statement (cf. Table IV.1).

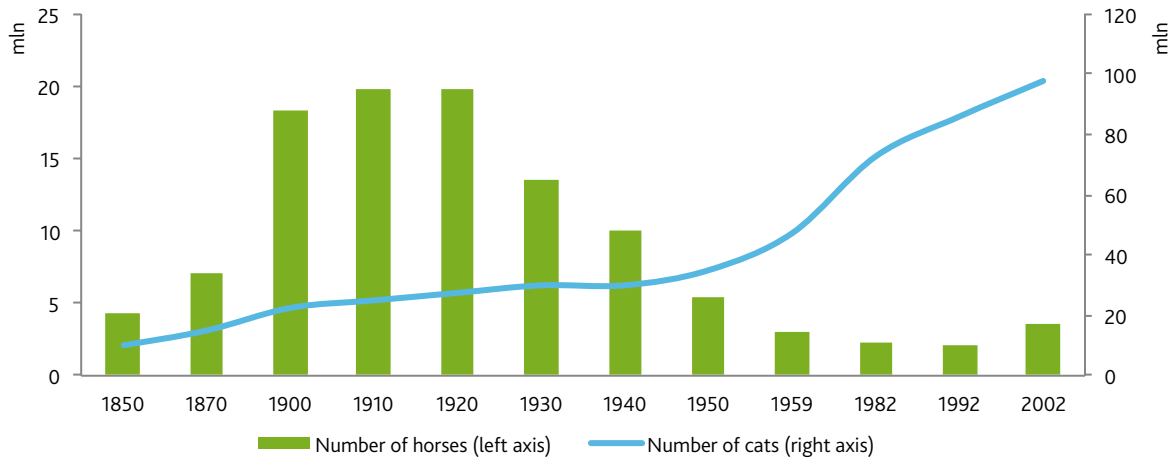
The problem of permanent unemployment due to technological changes was well illustrated by Wassily Leontief (1983), who compared people to horses. The major draught animals became massively 'fired' at the turn of 19th and 20th centuries, due to mechanisation of industry and farming. Although for some time it seemed that horses could still be useful in some circumstances (short-distance trips, or off-road conditions), all in all, they turned to be unable to earn for their daily rations. As a consequence, their population dropped down dramatically (cf. Figure IV.8).

Table IV.1. **Typology of technological unemployment**

| Type of technological unemployment | Short-term | Long-term |
|---|---|---|
| Transitory | liquidation of jobs outruns the pace of creation of new ones only for some time;<br>before new jobs are created, people employed in liquidated industries must be dismissed;<br>dismissed employees get employment at new positions easily | the pace of jobs' liquidation and creation tends to be balanced |
| Structural | the pace of liquidation of old jobs is higher than the pace of job creation;<br>the process may take place in case of particularly abrupt technological changes;<br>dismissed employees may be unable to perform new jobs without being retrained. | |
| Permanent | dismissed persons may remain unemployed for long periods of time, or be completely unable to find new employment;<br>their positions in the labour market are taken over by younger people, who are better adapted to contemporary working conditions. | the pace of job dissolution is permanently higher than the pace of job creation;<br>the number of the unemployed is sustainably increasing;<br>economy is not capable of offering new job opportunities to everyone who has been dismissed;<br>neither confined with specific timeframes, nor restricted to a shrinking group of "technologically incompatible" workers |

*Source: own data*

Figure IV. 8. **Populations of horses and cats in the US; 1850-2002**




*Source: own elaboration based on KER (2007) and Clifton (2013)*

At first, technological progress used to positively affect the population of horses. Railway supported the development of new settlements, transportation needs in towns also increased, and a horse was back then complementary to Colt and Winchester guns. However, the situation utterly changed after the invention of a car and tractor, and especially, after they became mass produced in the 1920s. The new machines were such a great substitutes of horses that the latter found no new uses, and their population shrunk tenfold over seventy years. Leontief suggests that a similar fate can be expected by the population of workers. As long as machines are only capable of replacing muscular power, a human worker with human intellect will be complementary to them. However, as soon as the machines start to "think" better than us, our position on the labour market will be at risk. Before analysing particular conditions that must be met for Leontief's scenario to come true, let us discuss, first of all, the less dramatic scenarios of technological unemployment.

Before analysing particular conditions that must be met for Leontief's scenario to come true, let us discuss, first of all, the less dramatic scenarios of technological unemployment. Technological unemployment in its transitory form has accompanied mankind since the beginning of the industrial revolution, and it was the scenario that Keynes referred to in the above quotation. Although the phenomenon cannot be questioned, one may object to defining the resulting labour market change as 'unemployment'. For example Mabry and Sharplin (1986) claim that, in fact, we are dealing here with rent-seeking phenomenon. If 'rent' is to be interpreted as a wage exceeding what one can earn on a competitive market, it means that a former employee rejecting jobs that would earn wages lower than obtained at his or her previous position displays a rent-seeking attitude. However, in the aftermath of technological change, earning the previous wage for the same type of job is no longer possible – to accomplish this, one would have to engage in different activities.

From an economic point of view, in order to prevent the shortage of such activities two conditions must be met: (1) there should exist human needs that could be satisfied by performance of human labour and (2) there should be sufficient financial resources at someone's disposal to remunerate such performance. If both these conditions are met, the following process will take place. First replacement of humans by machines will result in the lowering of production costs. Hence, an enterprise operating in its competitive surrounding will be, after some time, forced to cut down prices. However, if it gains a monopolist rent, its owners will earn extra profits. Regardless of whose purchasing power increases - i.e. that of the consumers of a product whose price dropped down, or of the shareholders of a monopoly[1] – the surplus resources may either be spent on consumer goods, or saved (invested). The unprecedentedly high production volume in the case of consumer (or investment) goods will demand higher employment.

The workers who have been dismissed may find jobs offering wages which, on average, are not significantly lower. For example, if any tasks which were performed by humans may now be performed for free by machines, the costs of an enterprise will be decreased by the value of wages of the dismissed workers. This amount of money will be spend for other purposes, and finally, it will again become an income of the dismissed workers. Although, most likely, this will not happen immediately – the surplus income may be spent on the goods produced so far – however, in equilibrium their supply cannot increase without hiring new workers.

The same process may be illustrated in another way. If wages earned by the workers who have been dismissed as a consequence of automation, were determined on a competitive basis (contrary to Marbly and Sharplin (1986)), it means that they depended on a remuneration offered at an alternative workplace. In other words, the employer had to pay a certain sum to encourage people to join his company, instead of the competitor. However, this amount was – due to competition among workers – only insignificantly higher. Hence, an employee 'degraded' to a job that he or she has not been previously willing to take, obtains a remuneration that is only marginally lower. By far, this mechanism has driven the growth of real income as a result of technological advancement – the dynamics of the growth of the real purchasing power of wages caused by decreasing product prices exceeded the pace of wage decreases due to redundancies and taking up less paid jobs.

Transitory technological unemployment should not be viewed as a side-effect of economic growth, but as its condition precedent, and one of its key manifestations. On the one hand, thanks to less expensive labour, the prices of goods can be reduced, and, hence, benefits of economic growth can spread. On the other hand, from a general social perspective, such benefits will be attained only if the dismissed labour is deployed for production of other goods or services. If, however, decrease of the prices of goods due to automation is not assisted by a significant increase in their quantities, social benefits related to dismissing a worker will only be obtained after he or she becomes reemployed to manufacture new products addressing other needs.

Structural and permanent technological unemployment will take place if either of the two conditions of transitory unemployment has not been fulfilled i.e. there are no needs that could be satisfied by the dismissed workers taking up new jobs, or no resources are available to satisfy such needs. If the first condition has not been met, we will face the problem of permanent technological unemployment. For now, let us assume that there are some needs that still need to be satisfied, but there exists no mechanism that would enable their fulfilment by workers who have been dismissed.

1 Increasing of a monopolist's income at the workers' expense leads to inequality increase. This, in turn, according to Pettis (2014), due to more affluent entities' stronger inclination to save money, may limit demand for new jobs, with poor flexibility of nominal wages, or limited number of investment projects with a positive return rates.

Table IV. 2. **Professions irreplaceable by robots**

| Universal desire | Corresponding profession | Tasks performed |
|---|---|---|
| Self-development | Personal coach | Planning exercises, accompanying during training sessions, motivation, setting a good example. |
| Overcoming solitude | Travelling, sports companion, elderly people's companion | Being a travelling companion, guide, interlocutor and companion. |
| Aesthetic needs | Landscape architect | Designing public and private space, making surroundings more aesthetic, counteracting entropy. |
| Raising children | Governess, home tutor, coach, babysitter | Active babysitting, personalised tuition, accompanying children. |
| Freeing oneself from menial tasks | Personal assistant | Optimisation of shopping, doing cleaning jobs, searching for information. |
| Sentimental needs | Renovator | Repairing old, sentimental objects, family souvenirs. |

*Source: own elaboration*

To explain this, let us use an example. Assuming that a supermarket shopping technology has been modernised, so that goods are marked with special chips. In such case, the checkout procedure will only consist in passing a trolley through a gate, and making payment via an automatic terminal. If this invention is cost-effective, it may successfully supersede checkout workers. Moreover, let us assume, that such ex-workers are not provided with any jobs that would offer them a comparable pay, and not require having additional qualifications, since all cleaners', security guards' jobs, etc. have already been automated. This does not mean, however, that the fired checkout workers are incapable of offering the society any other services. They could, for instance, work as house workers. By far, the society has not been able to afford such services, and it could only offer the pay corresponding to ca. one-third of checkout staff's earnings i.e. the minimum subsistence income. But what will happen with the income (attained by supermarket owners or their customers) that will surely increase due to the decreased labour costs?

Such income will be spent on other goods and services. However, their production volume will not increase, as there is no possibility to hire more labour force capable of providing adequate outcomes –ex-checkout workers are incapable of generating income that would justify earnings that they would accept. As a consequence, additional income will be translated into an increased rewarding of production forces in those industries that have attracted more demand. However, at the overall economic level real wages will not increase - the consequences of eliminating checkout staff from the market will only include the growth of wages and prices caused by the decrease of the demand for money caused by eliminating some market players.

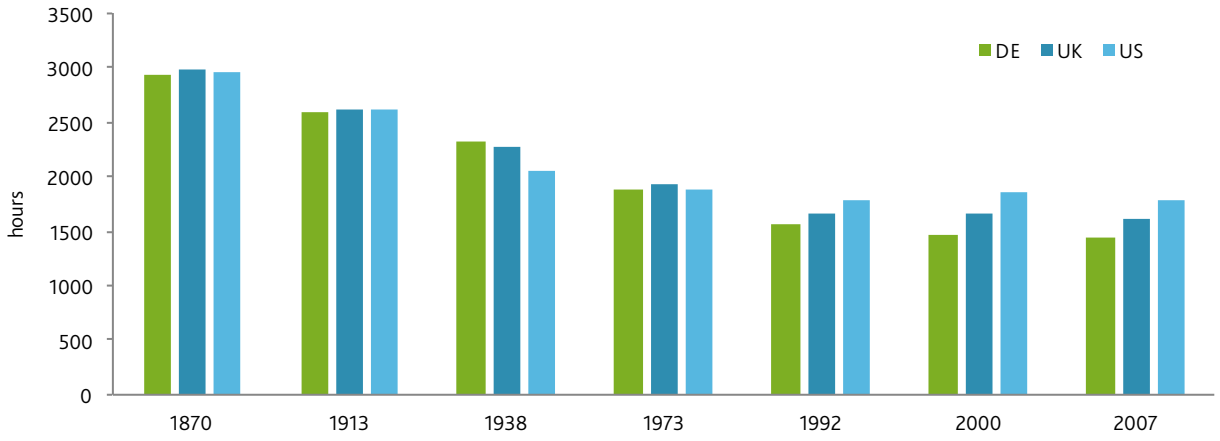
The ex-workers have two possibilities of improving their situation. First of all, they can learn new skills so as to get engaged in a production of the most desirable goods and services. Secondly, they can wait until the needs that they now are capable of addressing (i.e. domestic help) become more urgent, due to satisfaction of other more urgent needs. This may happen if due to technological advancement and higher capital investments, the supply of relevant goods and services increases, leading to the lowering of their purchase prices. Then it would be possible to allocate more resources for the services provided by a domestic help.

The above example shows that technological advancement can, at the same time, be an enemy and ally of unskilled workers – also in view of a growing demand for skilled workforce. Thanks to automation of subsequent branches of industry, disposable income of all market participants increases, thus making satisfaction of those needs which have previously been regarded as less urgent, more affordable. This can be perceived as an opportunity for those who have not had much to offer so far in more sophisticated production processes, provided, however, that there emerge new needs that could not be satisfied by modern industry alone. The needs that must be addressed by another human being (even lacking specialist skills) are directly correlated with the issue of permanent technological unemployment, as specified by Leontief.

Many such needs involve attentiveness to another human being, and the willingness to share one's world with others. A machine will only be capable of imitating real interactions – it would neither admire us, nor get amused, or pleased. An interaction with the machine will never become an 'encounter', but just a solitary act. However, our psychological needs are not the only ones that are hard to be satisfied by robots. A list of other such needs are presented in Table IV.2.

Apart from metaphysical differences between humans and robots, other causes of continuous labour demand include entropy of the world and preciousness of time. Entropy of the world is connected with an urge to continuously improve and systematise our surroundings so as to adapt it to our expectations, also aesthetic ones, especially if we notice that beautiful objects, in most cases, are also transitory. This means that even if it would be possible for robots to erect, maintain and clean buildings, such buildings might not be desirable as homes, for example due to their unattractiveness. Meanwhile, the more affluent a society is, the more it is able (and willing) to satisfy its complex aesthetic needs – even at a price of greater labour demand.

Figure IV.9. **Number of hours spent at work per annum in Germany, the UK and the US**




*Source: Madison (1991), Groningen Growth and Development Centre and Total Economy Database*

The issue of the preciousness of time stems from practical reasons. Instead of devoting time to any activities which do not provide us direct benefits, we would rather spend it practicing our hobbies. This would apply for example to housework, commuting or shopping. Each activity that takes our time, not offering us any financial rewards or pleasures in return, can be subcontracted – and becomes a source of labour demand.

Figure IV. 11 illustrates the downward trend in the case of hours spent at work per annum. Although since 1970 the tendency has slowed down, as shown by the chart, if we take into account demographic changes and exclude individuals at non-productive age from the sample, we will see that the amount of time spent at work has decreased. Over the past hundred years, also the amount of time devoted to household chores i.e. cooking, dishwashing or cleaning has also been reduced. Availability of food processors, dishwashers, washing machines and other appliances mechanising household duties was of key importance in the context of the analysed changes. From the point of view of the labour market, such processes affect the demand for subcontracted non-career activities, but also generate demand for jobs in entertainment industry. Someone who spends less time working professionally and in the household, may devote more time to reading books, watching films, performances, or travelling – thus creating labour demand.

At this point, we may use an analogy similar to Leontief's story about horses. Apparently, people on the labour market seem to resemble cats, rather than horses. As shown in Figure IV.8, in the years 1850-2003 the number of cats used grow continuously. At first, cats used to spread together with humans who needed them because of their practical skills i.e. ability to combat mice or other rodents. When people started using poisons and traps, such skills became redundant. However, cats did not become extinct. Since in 1947 Edward Lowe invented a cat litter tray, cats could start providing a new service which cannot be offered by machines – co-habiting with humans in their households, as their live companions. Despite temporary obstacles, they safely landed on their feet, finding a comfortable 'niche' that has protected them from 'unemployment'. It is quite possible that the same fate might happen to humans.

## 2.2 WHAT WOULD BE THE SKILLS OF THE FUTURE?

If, in accordance with what we have already stated, the demand for human labour does not disappear in the foreseeable future, we still need to think of the nature of such labour i.e. the skills that would yield the highest added value, be complementary to machines, and sought for by employers. According to scientific literature, technological advancement over the past decades has been favouring qualified workforce (cf. Berman, Bound and Machin (1997), Siegel (1999), Goldin and Katz (2008)). Although the hypothesis of skill-biased technological change has been present in economics for almost fifty years (Grilliches (1969)), it attracted more attention in the 1990s, ten years after an observation that inequality growth is accompanied by technological advancement in the field of computer technologies.

In order to better understand this phenomenon, and its future impacts on the labour market, we can use the examples based on the classification proposed by Goldin and Katz (1998). They claim that each production process can be divided into two phases: in the first phase, production assets such as necessary machinery and equipment, but also human or organisational resources, are created; and in the second phase the final product is created, using production assets and unskilled workforce. Table IV.3 provides a number of examples of the proposed division.

First of all, let us focus on the process leading to the purchase of ice-cream in a shop. It can be viewed as a consequence of the following three stages: production of an ice-cream machine, use of the machine and ice-cream sale. Each such stage, as shown in the table, can be divided into two phases. During the first phase, the production capital is being developed (by means of physical capital and skilled workers). This capital will be used during the second phase when, together with unskilled workers, it will contribute to the production of the final product of that stage. If we think that skilled labour force is needed during the second phase, it means that (in accordance with the scheme) we still have the first phase in mind. What is more, if no unskilled labour

Table IV.3. **Production process structure**

| Exemplary product or service | Phase I – creating manufacturing assets | Phase II – manufacturing of a specific final product |
|---|---|---|
| Ice-cream | | |
| Ice-cream machine | Designing of the machine, subcontracting production of specific parts | Assembly of the machine using ready spare parts |
| Wholesale supply of ice-cream | Installation, maintenance and repair of the ice--cream machine | Production of ice-cream with the use of the machine |
| Retail sale of ice-cream | Selection of the ice-cream shop's location, advertising the final product, creating a brand, purchase of ingredients, retail sales | Selling ice-cream to customers |
| Hairdressing | | |
| Hairdressing equipment | Designing of the hairdressing equipment, ordering necessary materials and letting the goods be manufactured | Production of scissors, hairdryers, shampoos and dyes |
| Hairdresser's service | Training of a hairdresser, getting practical experience, arrangement of a hairdressing salon | Offering hairstyling service at a salon |

*Source: own elaboration based on Goldin and Katz (1998)*

force is engaged in the second phase, it means that the production of the final product (in a given stage) is performed only by means of the production assets.

Technological development, which favours skilled workforce, leads to eliminating of the second production phase. A significant number of unskilled workers used in the process of production of goods and services are replaced by machines. Meanwhile, the first phase requires much higher investments i.e. deployment of skilled labour force in the process of construction, proper set-up and maintenance of the machines. If, in addition, (as it has been emphasised since 1960s for example by Autor, Katz and Kruger (1998)) increasing capital outlays is necessary, we are dealing with the phenomenon of capital-skill complementarity. As a consequence, instead of a small group of skilled workers, relatively small capital investments and a large number of staff working in the production process, there emerge technologies that demand higher numbers of skilled labour force, more capital, and fewer unskilled workers.

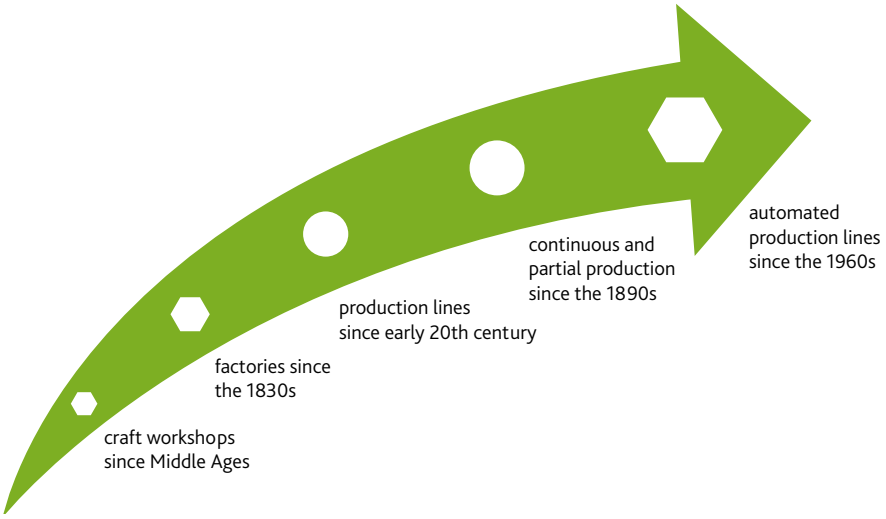
Let us focus on an example of hairstyling. To simplify the process, we have divided it into two stages. In the first stage, necessary professional tools are being created, and in the second stage a hairdressing salon and services are developed. Although the first stage resembles the same stage of ice-cream production process, the second stages of both processes are markedly different. As a matter of fact, hairdressing is quite labour-intensive i.e. to provide a service, apart from capital investment needed for professional training, what is needed most of all, is manual labour. The accumulation of human resources during the first phase is also based on labour i.e. hairdressers are trained by qualified professionals.

The 20th century technological advancement also affected the hairstyling industry. New, improved tools were developed and salons became filled with hairstyling cosmetics and dyes. This improved the quality of service without reducing the employment. On the contrary, the number of hairstyling salons in the US is sustainably growing as, thanks to a relative decrease in prices of other goods, more and more people can afford to visit a hairdresser. Technological advancement did not increase the demand for qualified labour force either. Just the opposite: invention of new types of scissors or electric hair clippers resulted in making professional requirements less stringent. Hence, it was an example of a technological change that did not favour high qualifications.

Hence, neither new technologies, nor higher capital expenditure would mean the increase of the requirements towards workers. A question arises, whether the changes that occurred in specific industries over the past two centuries resembled the transformation of the ice-cream industry, or that of the hairdressing services. Diagram IV.1. shows how subsequent technologies that revolutionised manufacturing processes were introduced, starting from dissemination of production plants in the 1830s. Before the first transformation occurred, the majority of goods had been manufactured at specialist workshops. Artisan jobs demanded skills which could only be mastered during long-term practical work. At the same time, the majority of labour force was employed in the farming sector, where education was redundant.

The emergence of factories brought about the concurrent growth of productivity and falling demand for skilled labour force. Division of labour, coupled by machine power enabled mass production of goods – although such goods had poorer quality than those manufactured by artisans, they were much cheaper. In the case of rural inhabitants, as a consequence of progress, farm work was no longer indispensable for food production. In this context, working in factories, which did not require any additional skills appeared as a salvation. Similar labour market consequences were caused by the introduction of a conveyor belt assembly line. As long as numerous human resources were involved in the production (phase II), higher efficiency of the entire process did not imply rewarding of more skilled workers.

Diagram IV.1. **Evolution of the goods' production methods in 19th and 20th c.**




*Notes: Hexagons symbolise manufacturing methods that favour educated workers*

*Source: own elaboration based on Goldin & Katz (1998) and IFR (2012)*

Subsequent breakthrough technologies seemed to favour more skilled labour force. The key element of such transition was the propagation of electrical power. In 1900 the share of electricity as a power source in factories was only 9%, and after two decades it attained 53% (Goldin and Katz 2008). Electrically powered machines were much more diversified and installing them at factories became easier. Electrically powered conveying belts, although they still belonged to the era that used to "favour" unqualified labour, eliminated a number of unsophisticated jobs such as, for example, carrying or loading goods (cf. Nye (1990)). Electricity also enabled to introduce more complex machines that enabled to manufacture the products in a continuous manner (i.e. household chemistry, dairy products, edible oils, petrochemicals) or in batches (i.e. canned foods, matches, cigarettes). These machines functioned as "black boxes" – a person inserted a half-product at one end, in order to obtain the final product at the other end. The production process required a minimum work effort.

The last stage which commenced in the automotive industry expanded fully automated production processes to the new areas. An automated production line allows to assemble final goods from parts, in order to obtain products much more sophisticated than cigarettes or matches with only a minimum human effort. Although on a mass scale it still looks like a distant future, the nature of the last stage makes us expect that at its end all products will be manufactured by robots. Humans will only be in charge of design and maintenance of the machines, and planning of production processes in the first stage. As a consequence, unskilled workers will become completely redundant.

The studies of industrial production in the 20th and 21st centuries have unarguably proved that technological changes which occurred during that period favoured skilled labour force. However, in order to examine the overall economic changes, we should also take a closer look at the services sector. The services are a major branch of each modern economy. We can venture an assumption that before the invention of computer, skills premiums in the service sector had not been increasing. It was industry (and also farming, to somewhat lesser extent), that despite lower employment figures, affected the labour market situation the most, by transferring the correlation of wages earned by skilled vs. unskilled workers to the services sector. However, the impacts of further restructuring of industry and farming are likely to decrease. At present, in the most developed economies, the share of services in the overall employment amounts to 70%, and in Poland it is ca. 60%. At the same time, in the US the proportion of industry in the overall employment is less than 10% (and ca. 30% in Poland). Hence, the future situation of the services sector is a core factor affecting employment and remuneration. It is good to use the lesson learnt from the history of industrial revolutions when similar changes take place. Depending on its type, the process in phase II might either be performed by robots, or by computers. A human being will only be in charge of preparation of the machines in phase I.

However, we should not use the experience of historical change on the services market unconditionally, nor extrapolate the knowledge about automation of services gained over the past thirty years. Even if so far the prevailing tendency was to reward skilled workers, this trend may reverse in the coming years. Computers will also substitute skilled labour force by allowing some tasks to be performed by unskilled workers, as long as they are computer-literate.

Regardless of the extent to which the specialist skills are rewarded, in the world predominated by modern technologies, requirements towards employees are changing radically. This topic was described by Tyler Coven in his book (2013). He pointed out to the three core competencies which must be mastered by

**Box IV. 3. Zero-marginal product workers**

Zero-marginal product workers are individuals who would like to find jobs, but who are incapable of working. From the employers' point of view, they are regarded as having zero or negative productivity. What a zero-marginal product worker could offer does not offset the risks faced by the entire production chain if he or she fails. Also, there exist some external hazards caused by his or her impact upon the social environment or the team's morale.

The proportion of zero-marginal product workers is similar to that of candidates who, according to HR specialists, are not suitable for a given job, regardless of the type of position or salary. In the US this problem has intensified over the past years. This phenomenon could be analysed in the context of military service readiness. According to an alarming report entitled Mission: Readiness (2009), 75% of people aged 17-24 are incapable of a military service. The main reasons are obesity, lack of secondary education and criminal past. Other factors include alcohol and drug abuse.

The military service is more demanding than a civilian career. However, if a candidate visibly shows any of the above characteristics, it is rather unlikely for him to be hired by a potential employer. All these problems are likely to intensify in the future. On the one hand, it would be much easier for prospective workers to become professionally useless (in the past, getting fat or long-term unemployed due to economic reasons was more difficult), and, on the other hand, the employers' expectations regarding discipline, meticulousness and ability to work as part of a team, will grow higher.

*Source: own elaboration*

anyone who would like to continue his or her professional career in the ICT age. These include, in particular: diligence, teamworking skills and creativity. Those who are incapable of mastering these skills might face difficulties in getting jobs, and as a consequence, become zero marginal product workers (Box IV.3)

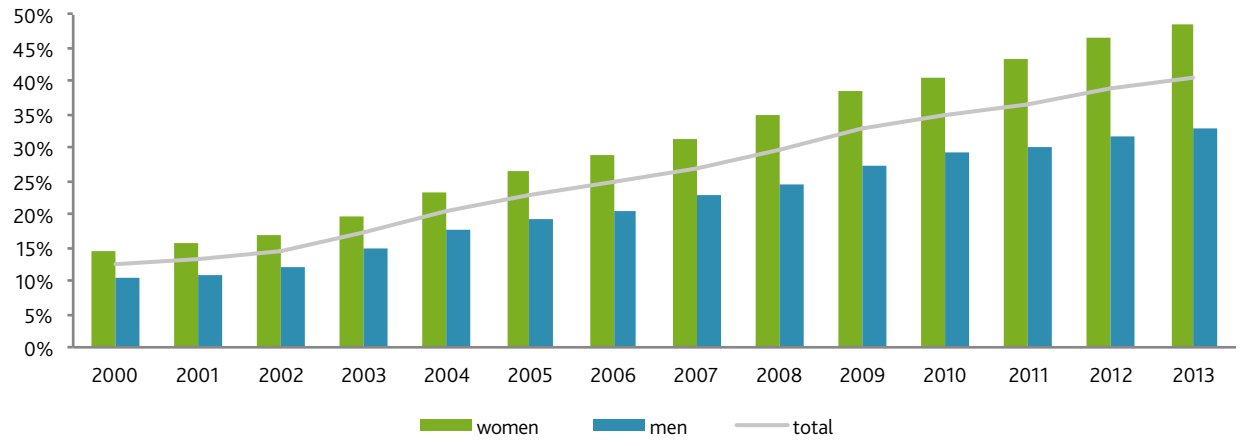
The labour market nowadays already rewards workers for their meticulousness, diligence and discipline – and this tendency is likely to intensify in the future. However, we should not perceive meticulousness and creativity as contradictory, as both these attributes will be equally valued, although according to the majority of labour market participants the former one will more often be a guarantee of getting relatively stable and well-paid job.

Rewarding such attributes as diligence and discipline is a consequence of increased specialisation and extension of cooperation across companies and workers. An average worker is becoming less and less aware of his role in corporate production processes, and may be also unaware of the products of his work. Therefore, diligence i.e. the ability to precisely follow the procedures, and timeliness are necessary attributes. Diligence is also very important in the service sector. Babysitters, caretakers or concierges should, first of all, be worthy of trust – in this case reliability becomes the main token of the quality of service.

Considering the fact that the knowledge needed for successful implementation of a project can be quite dispersed, teamworking ability is also necessary. Otherwise, coordinating and allocating tasks would be very difficult, even if everyone meticulously performed their part of work. In the case of multinational working teams, of core importance is the knowledge of foreign languages, especially the English language.

Psychological research and workplace experience have proven that women attain better results both in terms of diligence and teamworking skills. In this respect, they are much better prepared to face the challenges of the new economy than men. Statistically, apart from achieving better mean results, women

Figure IV. 10. **Holders of university diplomas aged 30-34, according to gender; 2000-2013**




*Source: Eurostat*

also obtain university diplomas more often. In 2010 36% of women and 29% of men were university diploma holders. Meanwhile, men used to more often go to prison or abandon schools. In Poland, such disparity is even more visible i.e. the proportion of university graduates among women aged 30-34 is nearly by a half higher than in the case of men. At the same time, over the past few years, the change dynamics in the case of men decreased significantly (Figure IV.10), which may further increase the existing gender differences in the case of education.

Those individuals who find it hard to work as part of a team, or to perform their work meticulously, may still choose to follow the path of creativity. According to Brynjolfsson and McAfee (2014), asking non-standard questions, inventing new ideas, discovering human cravings, anticipating emotions, composing flavours, images or sounds will remain important and valued fields of activity. Although such skills are governed by the rules of the superstar economy, it cannot be predicted in advance, how large the generation of creators will be. It depends on how much they will be appreciated by their surroundings and, in particular, on their educational profiles.

For many participants of the future labour market it will be very important whether they join the well-earning and skilled elite, or end up as common workers. For sure, the proportion of workers for whom such dilemmas will be meaningless will also increase. This applies to the so-called threshold workers, who would be happy to get an average salary, deliberately giving up their professional ambitions in order to have more leisure time. They will only work as much as it is necessary to afford pursuing a humble lifestyle. They might compensate their below average incomes by living in cheap suburbs, shopping for food at discount stores, and buying their clothes or furniture at second-hand outlets. If the state continues to provide them with healthcare, education and public transportation, they will be able to maintain a standard of living regarded as high, as compared to past generations.

## 2.3 PROFESSIONS THAT ARE LIKELY TO DISAPPEAR

By far, technological unemployment mostly applied to those sectors where employees performed routine, repeatable and uncreative jobs, which did not require any intellectual effort. Such tendency is definitely likely to be continued. Together with a new wave of technological revolution, occupations that have been unthreatened so far, may vanish from the labour market in the nearest future. According to some researchers, the factors that speed up the substitution of humans by machines include (Ford 2009, Brynjolfsson and McAfee 2014):

- repeatability of processes – unlike humans, machines never feel tired, and their level of precision does not deteriorate in time. Similarly, they are not put off by any jobs not giving them any chance of professional advancement or personal development.
- Existence of a pattern – having a pattern allows for repeating and structuring work, and comparing the working results attained by a machine; transparent and programmable procedures make robots less expensive as workers, especially due to the fact that there are no restrictions regarding the timing and working conditions.
- Use of physical strength – due to an absence of limitations resulting from physiology or law.
- Jobs with a high risk of injury – the costs of a destroyed machine pale in comparison to those of human life.
- Self-servicing functionality – provided that the interface is not complex so it can be operated by the customer.

For example in case of a radiologist's job, which requires long-term education, we can notice a number of recurrent, algorithmic elements that may be easily arranged into patters

**Box IV.4. Moravec's paradox**

*Encoded in the large, highly evolved sensory and motor portions of the human brain is a billion years of experience about the nature of the world and how to survive in it. The deliberate process we call reasoning is, I believe, the thinnest veneer of human thought, effective only because it is supported by much older and much more powerful, though usually unconscious, sensorimotor knowledge. We are all prodigious Olympians in perceptual and motor areas, so good that we make the difficult look easy. Abstract thought, though, is a new trick, perhaps less than 100 thousand years old. We have not yet mastered it. It is not all that intrinsically difficult; it just seems so when we do it*. (Hans Moravec)

Moravec's paradox is a statement that mathematical reasoning, a process complex for humans, but quite routine, demands little processing power, whereas reverse engineering of perception or motor skills typical for every human is a much more demanding challenge. For example, for a robot equipped with artificial intelligence it will be much easier to master chess rules, than to recognise a human face. On the other hand, while only few people are capable of calculating in mind the product of two six-digit numbers, even the most advanced speech recognition algorithms still find it hard to match a toddler in recognising human speech.

The demarcation line between the jobs that will or will not be automated and performed by machines is not going to overlap with the division into 'manual' vs. 'intellectual' labour. Steven Pinker, a famous Canadian psychologist, exaggeratingly remarked that: "as the new generation of intelligent devices appears, it will be the stock analysts and petrochemical engineers and parole board members who are in danger of being replaced by machines. The gardeners, receptionists, and cooks are secure in their jobs for decades to come."

*Source: own elaboration*

and, finally, automated. At first, American radiologists used to be replaced by their Hindu colleagues, but after some time, the demand for such professionals decreased, since there emerged computer programs capable of performing their work properly, yet, at much lower costs. Also an experiment that has been conducted among American lawyers has shown that in the case of certain tasks, regularity of machines brought about better results, which implies that such profession is likely to be automated as well (cf. Brynjolfsson and McAfee 2014).

Moravec's paradox shows that, compared to a radiologist's profession, the jobs performed by a mechanic or a gardener are much more difficult to reverse-engineer, since in such cases the lack of skills is replaced by advanced finger dexterity that has not yet been mastered by robots. Other features that make it harder for robots to replace humans include (Ford 2009, Brynjolfsson and McAfee 2014):

- Use of senses – it is still an obstacle for robots, despite ongoing studies. The sight and the hearing are relatively easiest to reproduce by machines. Besides, modern robots also react to touch, although they often cannot reproduce it themselves which makes them less useful as massagers or full-time babysitters. The smell and the taste are most difficult to be adapted.
- Making references to emotions, values and unobvious connotations – an ability which is difficult to be reproduced, and constitutes a key advantage of humans over machines in any occupation where empathy or artistic talents are used.
- Creativity, enterprise or initiative based on an ability to take non-standard decisions in response to diversified information, which goes beyond algorithms.
- Efficient use of machines – sophisticated analyses that require an ability to process, interpret and visualise various datasets.
- Prototyping – inventing new robots and algorithms through the creative use of existing technologies.

However, overcoming Moravec's paradox may just be a matter of time. A dozen or so years ago there was a widespread belief that in order to safely drive a car, one must necessarily use certain human skills. The tests described in subchapter 1.2 have proven that full automation of the transportation industry in the nearest future, thanks to hi-tech sensors and quick information processing, is quite a realistic scenario. Further in this chapter we will go beyond such examples, using a quantitative analysis of occupational (and economic) susceptibility to automation, based on WISE SARA model (Bitner, Starościk and Szczerba 2014).

Based on WISE-SARA model, which measures the automation risk, we have divided occupations in Poland and Europe into the following three groups: automation-resistant group where the automation probability ratio is lower 30%; moderately automation-prone with the probability ratio of 30-65%, and highly automation-prone (the probability of ca. 65-100%). Table IV.5 presents the list of twenty most popular occupations in Poland that are most automation-prone, taking into account their labour market shares.

## Box IV.5. WISE SARA model

The American O-NET database includes over 900 occupations, specifying their attributes and their quantitative characteristics. The attributes presented in Table IV.4, are those upon which the econometric study of occupational proneness to automation has been based.

Table IV. 4. **Selected attributes from O-NET database, also including those finally used in the model**

| Attribute | Description |
|---|---|
| *Persuasion* | An ability to persuade others, and make them act in accordance with our interests |
| *Finger dexterity* | An ability to make precise movements with one's hands in order to catch, carry and assemble tiny objects |
| *Originality* | An ability to come up with nonstandard ideas about a given situation or subject, and to find new methods of solving a problem. |
| *Critical thinking* | An ability to use logical and structured mode of thinking in order to identify the strengths and the weaknesses of a proposed solution or approach. |

*Source: own elaboration based on O-NET database*

The probability of automation has been measured by means of a logit model. At the beginning, dummy variables related to automation proneness were ascribed by the authors to 90 occupations accounting for 10% of the dataset, which had been selected in such a manner as to ensure representatives of the total sample. The variables were treated as a learning dataset for the purpose of assessment of model parameters. Next, on the basis of an estimated automation probability formula, the obtained results were extended across the whole sample.

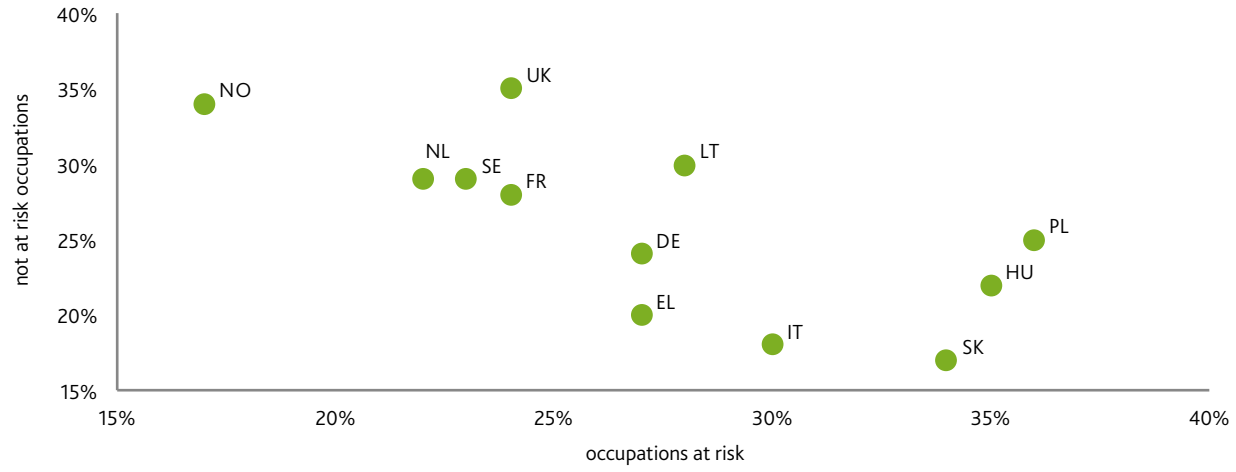
*Source: own elaboration based on Bitner, Starościk and Szczerba 2014*

## Table IV.5. Most automation-prone professional groups in Poland

| Occupation | Automation probability | Number of workers (thousand) | Proportion of workforce | Possible replacements |
|---|---|---|---|---|
| Lorry and bus drivers | 0.81 | 342 | 3.21% | Self-driving vehicles |
| Machine operators | 0.67-0.99 | 316 | 3.0% | Autonomous machines |
| Blacksmiths, locksmiths, etc. | 0.69 | 308 | 2.89% | 3D printers |
| Domestic help and cleaning staff at homes, offices or hotels | 0.92 | 302 | 2.84% | Cleaning robots |
| Security guards | 0.70 | 298 | 2.79% | Cameras, guard robots |
| Office workers | 0.68 | 256 | 2.40% | Computers |
| Clerks and qualified secretaries | 0.98 | 172 | 1.62% | Computers |
| Passenger car, delivery van and motorcycle drivers | 0.76 | 171 | 1.60% | Self-driving vehicles |
| Fitters | 0.82 | 165 | 1.55% | Fitting robots (?) |
| Food processing industry workers, etc. | 0.99 | 159 | 1.50% | Automated production lines |
| Garment manufacturing workers, etc. | 0.68 | 148 | 1.39% | Automated production lines |
| Foundry workers, welders, sheet-metal workers, fitters of metal structures, etc. | 0.69 | 142 | 1.34% | Welding robots |
| Auxiliary workers in mining and construction sectors | 0.91 | 141 | 1.32% | Robots performing construction works, mining robots |
| Chefs | 0.68 | 129 | 1.21% | Cooking robots (?) |
| Other workers performing simple tasks | 0.78 | 109 | 1.03% | Adequate robots |
| Monetary transactions staff | 0.98 | 96 | 0.90% | Automatic cash registered, non-cash transactions |
| Train drivers, train dispatchers, etc. | 0.87 | 78 | 0.73% | Self-driving trains |
| Checkout staff | 0.87 | 76 | 0.72% | Selling robots |
| Auxiliary workers in goods transportation and storage | 0.85 | 64 | 0.60% | Warehouse robots |
| Customer information staff | 0.96 | 64 | 0.60% | Recorded information, modern IVR systems |

*Source: own elaboration based on Bitner, Starościk and Szczerba 2014*

## Figure IV.11. Automation- and robotics-related threats to the labour markets in Europe




*Source: own elaboration based on Bitner, Starościk and Szczerba 2014*

The automation proneness is highest in case of those jobs that have most repetitive and routine nature i.e. checkout staff, security guards, car and train drivers, warehouse and industrial workers. We predict that in the future people performing such jobs will be entirely replaced by robots. Other occupations will not utterly disappear, but will undergo far-reaching transformations, calling for new skills. Such transformation processes will either imply lesser employment, or a change of the job's specificity (and, most frequently, both of these). The reduction of employment will probably affect such groups as blacksmiths, locksmiths or operators, as part of their duties will be taken over by the machines. Meanwhile, cleaners might not lose their jobs if, thanks to the use of cleaning robots, they will reduce their service prices, thus attracting new customers. Despite a growing range of robot vacuum cleaners etc., there are still many cleaning jobs that require human labour force, and as the society grows more and more affluent, the demand for such services will increase. A simultaneous employment decrease and transformation of working methods can be expected in the case of white collar work, which will rely more and more upon digitalisation and data processing, and a number of tasks will be changed into algorithmic patterns.

The professional groups presented above account for ca. 30% of the Polish labour market. Based on this model, we can assume that in the nearest future every third working Pole will be threatened by either transitory, or structural technological unemployment. Meanwhile, in Europe the proportions of those who are at risk are diversified (Table IV.6). Norway, the rating's leader, has significantly outpaced the other countries, by having the lowest number of threatened occupations, and the highest number of secure ones. It is followed by other most developed countries, which implies that, unlike the countries in our region, such countries have already taken the next step forward in technological revolution and initiated certain adaptation processes on their labour markets. This is confirmed by a markedly negative correlation (-0.85) between the labour market risk ratio and per capita GDP, a proxy of economic development.

The Polish labour market awaits a profound transformation, as the restructuring of the services sector is coupled by our underdevelopment in the field of automation. Preventing of a double reallocation of staff i.e. from industry towards automation-prone services and, ultimately, towards automation-resistant services, would be a reasonable option.

## 2.4 PUBLIC POLICY IN THE CONTEXT OF TECHNOLOGICAL UNEMPLOYMENT

According to WISE SARA, all European countries will face the problem of transitory technological unemployment. However, the model does not predict where transitory unemployment will transform into structural one i.e. where incompatibilities between skills and salary expectations will become a generational issue. Obviously, the countries that have reported the highest ratios of automation-prone occupations (including Poland) will be most threatened. The extent of such transformation itself does not have to constitute a problem, if the process can be carried out relatively smoothly. All in all, at least one of the following conditions will need to be fulfilled:

1. The workers should have such sets of skills that would enable them to find new jobs easily.

**Box IV.6. Automation- and robotics-related threats in the face of aging labour force**

Regardless of the ICT shock, the Polish economy is facing new challenges related to negative demographic changes, which are occurring in an increasing scale. Average number of children per woman fluctuates around 1.3, while the replacement rate exceeds 2.1. Simultaneously, average life expectancy after retirement increases, leading to an increasing share of the elderly in society. According to the European Commission forecasts, in 2060 labour force will shrink by 6.22 million, which equals to ⅓ of the current stock.

This is an amount close to the number of the endangered by the effects of automation and robotization estimated by the WISE SARA model. It can therefore be assumed that such a strong shrinkage of the labour force will have a soothing impact on changes associated with automation and robotization - especially due to the fact, that many physical jobs at risk of mechanization are definitely less frequently performed by older people. Fewer number of young people, who work physically more frequently than seniors, means also smaller redundancies in this segment as a result of robotization.

Among occupations classified by model as a free of risk of automation, the effect of population ageing will vary depending on the profession. For example, demand for health care professionals is likely to grow as population becomes older. This is an area with low probability of substitution by machines and only supportive role of machines in improving humans' tasks. It is easy to imagine that even if there was a breakthrough in the diagnostics, patient care will still be performed by people. On the other hand, due to decreasing percentage of children in population, demand for teachers and professors at all levels of education will diminish. It is worth noting that currently teachers are a very large professional group and students of education-related courses are the third--largest group among all students.

*Source: own elaboration*

2. Purchasing of goods and services that might be produced by the dismissed workers, even not demanding any valuable skills, by other workers should be made easier.

3. The workers should be retrained in a way making them attractive for new industries.

Let us now discuss each condition in detail, focusing on what can be done in order to fulfil it.

Workers' skills are a derivative of their education and professional experience. Assuming that a given profession (or industry) in which a worker has been employed, disappears as a result of the ICT revolution, his or her professional experience might not be useful when searching for a new job. Hence, in case of workers shifting from one sector to another, the skills learnt at subsequent levels of education are of key importance. Although education demands immediate investments, and its profits may be deferred for many years, investing in it may turn out to be the least expensive strategy of combating technological unemployment. This topic has been covered more broadly in chapter 4.4.

Even if solving the problem of technological unemployment by providing workers ex ante with adequate skills turns out to be impossible, it does not follow that such problem cannot be solved by other means. The dismissed workers may also perform jobs which do not require any specialist skills. This may happen relatively fast if they are willing to compromise on their salary expectations. However, this would neither be desirable from the workers' point of view, nor in view of the entire economy. Getting higher remuneration for work that addresses the actual market needs more precisely would be a better solution.

Raising salaries in the case of services performed in person by humans (according to chapter 2.1. it is the area where new jobs will be created) will only be possible if affluent customers start competing for such services. This affluence is a manifestation of nothing else than productivity of the economy. The economic growth stemming from technological innovation and accumulation of capital will also support, in a long run, those who have lost their jobs as a result of it. Paradoxically, innovation is not only a source of labour market difficulties, but also their cure. This cure works through increased productivity and, implicitly, growing purchasing powers of innovators' and their surroundings. In this context it is important for Poland to become an innovator, instead of being a passive user of innovation only. As a matter of fact, backwardness is not a good protection against negative impacts of innovation, and giving up the profits of being a leader, also takes away the chances for the labour market improvement. Considering the above it seems very important to have an innovation policy in place, as discussed in more detail in chapter 4.3.

Providing individuals looking for jobs with new skills may also be regarded as a public policy task. However, looking at the poor efficiency of the public training programs conducted so far, one may naturally feel quite sceptical. Americans have had extremely bad experience in this area (Lafer 2001), but in Europe the situation has not looked much better. Apart from the so-called lock-in effect i.e. lowering of the chances of getting a new job during the training, another issue relates to its poor long-term effectiveness. In France (Crépon, Ferracci and Fougère 2007), no long-term effects of trainings on re-employment were reported. However, the periods of staying employed increased in the case of those who had finally managed to find a job. In Germany (Lechner and Wunsch 2006) trainings had visibly positive effects, however they were perceived as quite expensive, so one can question cost/benefit ratio here.

The most detailed study was conducted in Switzerland (Gerfin and Lechner 2002), where effectiveness of specific types of trainings was analysed. Computer courses scored relatively well, and the worst results were reported in case of languages. Generally, many trainings had no influence on the probability of reemployment. According to the authors, instead of paying for retraining courses, a better option would consist in offering payroll subsidies in order to enable the unemployed to reassume employment immediately, and shift the possible retraining costs to the employer. The findings obtained from the Swiss study are consistent with the main argument formulated by Lafer (2001). He points out that the majority of occupations fall into either of the following two categories: those which can be learnt while working, and those which demand specialist skills. The former do not require any prior trainings. The latter, however, demand specialist knowledge that can only be learnt at universities, and not during free trainings, even if such trainings take up several months. Hence, even if initial payroll subsidies in case of workers whose former professions no longer exist are worth considering, education is still the best response to workplace automation. It is the only way to both improve employees' flexibility (by developing necessary skills in advance) and provide them with specialist qualifications.

From the point of view of technological unemployment, matching efficiency is also important due to the fact that access to adequate human resources, might be an important barrier for entrepreneurs effectively preventing them to sell their product to customers. In many cases, it is an employee's personality that makes customers willing to buy specific goods or services. On the other hand if the job seeking process becomes more effective, workers would not have to compromise their pay expectations too much, as they would be redirected to the positions where they are most needed. This is another argument in favour of the facilitation of recruitment processes.

The experience with public institutions so far has been even worse than in the case of trainings, which can be explained (Box IV.6). In Europe, except for Germany, the role of public employment agencies in the recruitment process is marginal, and even in Germany the proportion of workers who have found new jobs thanks to public job placement agencies is only 12%. In Poland only one of eight job vacancies is processed via employment agencies, and nearly 70% of companies have never used public job placement agents (Tyrowicz 2013).

Fortunately finding new career opportunities may be also greatly helped by technical innovation. ICT technologies allow for giving job placement processes a new dimension. The radical change of the labour market brought by the Internet was envisioned over ten years ago (Autor 2001). The advantages that were highlighted included lower costs of job ads, compared to paper data carriers, easier viewing and filtering of ads by potential candidates, or possibility of including more extensive specifications of jobs and skills. On a long term basis, algorithmic methods of aligning personnel with jobs were considered. All these tools were supposed to improve the efficiency of recruitment processes.

The beginnings of e-recruitment used to be difficult (Diagram IV. 3). A dozen or so years had to pass, after launching of the most famous American online job placement agency Monster in 1995, before the breakthrough happened. The first studies (Kuhn and Skuterud 2004) used to present online methods as counterproductive. According to authors, this was due to the informational asymmetry of the modern media and negative selection resulting in an overrepresentation of undesirable workers. Meanwhile, according to Kraft and Pope (2014), the inefficiency of placing job ads online could be attributed to the fact that extended job descriptions do not help to shorten the period of staying out of job. It is understandable, that thanks to

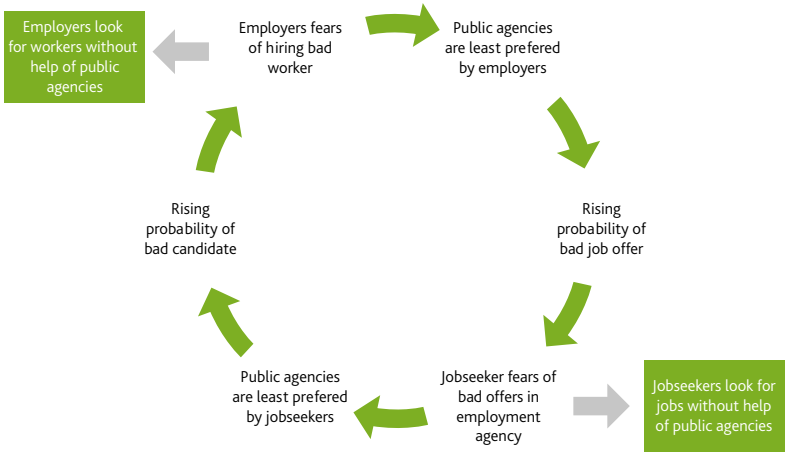
## Box IV.7. Support of the recruitment processes by labour offices

According to Larsen and Vesan (2011), imperfect fulfilment of job placement roles by labour offices has deeper grounds – such institutions are ineffective in nearly all countries. The authors point out to the fact that the mission fulfilled by labour offices in the light of informational asymmetry makes them doomed to fail as job placement agencies:

- Labour offices must provide assistance to all individuals seeking for jobs, who, in other circumstances, would find it hard to get employment.
- Labour offices may not refuse to assist employers who would like to hire staff through a job placement agency.
- Labour offices are obliged to register the unemployed who are automatically entered on the list of human resources. As a consequence, an employer may get involuntarily entangled into a game between the unemployed and the employment agency, in connection with benefits that are payable to the unemployed actively searching for jobs.
- The problems related to using state employment agencies may be avoided by choosing the service offered by private job placement agencies or informal channels.

As a result, a vicious circle (see the diagram below) is created, which leads to the situation when agents are mostly approached by problematic workers and unfriendly employers.

### Diagram IV. 2. Vicious circle of the state employment agencies




*Source: own elaboration based on Larsen and Versan (2011)*

Neither solution seems to be capable of breaking the vicious circle. Although improvement of the quality of interactions between officers and employers may improve the situation, yet, interviews with the employers in the countries where such attempts were made, have indicated that that the scope of positive changes is limited. Meanwhile, monopolisation of state labour agencies, although it would reduce the risk of negative selection, would generate a number of problems, as it happened in Italy (Ferrera and Gualmini 2004). Finally, the authors suggest that labour offices should cease to perform the agency roles, and unemployment benefits should depend on active searching for jobs, rather than on the results of such search. However, this solution has one drawback – it is not a step ahead towards a more effective job intermediation, which is definitely needed by some labour resources.

*Source: own elaboration based on Larsen and Vesan (2011)*

the popularity of Craigslist local ads website, the period needed to find tenants for an apartment was reduced by three weeks (ca. 25%). This is due to the fact that pictures of apartments can be published online, which radically speeds up the selection of the most attractive offers. However, in case of job ads, it is difficult to pinpoint any such key feature that would immediately attract employers.

The more recent studies by Kuhn and Mansour (2014) present a more optimistic view. While in 1998-2001, people who were searching for jobs online were more often regarded by employers as problematic (which adversely impacted upon the period of staying unemployed), similar studies conducted in 2005-2008 indicated that the period of seeking jobs online shortened by 25%. Most probably, over the past years online job search has become the strategy most often adopted by the unemployed. In the US in 2000-2008 the proportion of the unemployed searching for jobs online increased from 24% to 74%. Systematic upgrading of functionalities of online job placement agencies also reduces the incidence of negative selection, by reducing informational asymmetry.

Overcoming of the initial barriers will give us a chance to use the advantages of the second phase of e-recruitment, by exploiting the full potential of the ICT (Diagram IV. 4). Such advantages would include, first of all, the possibility of gathering data of the users i.e. employees and employers, and of effective searching through such datasets in order to better align people with jobs. These developments will still take some time to occur, and by far no spectacular successes have been reported in the US. Hence, it is rightly to conclude that the second phase of e-recruitment is only at its preliminary stage.

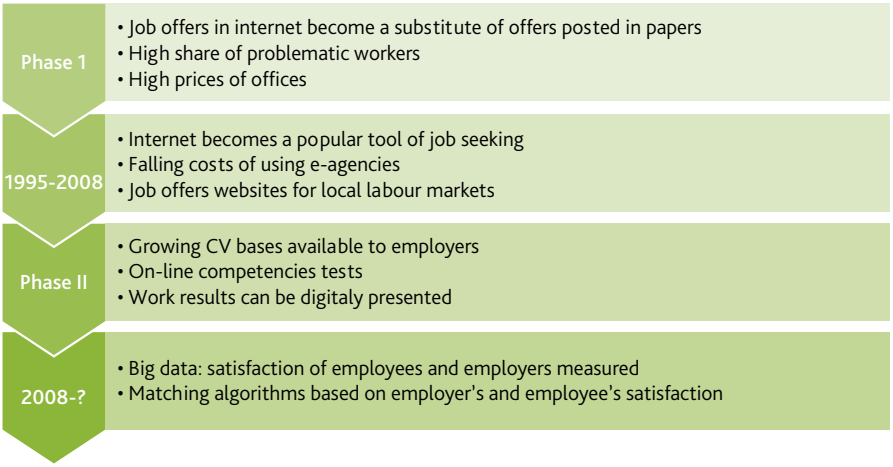
Poland tends to lag behind in terms of such transformation processes. According to a study conducted by the National Bank of Poland (Tyrowicz 2013), not only labour offices are ineffective, but the entire job placement system in Poland does not work. Only 2 out of 5 employers use media to search for workers, and only several percent of them take advantage of the professional support. Small companies and microenterprises are most passive. Obviously, the prices of such services could be an obstacle. For example publishing of a 30-day job ad on a popular Polish website would cost an equivalent of a half minimum wage, and adding extra features further aggravate the costs. On the other hand, only 2.3% of the unemployed take advantage of the national CV database. Others use the internet in the same way as press ads. Meanwhile, passive employment placement consisting in providing valuable information via modern channels is a chance for counteracting negative selection and informational asymmetry.

E-recruitment has an enormous potential, which means that supporting it in Poland would be advisable. Such support could assume the following three forms:

- Financing of a public e-recruitment platform that would be available at a small charge to employees and employers (e.g. from the EU funds allocated for HR development).
- It could be a multinational initiative based for example upon EURES network, including EEC job vacancies. However, implementation of this idea may be problematic, as the public sector may not be an adequate partner in the case of innovative ICT projects.
- By creating a free website, modelled upon JobCentral.com established in 2001 by prospective employers. This initiative was taken in aim to curb down corporate e-recruitment costs, which could be its direct benefit.
- By supporting establishment of any such website by NGOs, including trade unions, which should become interested in such an initiative just to improve their reputation.

If no actions are urgently taken by public institutions or NGOs, which dispose of sufficient resources, we will need to wait for

Diagram IV.3. **Development of e-recruitment methods**




*Source: own elaboration based on Nakamura et al. (2009)*

Diagram IV.4. **E-recruitment benefits**


*Source: own elaboration*

a dozen or so years to see the recruitment processes in our country revolutionised. Otherwise, such a revolution could support economic changes in the coming two or three years, by minimising their adverse impacts. However, each of the above solutions requires robust ICT partners and a good knowledge of functions offered by the US websites, which have practically monopolised modern e-recruitment processes all around the globe i.e. Monster and MonsterTRAK, or its division enabling search of the most talented graduates, CareerBuilder or HotJobs.

# 3 THE NEW AGE OF INEQUALITIES

The impact of modern technologies upon social inequalities is one of the most widely discussed topics in the context of current and future consequences of ICT shock. The present chapter will start with a review of inequality dynamics in OECD countries over the past thirty years. Then we will present a number of hypotheses explaining the reported inequality growth. Finally, we will juxtapose selected hypotheses against empirical data. Decomposition of impact of the two key factors i.e. ICT shock and globalisation upon inequality, deserves particular attention.

## 3.1 DIVERSIFICATION IN OECD COUNTRIES

Co-existence of inequality growth and ICT expansion is an unquestionable fact. Since the end of 1970s inequality ratio measured as the proportion of 10% of the highest income earners in the overall income increased in the Western Europe, the US, Canada and Australia. Although the largest increases in the share 10% of the most affluent earners were reported in the US and Portugal, this phenomenon also occurred in Sweden and Finland, countries which are commonly perceived as egalitarian.

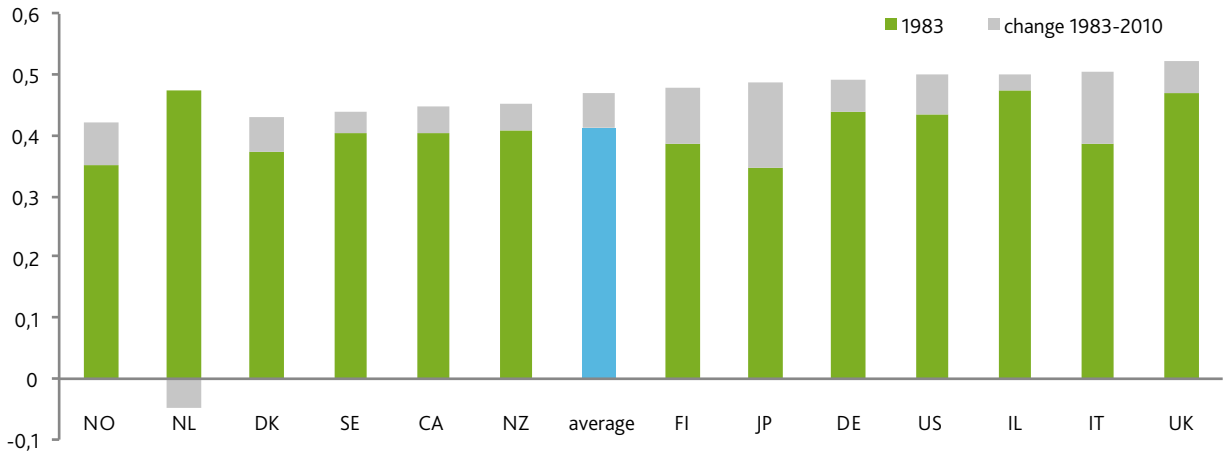
In almost all analysed OECD countries the value of the Gini coefficient increased (Figure IV.11.). However, while income inequalities on a national level aggravated, disproportions across specific countries decreased. Norway which in 2014 reported the lowest income inequalities would not look impressive, if assessed in accordance with the 1970s's standards. On the other hand, the countries which reported the highest inequalities in the mid-1980 (the UK, Israel and the Netherlands), experienced only insignificant increases in inequality, or even its decline.

In view of certain limitations of the Gini coefficient (non-resistance to strongly divergent results), the ratio defining the correlation between 80$^{th}$ percentile vs. 20$^{th}$ percentile income HHs appears to be more informative. In this case, national differences are much more visible, but the key results of comparisons of the Gini coefficient hold: each OECD country (apart from Turkey) reported inequality increase, and, on average, the lower such inequality was at the beginning of the 1980s, the more it increased. As a consequence, the countries with relatively flat income structures now are much closer to the average. However, it did not substantially affect their sequence on the list.

The growing inequality trend is observable not only in the most developed countries – it is visible all around the world. This observation is made irrespective of the data aggregation method – either considering geographical location, or the level of economic development. Exceptions to the rule include Sub-Saharan Africa, and the post-communist Commonwealth of Independent States (CIS). This phenomenon has been illustrated in Figure IV.13.

Such phenomenon allows us to arrive at a number of conclusions. First of all, inequality increase is attributable to the increase in the proportion of 20% of the most affluent earners in the overall income (with even more spectacular increase in the share of the most affluent 1%). The middle quintile has shrunk, and the proportion of the poorest 20% has remained unchanged. Inequalities increased most of all in the countries attaining high and medium income levels, while in the least developed countries the changes – although also to the negative

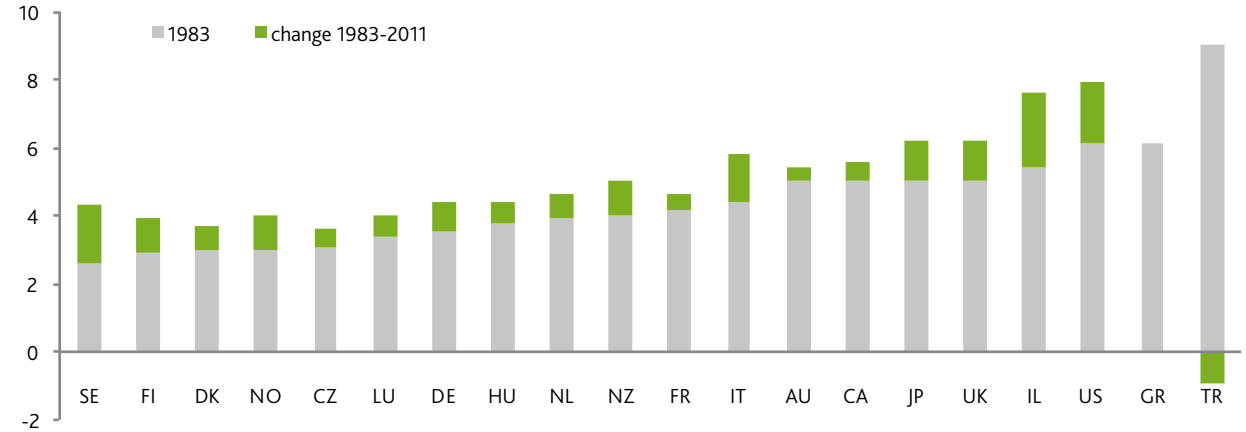
Figure IV.12. **The Gini coefficient's change in OECD countries; 1983-2010**




*Comments: using the unweighted average*

*Source: own elaboration based on OECD figures*

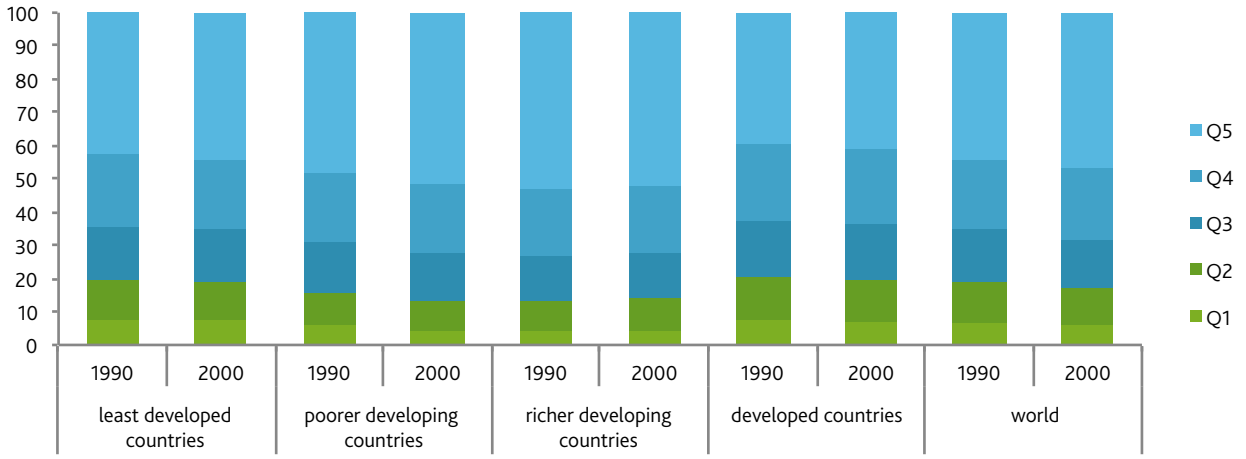
Figure IV.13. **HHs income diversification in OECD countries; 1983-2010**




*Notes: P80:P20 indicator has been used*

*Source: OECD*

Figure IV.14. **HHs income structure; 1990, 2000**




*Source: own elaboration based on OECD (2007)*

– have turned out to be marginal. Further in this chapter we will present a number of hypotheses explaining inequality increase in the contest of the ICT revolution and globalisation (Box IV.8).

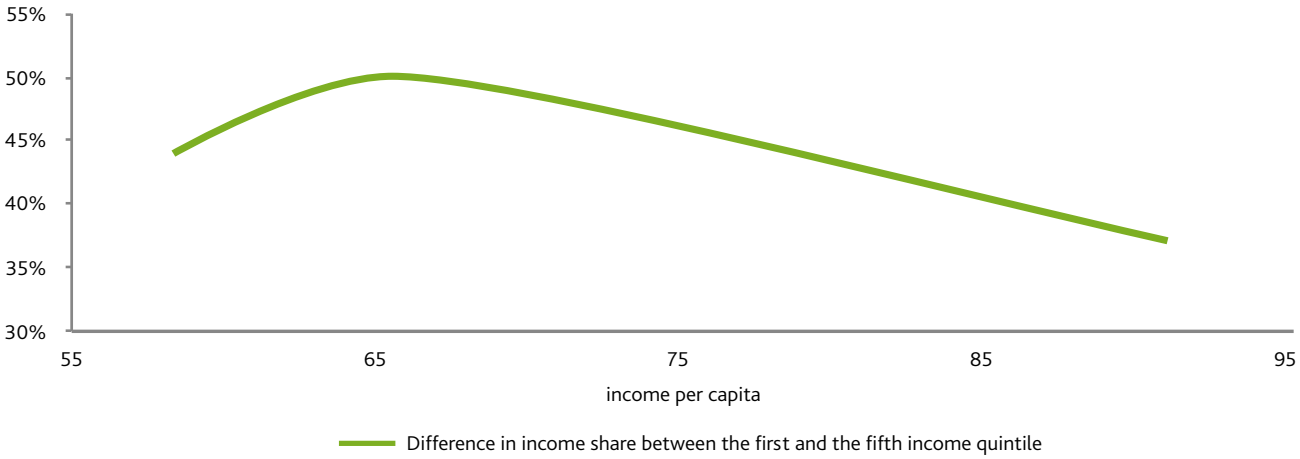
## 3.2 EXPLANATION ATTEMPTS

### 3.2.1 THE KUZNETS CURVE HYPOTHESIS

A founding father of the contemporary theories linking technological development (or, more broadly, economic growth) with inequalities was Simon Kuznets. In his view (1955) the interdependency between economic growth and inequality can be presented in the form of an inverted U curve (cf. Figure IV.14). Initially, due to technological advancement, the level of inequalities increase, however, after some time, the tendency is reversed. According to Kuznets, this interdependency is attributable to the changing sectoral structure of employment .

At the first stage, the leading role in an economy is played by agriculture, a sector where inequalities are much lower than in the case of industry and services, but which visibly lags behind the cities in terms of productivity and income. Hence, the overall inequality level depends on diversities within employee groups and across sectors. As the Kuznets curve ascends, when urbanisation and industrialisation processes are still fledgling, of key importance are intra-group differences i.e. low income diversification in agriculture. The decreasing proportion of farmers corresponds to greater inequality. At some point, however, relatively unproductive farmers also become a source of inequality since they earn less than city dwellers. The further decrease of their proportion in the overall employment improves the status quo, subsequently leading to a decrease in inequality, mostly due to a decrease in the proportion of the most affluent earners in the overall income. By shifting to more productive sectors, farmers improve their share in the overall income, hence, leading to decreasing of the proportions of other workers, also including the most affluent earners.

Figure IV.15. **The Kuznets curve**




*Source: own elaboration based on Kuznets (1955)*

Although in the majority of developed countries, the process described by Kuznets ended long time ago (the share of agriculture is insignificant), the Kuznets curve theory, in its broader sense, may also apply to contemporary economies. Having this in mind, Goldin and Katz (2008) illustrated how the unprecedented development of subsequent levels of education used to counterbalance the impacts of new technologies upon inequality in the US until the 1970s. Their approach assumed that there existed the following two sectors: (1) old and less productive economy (today associated with low ICT-intensive sectors), and (2) more productive mechanised sector (equivalent to automated or computerised sectors of today). At first, labour force is employed in the first sector only, but as new technologies emerge, they start to shift across sectors. The proportion of income attained by those employed in the mechanised sector grows, leading to greater inequality. However, if the flow of workers continues, inequality will ultimately start to decrease. Just like in the case of Kuznets' theory, specific sectors are separated by cultural or mental barriers, overcoming of which takes some time. A skill barrier is yet another factor – first of all it applied to secondary education (1st half of the 20th century), and then to college degrees (2nd half of the 20th century).

The Kuznets curve theory may also apply to the Polish experience in the period of transformation. The first sector is composed of those industries, enterprises and workers that failed to adapt themselves to the market economy, and the second one includes those entities which were capable of adjusting themselves to the new system. Hence, at the beginning of the transformation period inequalities should increase, in order to drop down later on. In any economy there may be a number of similar processes with corresponding Kuznets curves, whose consequences tend to overlap. In Poland there are at least three such processes – apart from the transformation, we are still dealing with an unfinished process described by Kuznets (13% of workers hired in agriculture) and, obviously, the ICT shock. Hence, it can be expected that in terms of income inequality dynamics, Poland will substantially differ from more developed countries.

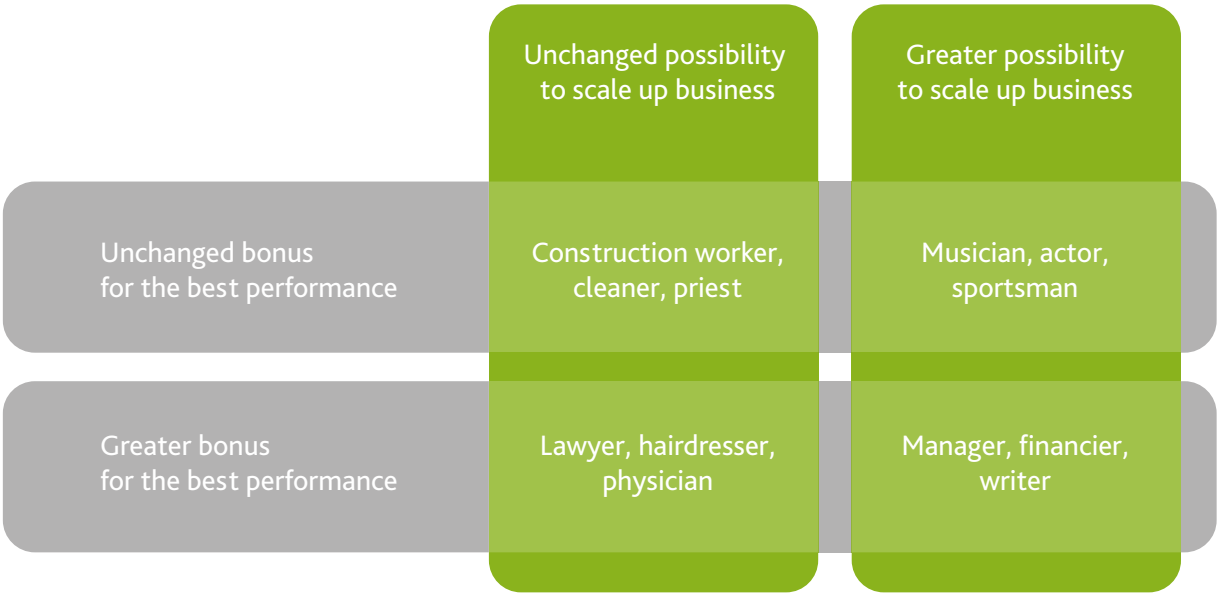
### 3.2.2 SUPERSTARS

The Kuznets curve hypothesis was not the only attempt of explanation of the correlations between technical advancement and inequalities. However, it presented the most optimist scenario – even if there are several Kuznets curves, finally each of them will come to a point when inequality starts to decrease. Such optimistic conclusions cannot be derived out of the so-called superstars hypothesis (Rosen 1981). According to this theory, expansion of ICT technologies leads to an increase of income attained by the most affluent earners. This happens due to the two independent, but often correlated reasons: (1) increase in the productivity of certain workers due to the possibility of expanding the outcomes (scalability) of their work to broader markets and (2) reduced costs of comparison of efficiency of workers and companies thanks to modern technologies (e.g. the use of big data), which raises the premium for being the best. Let us now look at some examples illustrating these two phenomena (Figure IV.5).

The first phenomenon has been well reflected by the entertainment industry. Musicians, actors or sportsmen thanks to a development of display (i.e. projectors, TV sets) and broadcasting technologies (live broadcasts, Internet) have substantially increased their audiences, which has increased the revenue attained from selling of wide ranges of products and attracted sponsors. A similar phenomenon has occurred in case of managers, financiers or writers, and especially those writing in English. They now tend to control higher enterprises (Gabaix and Landier 2008), more assets (Kaplan and Rauh 2009) or write for broader audiences.

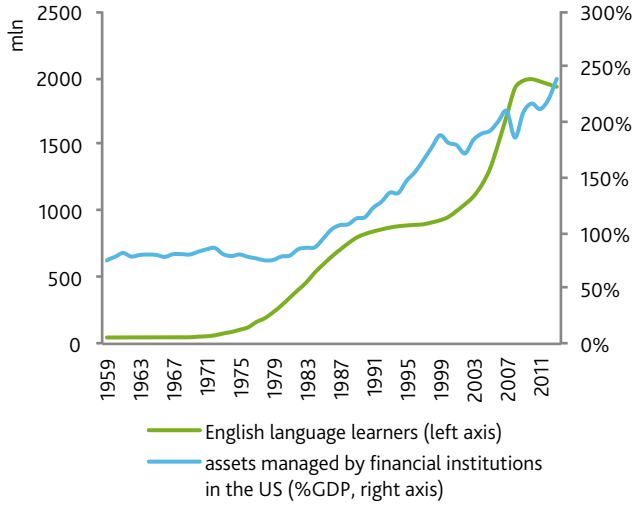
The three groups specified above also experience an increase in the best performance bonus. Such an increase may be attributable to the higher impact on the entire project, or possibility to compare performance – ICT allows for optimising data flow, centralisation of the decision process, and more effective gathering of productivity data. The contemporary managers and financers

Diagram IV.5. **Effects of the ICT launch in the light of the superstar hypothesis**




*Source: own elaboration*

Figure IV.16. **Increase in the scale of operations – financial assets and the English language; 1959-2013**




*Source: Graddol (2006), Haldane (2014)*

Figure IV.17. **Changes of corporate goodwill and profits versus GDP growth in the US; 1980-2003**


*Source: Gabaix and Landier (2008)*

not only control bigger projects, but they also have more power. Also in the case of writers, verification of readers' opinion about books has become definitely less labour-intensive, as comments on the Internet have replaced reviews in specialist periodicals that used to take more time to be published.

The possibility of comparing products of works thanks to modern technologies has also led to polarisation of incomes in the occupations whose productivity has not increased thanks to the ICT. At present, professional leaders can be selected in the course of ratings, whose winners increase their income even without scaling of their operations. For example an enterprise may be willing to hire even the most expensive lawyer to increase its chances of getting a billions dollars' worth compensation. Similarly, many people would be eager to hire the best surgeon to have more confidence of an uncomplicated surgery, or the best chef in town to increase the chances of having an exquisite meal. Without setting up such competence hierarchy, such price diversification would not be viable.

What also deserve our attention are the interactions between scalability of operations and the premium for being the best of all. Only the possibility of making multiple comparisons, allows for extending the scale of operations. For example thanks to the ease of comparison of products many companies have managed to extend their operations, and implicitly, to increase their managers' salaries. Moreover, many superstars create extra demand for top-quality services, hence contributing to the increase of service bonuses. The most affluent elites contribute to the emergence of well-paid specialists who provide services for this target group. Both these processes contribute, according to the superstar hypothesis, to the raising of the labour market inequality.

### 3.2.3 ROBOTICS

Other modern technological factors that could affect inequalities include robotics and automation of jobs. Rise in income diversification could be ascribed to the following three factors:

- taking over workers' income by small group of machine owners,
- increase of the capital share in income,
- structural technological unemployment.

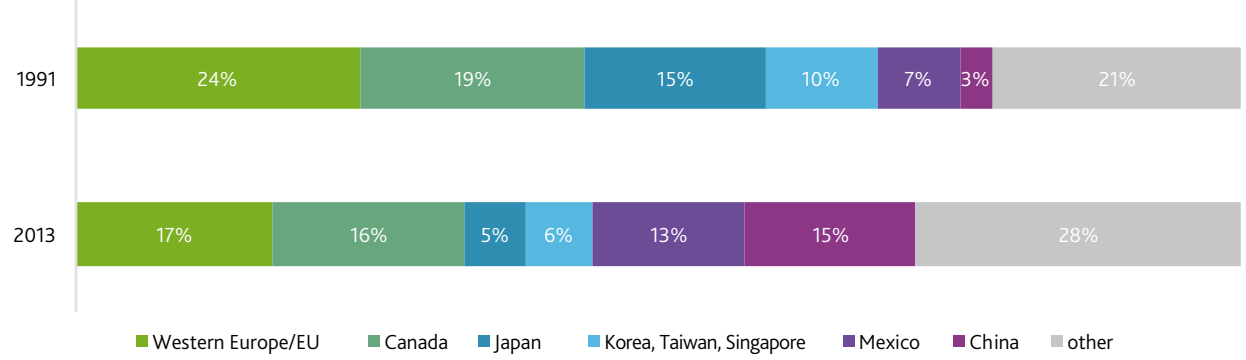
The process of taking over of incomes by a producer of machines can be easily illustrated. For example instead of hiring cleaners, companies may deploy cleaning robots. As a consequence, the former cleaners' wages will go to the narrow group of robot manufacturers, thus increasing social inequality. However, this would only be a short-term process – extraordinary profits of robot manufacturers will shrink when the competitors emerge. In a long-term perspective, cleaning expenses are likely to decrease, and the savings could be invested into other goods or services, presumably at the end requiring human labour. Moreover, a temporary increase in the profits attained by robot manufacturers will be partly offset by the losses incurred by the manufacturers of goods that used to be complementary (e.g. manual cleaning tools). Hence, the impacts of such changes upon inequality are insignificant and temporary.

**Box IV.8. Globalisation and inequality increase**

The integration of the world economy, due to the rapid globalisation of trade, services, and capital flows has reached yet unprecedented dimensions over the past years. The most popular theory explaining correlations between growing income inequalities and liberalisation of trade was formulated by Stolper and Samuelson (1941). The theory states that abolishing of trade barriers in a country where unskilled labour force is abundant leads to an increase in their wages, which, assisted by a rewarding of skilled labour force being limited by foreign markets, results in a decrease in inequality. When trade barriers are abolished, prices of imported goods which require use of skilled labour force, drop down, putting downward pressure on payroll compensation of the most skilled workers. Similarly, prices of exported goods increase, which leads, on average, to an increase in the wages paid to unskilled labour force, holding all else constant. As a consequence, in developing countries which have a comparative advantage in terms of manufacturing of low-processed complementary goods using unqualified workforce, inequalities decrease. Meanwhile, in developed countries, situation is the opposite, as demand for highly processed goods manufactured by qualified workforce increases, raising inequalities.

The impacts of intensified trade upon the labour market depend on who are the trading partners. Intra-industry trade, more widespread in the case of countries at similar level of development, where varieties of the same good are exchanged, does not affect the wages dynamics substantially. Of more significance is inter-industry trade, which is more common among the countries having diverse economic statuses, and which involves far-reaching specialisation. Over the past twenty-five years such type of trade has gained much more importance. For example the increased trade turnover between the US and developing countries (mainly China and Mexico) consisted, most of all, in replacing production with imports, rather than in the mutual penetration of markets by different varieties of similar goods. As presented in the Chart below, the proportion of the major developed economies in trade in the US dropped down from 70 to 45 percent in only 22 years.

Figure IV.18. **The US main trade partners in 1991 and 2013**




*Source: U.S. Census (1), (2), (3)*

The growth of the capital share in income leads to the increase of inequalities, just because the majority of capital is in the hands of the most affluent 20% of the society. The third factor (structural technological unemployment) has been discussed in chapter 2.1. At this point, it is worth reminding that technological unemployment raises inequalities only if dismissed workers are forced to accept substantially lower salaries. As automation should not lead to permanent technological unemployment, what we have here is just a transitory period (cf. the Kuznets' curve) when the dismissed workers either learn new skills, or are replaced by the younger generation possessing such skills.

## Box IV. 8. cont. Globalisation and inequality increase

It needs be emphasised that the directions of labour market impacts in case of shifting production of certain goods to less developed countries, and development of the ICT may be similar. In both cases, employment and salary decreases will mostly affect unskilled labour force. Moreover, it is worth noting that this tendency is not only observable in case of production of goods, but also in the case of certain services, such as telephone assistance, which is very often outsourced to India. This is an example of the links between globalisation and technological change – without the Internet which has enabled reducing the costs of communication as compared to the traditional means (phone, fax) and has created brand new channels (e-mail, chat), remote cooperation with inhabitants of distant countries would be impossible.

However, the above theory does not provide us with complete explanation. Apart from the forecasted increase in inequalities in developed countries, in the majority of developing countries, having enormous unskilled labour resources, inequalities also increased. This makes us pay more attention to the role of foreign direct investments (FDI). Although they have increased considerably, their allocation is of key importance. As it has been shown in Figure IV.18, FDI are mainly directed to the economic sectors which are characterised by large demand for skilled labour force. It should also be highlighted that an investment that is perceived by a developing country as demanding high qualifications may not be perceived as such by a developed country. As a consequence, investing in developing countries should lead to an increase in relative demand for skilled labour force in both countries, which will also raise inequalities in both economies.

Figure IV.19. **Sectoral FDI allocation – according to the required skills**

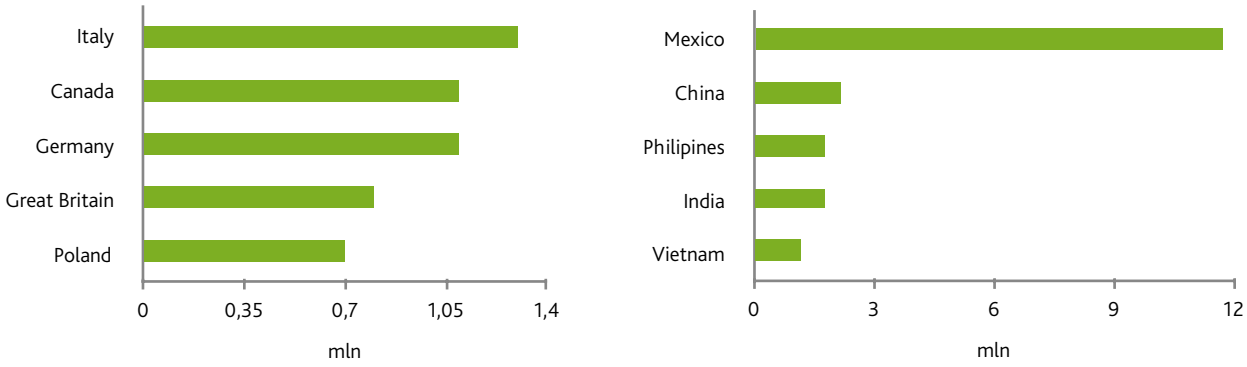

*Source: own elaboration based on OECD data*

The increase of inequalities in developed countries is also related to the growing number of immigrants, and the change of their profile. Referring back to the American history, before 1965 when national quotas favouring Europeans were abandoned, the US had accepted immigrants who were often better skilled that the domestic labour force. As shown by Borjas [2006], an average wage earned by the first generation of immigrants who arrived in 1940 was by 5.8% higher than earnings attained by third-generation Americans. In 1970, the positive difference almost vanished, whereas immigrants who arrived to the US in 2000 earned by almost 20% less than 'native' Americans.

These tendencies have been illustrated in Figure IV.19 which shows the most popular destinations of origin of US immigrants in 1960 and 2010. It can be observed that the number of foreigners has increased, and their ethnical profiles have changed. What is striking is the emergence of a group of over 11 million Mexicans. Their impact upon the labour market cannot be ignored, especially due to the fact that the average wage of the first generation of Mexican immigrants is by one-third lower than that earned by 'native' Americans. What is more, the second generation of immigrants (not represented in Figure IV.19), also vividly lags behind the third-generation Americans [Borjas 2006].

**Box IV. 8. cont. Globalisation and inequality increase**

Figure IV.20. **Top five countries of origin in terms of the number of immigrants (in million) in the US in 1960 (left) and 2010 (right)**




*Source: U.S. Census*

Based on the above discussion it can be concluded (cf. Table IV.7) that the impacts of globalisation upon national inequalities are not homogenous. Their direction can be predicted only in case of developed countries where globalisation raises inequalities. Meanwhile, in developing countries, there are two opposite forces of globalisation-related changes, which makes their final outcomes more difficult to predict.

Table IV.6. **Impacts of specific aspects of economic globalisation upon inequalities**

| Factor | Developed countries | Developing countries |
|---|---|---|
| Trade intensification | ↑ | ↓ |
| Foreign investments | – | ↑ |
| Migration | ↑ | – |

*Source: own elaboration*

*Source: own elaboration*

## 3.3 REASONS FOR INEQUALITY GROWTH

In accordance with the hypotheses presented in the previous subchapter, inequality increase connected with the technological shock may occur as a result of:

- restructuring processes which do not affect the entire market straightaway, thus increasing inequalities between those who have benefited from them, and those who have been excluded (the Kuznets curve, technological unemployment),
- rapid income growth in case of those who have become "superstars" in a new economy,
- increased capital income share.

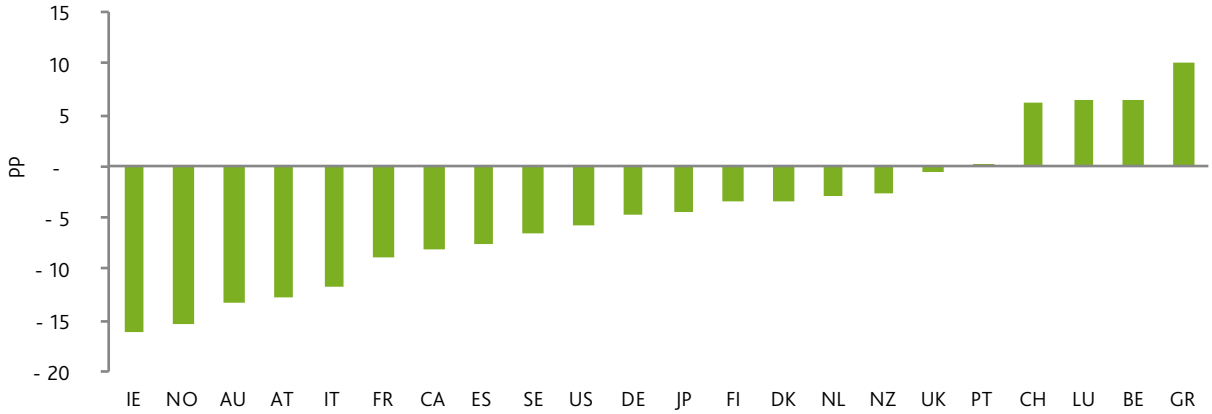
Moreover, as presented in Box IV.8, inequalities, especially in developed countries, may be due to globalisation processes.

### 3.3.1 WILL CAPITAL DOMINATE LABOUR?

In the majority of the developed countries the labour income share over the past fifty years has decreased . Another striking feature, which has been illustrated in Figure IV.21 is the convergence of the ratio on national levels – i.e. the higher it was, the more it decreased. Figure IV.22 presents the latter of these processes in a number of selected countries. Apart from the initial labour income share, it is difficult to indicate any attribute that would allow us to predict the direction of change. The labour income share fluctuations neither depend on the initial per capita GDP, nor on the pace of economic growth.

In order to determine the reason for decrease in the labour income share, and, in particular, to evaluate to what extent it could be attributable to the spreading of the ICT, one needs to take a good look at the entire process, instead of just focusing on its outcomes. First, we should take a look at the mean value (GDP weighted and

Figure IV.21. **Changes in the labour income share in OECD countries in 1970-2012 (percentage points)**




*Source: own elaboration based on OECD data*

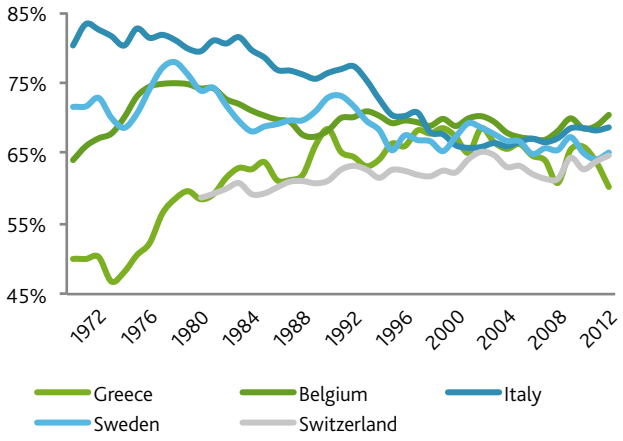
calculated for the most developed countries) illustrated in Figure IV.23. This value already started to drop down slightly in the second half of the 1970s, several years before the ICT shock occurred.

As shown in Figure IV.23, the labour income share started to drop down slightly in the second half of the 1970s, several years before the ICT shock occurred. The process accelerated in the 1980s and still continues. According to Karabarbounis and Neiman (2013), the fall of the share of labour in added value was not only limited to developed countries – the downward trend was also reported in relatively labour-rich countries such as India, China or Mexico. The latter of them even reported the highest relative labour share decrease among OECD countries i.e. from 58% to 41%. The authors estimate that this share has decreased globally from 64% in 1975 to 59% nowadays.

Considering the above, the situation of the technological leader i.e. the United States has substantially differed from the average over the analysed period. Although the labour income share started to significantly drop down during the past decade (Figure IV.23), researchers look for the beginnings of the downward trend somewhat earlier, due to the disturbances caused by exercising of employee stock options during the dot-com bubble (cf. Himmelberg et al. 2004). Even if this observation is accurate, it moves the downward trend not further in time than to the end of the 1980s, which was ten years after it had started in other OECD countries. Although the sequence of events does not exclude that the process has been affected by the ICT revolution, it indicates that its primary causes are different.

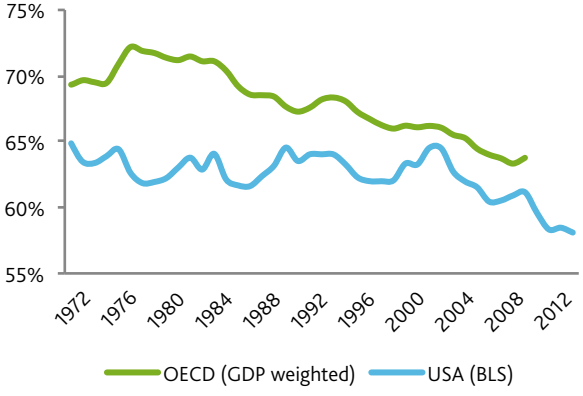
A question to what extent the changes of the labour income share are attributable to the ICT shock has been asked quite recently – the body of research has not yet reached any consensus due to the limited data resources. Karabarbounis and Neiman (2013) state that half of the decrease in the labour income share can be attributed to the relative decrease in the prices of investment goods as opposed to consumer goods. As a result of such decrease the capital has become, in many cases, less expensive than labour, which has accelerated the process of substitution of humans by machines. At the same time, they argue, the decrease of labour income share in developing countries cannot be explained in terms of the globalisation of trade and exporting of labour-intensive production processes abroad.

Figure IV.22. **Labour income share in OECD countries; 1970-2012 (percentage points)**



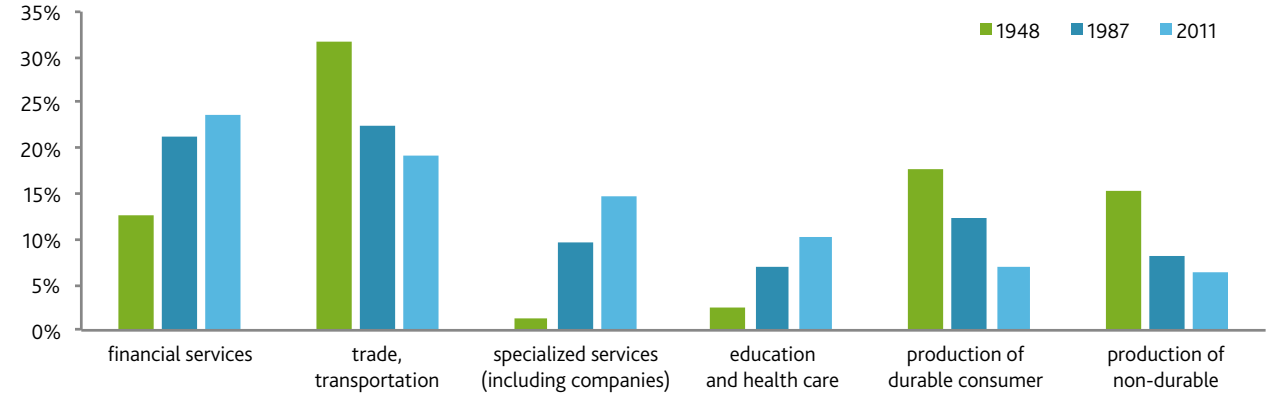

*Source: own elaboration based on OECD data*

Figure IV.23. **Mean labour income share; 1970-2012**




*Source: own elaboration based on OECD and BLS data*

Figure IV.24. **Share of the highest added-value sectors in the US economy; 1948, 1987 and 2011**



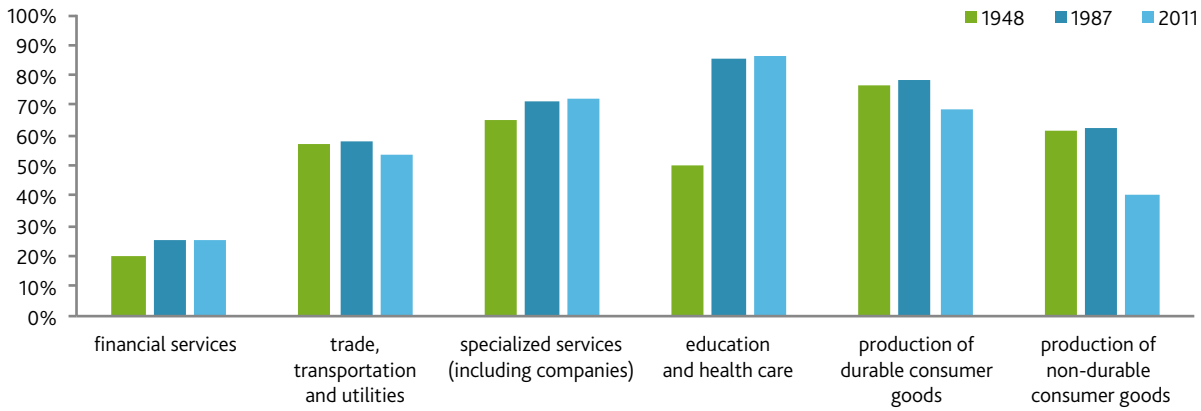

*Source: own elaboration based on Elsby, Hobijn and Şahin (2013)*

An entirely different approach was presented by Elsby, Hobijn and Şahin (2013). In their study (covering the US only) they indicated that the theory presented by Karabarbounis and Neiman only explained the labour share decrease reported at the turn of the 1980 s and 1990s., while after 2000 the downward trend was accompanied by decreasing investments. Elsby et al. indicate that the nature of labour income share changes should be explained by sectoral analysis. They also point out that one-third of the labour income share decrease reported by the Bureau of Labour Statistics (BLS) has been due to a previous overestimation and subsequent underassessment of the income attained by the self-employed. Still the decrease in payroll share from 57.4 % to 53.7% in 1987 and 2011, respectively, needs to be explained.

Elsby et al. devoted much attention to the sources of relative stability of the payroll income share during the post-war period. In 1948 the wages accounted for 56.8% of the total income, which was nearly the same as forty years later However, the relative stability of this ratio is accompanied by major sectoral changes, as shown in Figure IV.24 and Figure IV.25. Over forty years the changes of income distribution among production factors within the main sectors (except for education and healthcare) were relatively minor, although the share of labour in each sector slightly increased. More profound changes occurred in the structure of the economy i.e. production and trade lost ground to specialist services. Although the proportion of payrolls in added value was substantial in the diminishing production sector, the dynamically growing part of the services also had the same feature. Despite the fact that workers shifted from the industry (where the average labour income share exceeded 65%) to the services sector (where it was slightly above 50%), the total labour income share did not decrease, as employment increased in the services with relatively high labour share in added value. In the past 25 years the process continued, but the changes led to a decrease in the payroll income share. Although workers still continued to migrate from the industry to sectors with relatively high labour income shares, the situation in the industry negatively affected the national average.

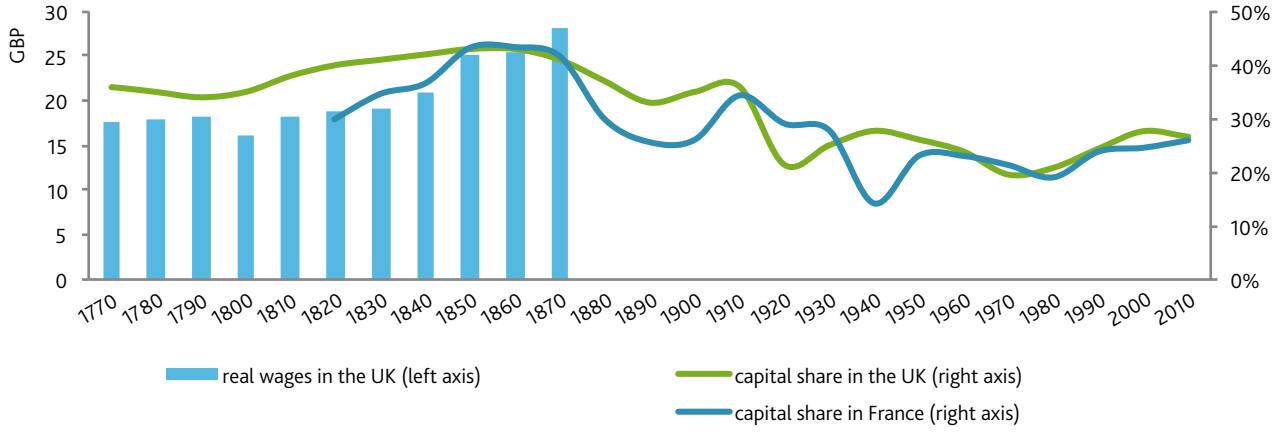
On the sectors' level the authors examined the three major theories of the decrease of payroll share in the added value: decreasing prices of capital goods in a given production sector, trade union membership decline and foreign trade increase. In case of the two former hypotheses, no statistically important correlations were revealed by the study, and in case of decreasing prices of capital goods, the actual impact even turned out to be contrary to the expectations (the sectors which experienced the most rapidly decreasing prices of capital goods, also

Figure IV.25. **Labour income shares in industries generating the highest added-value in the US; 1948, 1987 i 2011**




*Source: own elaboration based on Elsby, Hobijn and Şahin (2013)*

Figure IV.26. **Capital income shares in the 19th and 20th centuries, and wages at the beginning of the industrial revolution**




*Source: own elaboration based on Piketty 2014 and Allen 2007*

reported an increase of the labour share in the added value). Meanwhile, globalisation hypothesis explained 85% of the decrease of the labour income share. The authors shown that the sectors most exposed to imports, were those which reported decreases in the labour income share. Hence, it can be concluded that the United States specialise in the production of capital-intensive goods, while manufacturing of labour-intensive goods is either transferred abroad or leads to a decrease in the payroll share in income, as a result of international competition.

Could this explanation also justify decreasing labour shares reported in the countries to which labour-intensive production processes are transferred? Theoretically, there are no arguments proving the contrary. As compared to the Western Europe and the US, in such countries as India, China or Mexico wages are very low. As long as the available capital resources are relatively small, its remuneration is relatively high (which is reflected for example in higher ROI rates). As capital-intensity of a given economy increases, the capital income share may also initially increase (especially if investments are targeted at the labour-intensive industries). As the economy becomes saturated with capital, and the wages increase, the labour income share should continue to grow in a manner resembling the Kuznets curve pattern.

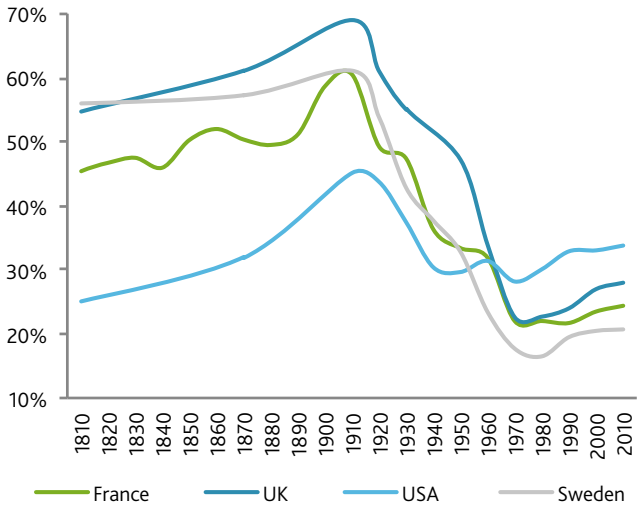
The above explanation has been illustrated in Figure IV.26 showing approximate capital income shares in France and the Great Britain since the beginning of the industrial revolution. Since ca. mid-19th century, an increase of the capital income share has been accompanied by a very slow payroll increase, due to fast-growing labour supply in the cities. Although, over the past few decades the wages in India or China have grown faster than in the 19th century's France or England, their increase lags behind the productivity, and urbanisation speed is higher than during the industrial revolution in Europe.

An analysis of the reasons for the decrease of the labour share in the added value in the US shows that this phenomenon has not had much in common with the ICT revolution so far. Still, a question remains to what extent this aspect will change in the future. Presumably, substitution of labour by capital did not bring about any decrease in the labour income share only due to the fact that workers used to shift to the services sector, where added value and income share were growing rapidly, while the possibilities of substituting labour with capital remained limited. If this theory is true, automation of services may lead to a further decrease in the labour income share. The present discussion again refers back to the issue of technological unemployment, as described in chapter 2.1 – workers who will fail to adapt quickly to a new reality will see their wages stagnating or even decreasing, which will be manifested by the decreasing labour income share. However, if they shift to industries enjoying high demand, where human work is still irreplaceable, the decrease of costs in the remaining (mechanised) industries will raise the added value generated mostly by humans. In this case, wages will continue to grow, and so will the labour income share.

Finally, an entirely different explanation of the growth of capital share in income was presented by Pikkety (2014). He argues that its main cause is nether related to globalisation, nor to the new technologies. In Pikkety's view, the value of income from capital compared to income from work increases, due to the fast growth of wealth which generates such income. This is possible since the return on assets (capital investment) is sustainably higher than economic growth rate. As a consequence, if no external intervention occurs, market economy leads to the concentration of wealth in the hand of a small section of society – and the increase in capital share in income is only the consequence of the process, and not its cause. As presented in Figure IV.27, before World War I the share of the wealthiest in income had grown. Although the two world wars fundamentally changed the status quo, the last two decades witnessed a return to the 19th century trends.

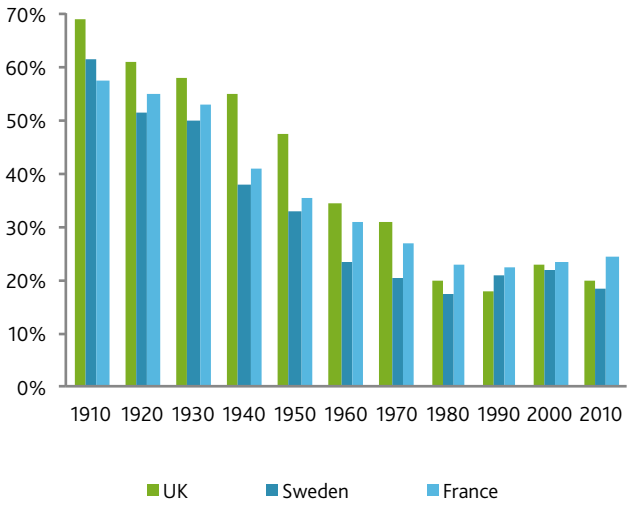
Pikkety's book has been criticized on both theoretical and empirical grounds. Summers (2014) pointed out that Pikkety should look at the net return on capital that takes into account depreciation rate which is proportional to the stock of capital. What

Figure IV.27. **Share of the wealthiest 10% in the overall assets - Pikkety's data**




*Source: own elaboration based on Piketty 2014*

Figure IV.28. **Share of the wealthiest 10% in the overall assets – data revised by Gilles**




*Source: own elaboration based on Piketty 2014, Financial Times*

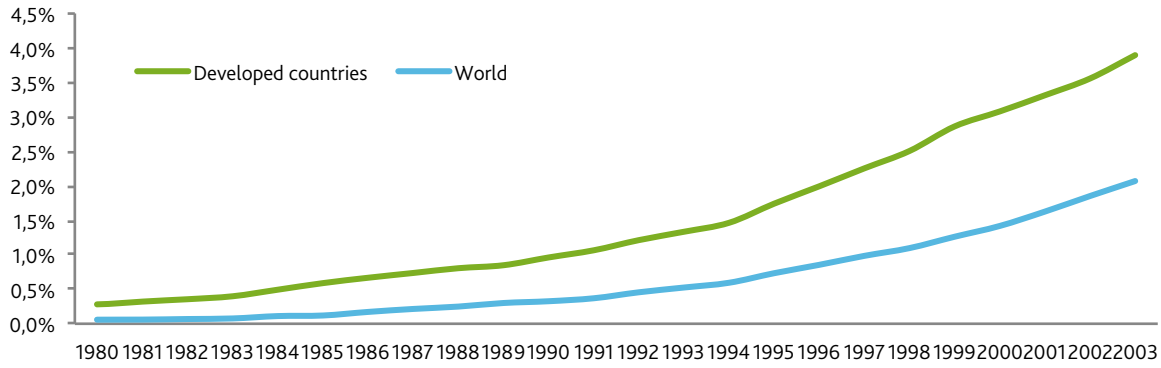
is more the wealth held by the most affluent is only partly invested. Most of it takes a form of mansions that do not generate any income. Taking into account this two issues makes grow in capital income share much less likely at least not from the reasons named by Pikkety. On the other hand Giles (2014) argues that data used by Pikkety to compare wealth inequalities were not correctly assembled. Figure IV.28 shows Piketty's data corrected by Giles. After the correction the rise in the share of the wealthiest 10% in the last thirty years is much less clear. This result is similar to the one presented by Bitner (2014).

### 3.3.2 TECHNOLOGY OR GLOBALISATION

Although the superstars theory has not found support in the data, and it cannot be proven that new technologies contributed to increasing top income share (cf. Bitner 2014), the impact of the ICT revolution upon inequalities increase are unquestionable. According to the Kuznets curve hypothesis and the analysis presented in chapter 2.2, technological advancement has led to a significant increase in the demand for qualified labour force, which almost in all cases results in increasing of the college premium. As a consequence, growing demand for skilled workers, combined with decreasing need for unqualified labour force has led to higher income inequalities. In order to assess impacts of the ICT revolution upon inequality increase, the authors of OECD report (2007) tried to determine, among others, whether such increase was due to globalisation or technology, and proposed a variable defined as the ICT capital share in the overall capital resources. Hence, they indicated a factor that could easily be linked with the advancement of the ICT revolution. Indeed, as presented in Figure IV.29, over the analysed period of time its value has substantially increased on a global scale, especially in the developed countries.

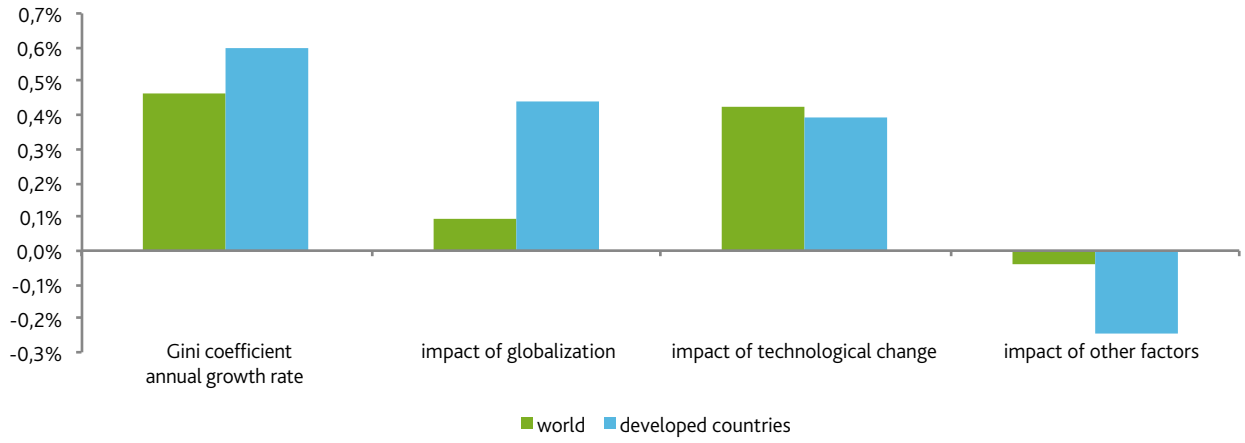
In a model proposed by OECD experts the variables associated with globalisation were implemented in such a manner as to include both its commercial (imports and exports as GDP%) and

Figure IV.29. **The ICT capital share in overall capital resources; 1980-2003**




*Source: own elaboration based on OECD data*

Figure IV.30. **Decomposition of income inequalities according to factors**




*Source: OECD (2007)*

financial aspects (excluding migration). The expected assessments of parameters of an econometric model developed by OECD experts, where the dependent variable is the changing value of the Gini coefficient – have been based upon the above research hypotheses. Apart from technological advancement and globalisation variables, the model also incorporates a broad spectrum of control variables such as e.g. years of education, ratio of university graduates, proportions of individuals working in specific sectors, or finally, the value of loans granted to a private sector.

The respective shares of technological advancement, globalisation, and other factors, in the increase of inequalities, obtained from the model, have been presented in Figure IV.30. It is easy to observe that technological progress has the largest share in diversification of income on a global scale. The impact of globalisation, although positive, is relatively insignificant, whereas the remaining factors, in aggregate, contribute to inequality decrease. In the latter case, education is of key importance and it becomes more and more accessible even in the poorest countries, which slowly eliminates the so-called skill gap i.e. the presence of skills that are incompatible with the labour market among a substantial share of population. Of significance are also the structural changes in specific economies i.e. globally the share of farming decreases, being replaced by industry and services. Just like in the Kuznets theory, this ultimately leads to inequality decrease. In case of the most developed countries, the proportions of factors leading to the raising of inequalities are different. Technological factors are still important, but the key driver of inequality growth is globalisation. The above differences can be explained as follows: globally the most visible effects are those of financial globalisation, since the effects of commercial one are mutually offsetting. Meanwhile, in the developed countries, globalisation fully reveals its anti-egalitarian aspect.

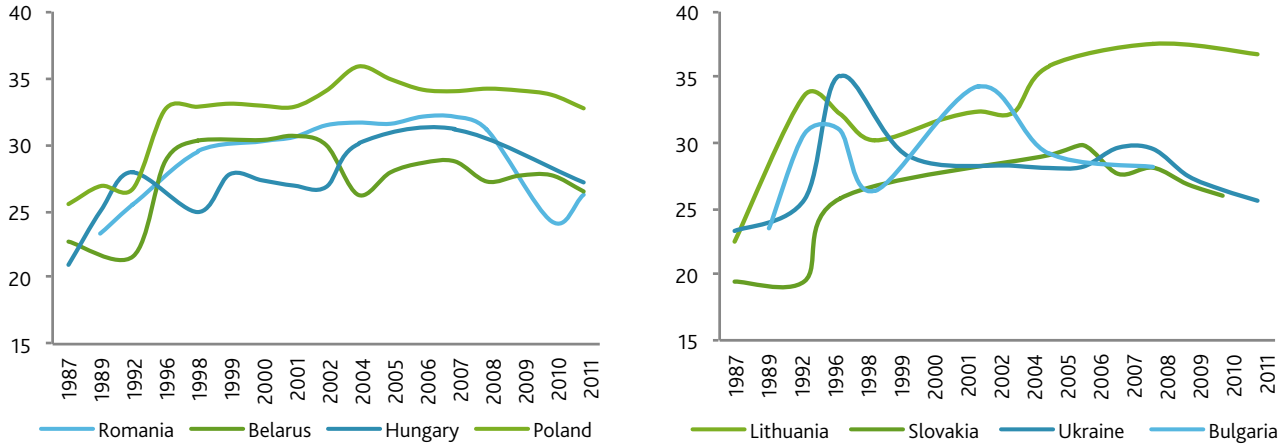
Since Poland is somewhere in-between developed and developing countries, in the coming years we should expect – if we treat the situation of developed countries as a landmark – an increase in inequalities both as a result of globalisation, and dissemination of new technologies. While an increase in the trade volume and financial globalisation will occur irrespectively of the national policy, according to the aforementioned study, nearly half of inequality increase may be prevented by proper adaptation of an economy to the ICT shock. The viable solutions have been discussed in the last chapter.

## 3.4 INEQUALITIES IN THE CENTRAL AND EASTERN EUROPE AND POLAND

After discussing specific theories and hypotheses concerning impacts of the ICT revolution on an increase in income inequalities in the previous sections, in this subchapter we are going to present a comparative analysis of the Central and Eastern European countries, including Poland. We are going to analyse the basic measures of diversification, in order to explain the sources of differences between specific countries.

If we look at the changes of the Gini coefficient in the years 1987-2007 in the analysed Central and Eastern European countries, we will easily arrive at a conclusion that an increase in inequalities measured by this indicator occurred in all of them. This process has been presented in more detail in Figure IV.31. The scale of the phenomenon differs considerably across specific countries. The highest inequalities are observed in Lithuania and Poland, and the opposite situation is reported in Belarus and Ukraine. In the two latter countries, and also in Lithuania, a visible inequality increase could be observed in the mid-1990s, which can be linked to economic transformation processes, especially in case of Belarus and Ukraine. This proves that next to globalisation or technological advancement, as presented in the previous sections, also institutional factors play a significant role in the shaping of overall inequality changes. Moreover, based on the available figures for the years 2007-2011 (which were available only in selected countries) one may venture an assumption that the past years' financial crisis, just like in the case of more affluent West European countries, favourably affected the adjustment process of income redistribution. In 2007-2011, income inequalities significantly decreased in all analysed countries. Moreover, if we analyse the situation in

Figure IV.31. **Values of the Gini coefficient in the Central and Eastern Europe; 1987-2011**



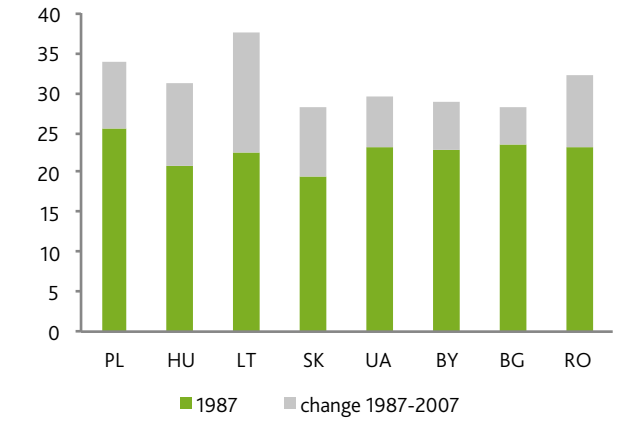

*Source: own elaboration based on the World Bank data*

Poland, we will see that the diversification has decreased also due to a considerable relative income growth in case of the poorest quintiles of population. For example in 2007-2011 the minimum wage increased by nearly 48%, which was accompanied by a much lower pace of increase of real wages in the entire economy.

It is also worth taking a good look at absolute increases of the Gini coefficient in 1987-2007 (Figure IV.32). It should be noticed that Poland was the country which reported the highest inequalities before the transformation, and one of the lowest inequality increases afterwards. The highest inequality growths occurred in Lithuania and Hungary, whereas the Gini coefficient increased only slightly in case of Ukraine and Bulgaria. At the same time, it is worth to look again at the changes of this indicator in the selected countries in the years 2007-2011, as, in some cases, this can considerably affect the above results, and their conclusions. A good example is Hungary, where a substantial inequality decrease (6-7%) occurred within only 4 years, which visibly reduced income diversification in that country.

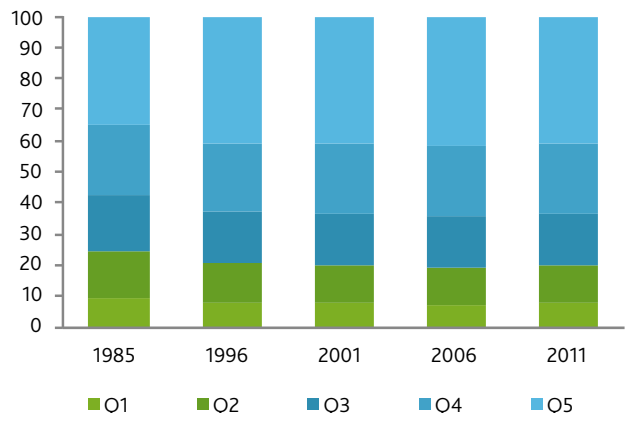
Interesting findings can also be obtained when analysing income quintile structure (Figure IV.33). Just like in case of previously analysed global data, inequality increase can mainly be attributed to the increasing share of the most affluent 20% of population. Although on the global scale this share used to grow at the expense of 3rd and 4th quintile, in Poland the proportion of the latter has remained virtually unchanged, and the increase is relatively symmetrical to the 1st, 2nd and 3rd quintile. In other analysed countries the situation looked similar, and the highest decrease in shares of 1st and 2nd quintiles, representing the poorest groups was reported in Hungary. To explain this difference we should look back on the process of the systemic transformation. Inhabitants of major cities and other regions, which have taken advantage of market economy opportunities, grew rich relatively fast, while the status of others is improving slowly, or does not change at all. Unarguably, this divide determines heavily the pace of the ICT revolution and its outcomes in Central and Eastern Europe.

Figure IV.32. **Increases in the value of the Gini coefficient; 1987 - 2007**




*Source: own elaboration based on the World Bank's data*

Figure IV.33. **Structure of income distribution in Poland; 1985-2011**




*Source: own elaboration based on the World Bank's data*

# 4 ADAPTATION CHALLENGE

Technological unemployment and inequality increase are not the only challenges faced by the Polish economy and labour market in the time of the ICT shock. First of all, Poland will need to absorb the new technologies quickly enough. Any delay could, on the one hand, hinder the unavoidable process of adaptation to the challenges described hereinabove, and, on the other, allow to take all opportunities offered by the new wave of automation. Moreover, the process of the ICT absorption in Poland will co-occur with the ageing of the society, which will also pose a specific challenge. An analysis of these two challenges will precede the suggested adaptation measures in such areas as innovation, industrial policy and education.

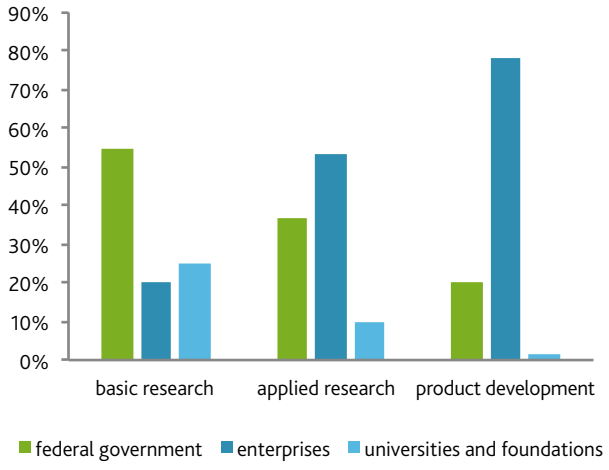
## 4.1 ICT REVOLUTION'S PROGRESS IN POLAND

Considering enormous changes caused by the technological revolution and correlated labour market problems, we need to determine at what stage of absorption of the ICT shock Poland is. The spread of the ICT is measured by an index developed by the United Nations International Telecommunication Union. ICT Development Index (IDI) uses three basic indicators covering the following three areas – the access, the use and the skills. In Poland, its indications in 2011-2012 look disturbing. Although, just like in the majority of countries, the ICT absorption level in Poland increased during the analysed period, the country's relative position in the rating dropped down from 32 to 37 (of over 150 countries). The disturbing result could be ascribed to a number of deficiencies:

- **Availability of the ICT**. Major delays occur in case of well-established solutions such as broadband internet. In 2010 only 77% of the overall population had access to broadband connections. Romania, which occupied penultimate rank among EU countries, reported 83%, while the Competencies - PIAAC EU average was 97%. The data concerning broadband internet access at workplaces does not make the situation look better, either i.e. Poland attained 23rd rank in the EU 27, obtaining 21% and overtaking only such countries as Bulgaria, Greece and Romania, as compared to the average result of 32%.
- **Use of the ICT**. E-administration has not become popular among entrepreneurs. In 2013 VAT returns were filed by electronic means by only 28.5% of all entrepreneurs having internet access, which was lower than half of the EU average in 2011.
- **New opportunities**, especially in terms of marketing and advertising, have appeared ahead of enterprises also thanks to social media. As shown in Figure IV.34 in case of each social media category, Poland has scored substantially below the UE average. In 2013 enterprises which, apart from using social media, also had their corporate websites, apparently an obvious promotional tool, accounted for 17% of all Polish companies, as compared to the EU average of 28%.
- **Digital skills.** According to the Programme for the International Assessment of Adults - PIAAC (2011-2012), only half of respondents attempted to solve a computer task, as compared to the OECD average of 75.6 %. Surprisingly, this difference holds across age groups, although in case of the youngest people, levels of the ICT skills were higher (80% in case of people younger than 24, as compared to ca. 90% in the case of OECD). The study results have also shown that the share of individuals with the two highest ICT competence levels (2 and 3) in Poland is the lowest (19.2%) of all analysed countries.

Having analysed the examples of ICT absorption, taking into account all IDI indicators, we will not be surprised by Poland's unimpressive, or even weakening position in the rating. Delays in absorption of new technologies have also been confirmed by data on robotisation. Also in this respect Poland lags behind the EU, being superseded not only by the leaders such as Italy or Sweden where in 2011 there were more than 150 machines per 10 thousand workers, but also by similarly developed countries (e.g. Hungary, Slovakia). Even though the number of industrial robots in Poland constantly grows, the pace of this increase suggests that attaining the EU average in the coming decade will be rather unlikely. Moreover, automation in Poland is mainly driven by automotive industry. In 2011, that branch of industry possessed 43.8% of all robots, which confirms that the real level of backwardness in this field is higher than the average ratio indicates. It should be considered what measures could be taken in order to reverse such negative trends.

Figure IV. 34. **Use of social media by enterprises in the EU; 2013**




*Źródło: Eurostat*

## 4.2 LABOUR IN THE SILVER ECONOMY

Regardless of the ICT shock, the Polish economy also faces new challenges related to the growing scale of unfavourable demographic changes. Mean number of children per woman in Poland is ca. 1.3, while the figure that allows for attaining simple generation renewal must exceed 2.1. At the same time, the Polish society is undergoing changes related to the final stages of demographic transition, typical, most of all, for the developed countries. For example thanks to continuous improvement of the quality of healthcare the lifespan after attaining of the retirement age increases, which leads to increasing of the proportion of elderly people. Implicitly, the supply of goods and services targeted at seniors also increases. This phenomenon nicknamed as the silver economy, and already affecting economic processes in the EU-15 considerably, is still at its initial stage of development in Poland.

Based on the European Commission's forecast, by XXXX labour resources will shrink by 6.22 million which is more than 1/3 of their current status. This ratio is similar to the proportion of individuals threatened by automation and robotisation, assessed by means of WISE SARA model. Hence, we can venture an assumption that such radical shrinking of labour resources will alleviate the impacts of automation and robotisation upon the labour market – especially considering the fact that the majority of occupations threatened by new technologies are manual jobs, which are definitely less frequently performed by seniors (Smaller number of young people who perform manual jobs more often than seniors means that the extent of downsizing in such sector as a result of robotisation will be lower).

In case of occupations which have been categorised as unthreatened by automation, the impacts of ageing of Poles will be diversified, depending on an occupation. For example demand for healthcare professionals is very likely to increase as the society grows older. This field is rather not susceptible to substitution by machines and robots, serving rather as a facilitation and support. Even if the area of diagnostics is revolutionised, patient care will remain non-automated. On the other hand, due to the fact that the proportion of children in the population continues to decrease, the demand for teachers and lecturers at all educational level will drop down as well. It should be stressed that they currently represent a very numerous professional group. What is more, students of education-related subjects in 2011 accounted for 11.3 per cent of the total that is almost 50 per cent more that health related students.

Another important aspect of demographic changes is an increase of the average lifespan. Currently, in Poland life expectancy amounts to 72.7 and 81.1 years in the case of men and women, respectively. According to the European Commission's forecast, by 2060 such figures will increase to 82 and 88 years, which will be accompanied by the lengthening of the so-called health expectancy i.e. absence of chronic illnesses and other health conditions significantly deteriorating one's everyday life. This will allow seniors to stay active on the labour market for longer. However, the silver economy, adapted to the reality of western countries, faces major problems in Poland. Such problems have been described in a study entitled: *Consumer 55+* (Bombol, Słaby 2011), which has shown that there exist major barriers related to income, technology and mentality (distrust towards strangers) that make seniors unable to benefit from the market tailored to their needs. Hence, it is rather unlikely that the silver economy unadjusted to the Polish reality will play an important role in national economic changes. However, after some time and further convergence of Poland and the old EU, both on technological and economic levels, and in terms of mentality (as younger generations attain the required age threshold), it can be expected that the silver economy adaptation processes will also start to gain pace.

At the same time, promoting ICT literacy among seniors is also important. Taking such steps would ultimately help to counteract technological exclusion, typical for this group and regarded as a major obstacle of the silver economy. Nowadays everyone who is familiar with new technologies gains access to many functionalities substantially facilitating daily life. Especially in the case of seniors such functionalities as payment of bills, or shopping online, may prove to be very useful. A good example is IPG (Integrated Patient Guide) introduced in the health sector especially for senior people. Taking actions aimed at overcoming biases and stereotypes of the past appears to be indispensable.

## 4.3 ADAPTATION THROUGH INNOVATION

As we have already mentioned, non-innovation is not a cure for the negative impacts of innovation. As a matter of fact, it deprives us of the benefits that can be attained by being a technological leader, and of the chances of improvement of the labour market situation. A more effective solution would be opening oneself to innovation, or even developing state policies supporting innovation, and adequate industrial policies.

A conviction that research should be financially supported by the state has predominated economic studies at least since the article by Nelson (1959). He argued that privately owned enterprises are not eager to invest their resources in science, since the profits that they can obtain from scientific achievements are not fully captured by them. According to Nelson, such benefits consist in decreasing of the number of alternatives that need be examined when developing new products. From an entrepreneur's point of view, the higher the level of knowledge, the lower the costs of developing of an invention. However, gaining such knowledge in the course of research is quite uncertain. There is no guarantee that engaging in research whose results cannot be predicted in advance will lead to a decrease in the corporate costs of an invention. Moreover research findings can also be beneficial for competitors and other companies representing either the same, or completely different economic sector.

Although Nelson focused, most of all, upon basic research, his arguments also apply to other stages of the research process.

## Box IV.9. What is R&D?

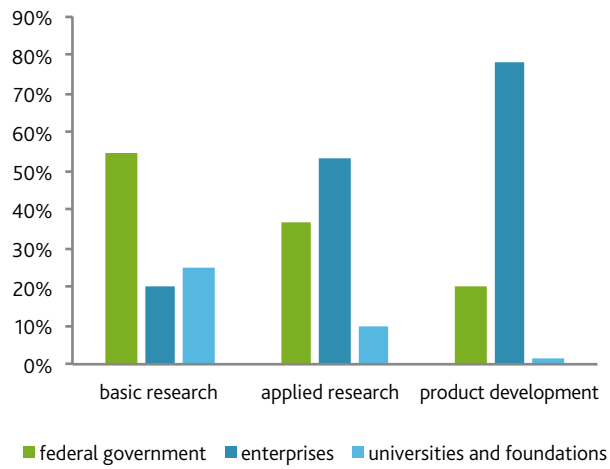
Research and development is a process that leads to creating of innovations i.e. new techniques, technologies and products. According to the US National Science Foundation, the process is comprised of the following three elements (cf. Chart below).


The basic research denotes all research activities aimed at extending of general knowledge in a given field, without focusing on its specific applications. Meanwhile, the applied research aims at resolving, or better understanding of problems which often hinder production processes. Finally, development consists in designing of a specific product, material or manufacturing method, based on the scientific knowledge.

The borderline between specific elements is very unstable. Moreover, although sometimes innovations can be developed at the three process stages subsequently (as sequenced in the chart), in many cases the process cannot be divided into stages. It happens very often that new products are invented in the course of basic research. For example according to J.J. Thomson, a discoverer of the electron Roentgen's discovery of x-rays was due to 'studies aimed at discovering of the nature of electricity'. On the other hand, the development of new products often used to lead to an emergence of new scientific theories. George Porter, chemistry Nobel Prize laureate stated that: "science owes more to the steam engine, than steam engine owes to science".

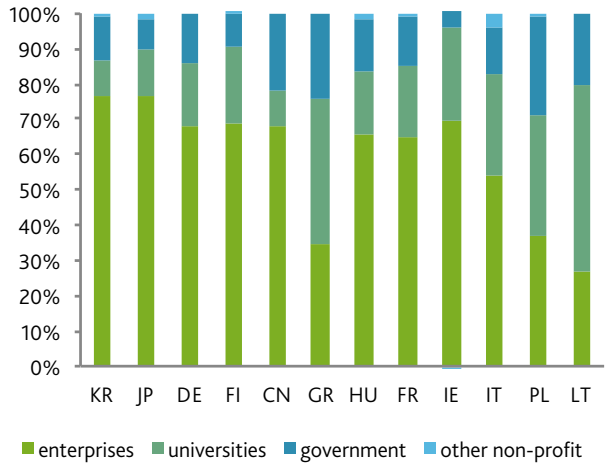
*Source: own elaboration*

Figure IV.35. **Entities co-financing R&D projects in the US; 2011**




*Source: National Science Foundation*

Figure IV.36. **R&D financing globally; 2011**




*Source: Eurostat, NSF*

Since R&D is a non-linear and two-way process (cf. Box IV.7), the rules that govern basic research will also apply, to some extent, to applied research and development of new products. Bloom, Schankerman and van Reenen (2013) have assessed that the overall benefits attained by an economy from research activities undertaken by enterprises are two- or even fourfold as high, as those captured by the enterprises.

In Nelson's view, there were two methods of internalizing the external benefits on the market. First, enterprises could be expanded so as they could incorporate different industries, and hence, more often use the commercial applications of their research. A recent study (Akcigit et al. 2013) involving French companies has shown that each new branch of industry added to company's asset portfolio leads to increasing of the share of R&D expenditures in the

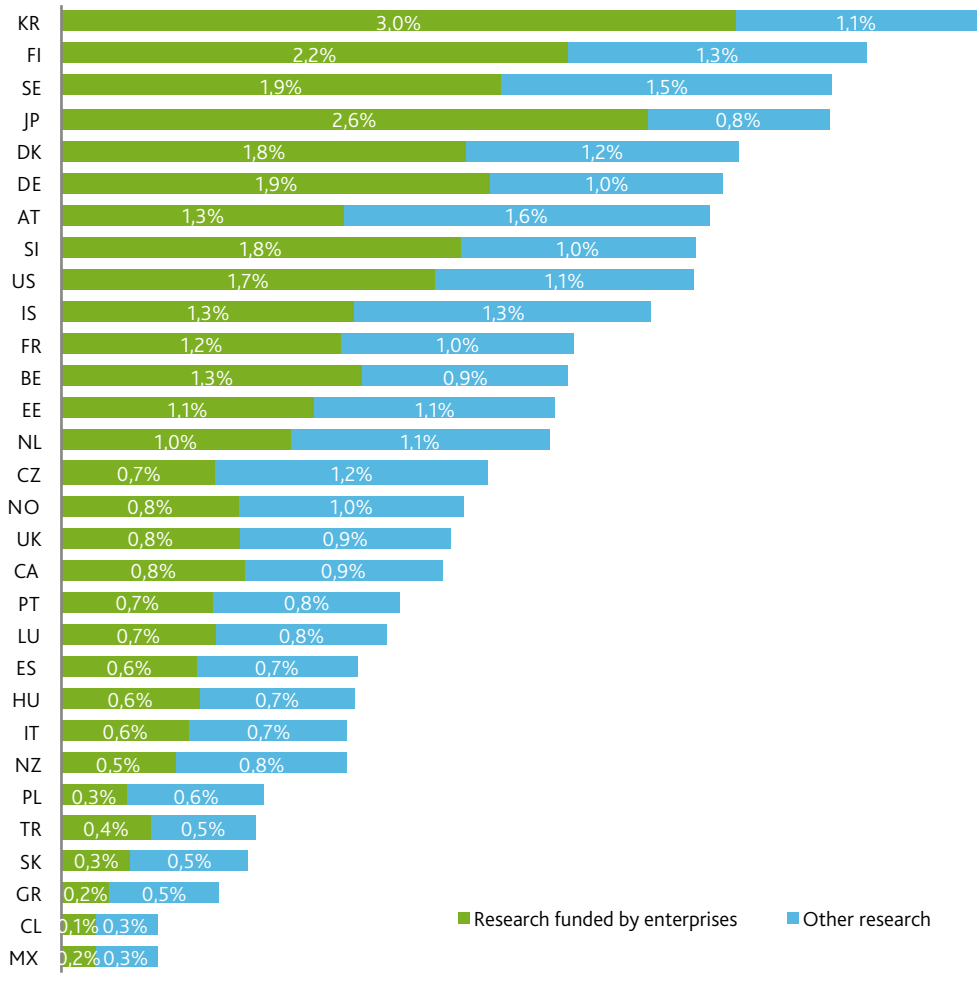
corporate revenue by 3 percentage points. However, this solution has a major drawback – it leads to an emergence of too large companies, disrupting the optimum choice between transactional vs. agency costs (Coase 1937). Secondly, companies may conduct research in the framework of industry consortia. Although such consortia have become widespread all around the world, they too have their disadvantages. In many cases their research findings could have been applied more extensively (beyond a given industry). Besides not all companies are part of consortia, and thus, they are deprived of the benefits of such research, although they could have made a good use of them.

In Nelson's view the market does not fully solve the problems of external impacts, which makes partial subsidising of R&D by the state necessary. Establishment of such conviction in economic studies has led to a development of a research model assuming its partial financing by the state, and private (but not necessarily commercial) performance.

In the US (cf. Figure IV.35) the government finances, most of all, basic and applied research. Product development is being financed by companies. Although the federal government plays a fundamental role in financing of basic research, in the US 30% of all R&D expenses are covered by the public budget. This proportion is similar in other developed countries (cf. Figure IV.36). In Poland, only 32% of research costs are covered by enterprises. In the EU, less favourable situation can be observed in Lithuania, Latvia and Cyprus. Meanwhile, the share of enterprises in co-financing research largely affects the overall proportion of such expenditure in the GDP (cf. Figure IV.37). The share of private financing explains 55% of national R&D expenditure level in a given country, and an increase in the corporate R&D co-financing by 10 percentage points corresponds, on average, to increasing of the GDP share of R&D expenses by 0.42 percentage points.

If Poland intends – in accordance with its national objective in the framework of Europe 2020 strategy – increase its GDP share of R&D investments to 1.7% in 2020, it should increase the private co-financing share to at least 51%, as compared to the current 37%. This objective (50%) was formulated by the government three years ago (Kudrycka 2011). Although two-thirds of the burden of increasing R&D outlays is going to be borne by the private sector (encouraged by the government only), the remaining

Figure IV.37. **GDP share of R&D expenditure; 2013**




*Source: NSF*

one-third should be obtained from public sources, since public expenditure intended for scientific development in Poland is also low. In order to fulfil Europe 2020 national objective, public R&D investments should increase from 0.56% to 0.85%.

### INNOVATION-FRIENDLY INDUSTRIAL POLICY

Academic authors also claim that in developing countries the classical R&D co-financing model, assuming the key role played by the private sector does not always work, so the role of the state should be greater. The private enterprises conducting research face difficulties in the three areas (Breznitz and Zehavi 2010): (1) mutual distrust between authorities and enterprises, and between specific private entities, (2) lack of coordination of corporate actions aimed at adapting and transmitting innovation, (3) lack of motivation to translate research findings into development of products on local markets.

The sense of distrust is connected with the fact that specific entities are lacking knowledge about each other. This deficiency is related to the nature of an innovative undertaking. Since no one has ever taken the action in question, conducted that particular research successfully, or put its outcomes into practice, it is difficult to predict which entity is likely to succeed. Hence, there are no strict criteria that would enable assessing reliability of a given company as a partner, both for the government, and for another company. The problem becomes more acute if a given economy lags behind global technologies and suffers from underdevelopment of capital market, because of lack of third-party expert assessments or venture capital funds.

Confidence is also necessary for the coordination of cooperation between companies, as their short-term perspective of gaining profits may overshadow the long-term benefits of intra-industry cooperation. Nowadays innovation demands cooperation among various groups of professionals – as any of them working in isolation would not probably have made any breakthrough discoveries. Moreover, the coordination of innovative actions should take place in compatible surroundings i.e. academic centres conducting scientific studies, well-educated graduates, necessary infrastructure (including transportation) and robust financial market. Basic market economy institutions, such as, in particular, effective courts, are also necessary.

The motivation to work for the benefit of the entire country or specific industry can be also problematic. A company which has launched an innovative project may not be sufficiently motivated to share its outcomes with others, even if it were beneficial for the entire industry. An unwillingness to share R&D outcomes is not always related to short-sightedness, but stems from a real conflict between corporate and collective benefits. Sometimes collective benefits can be attained by another country. In practice, this often implies that innovative companies migrate to the US.

Difficulties related to the lack of confidence, coordination and motivation in the private sector may be resolved by extending operations of the public sector beyond co-financing of R&D works. In this case, a state-owned institute provides domestic enterprises with research findings to the level of a working prototype. Thus, there is no problem with choosing enterprises that would receive R&D co-financing (all of them are provided with the results), the cooperation is maintained through the institute and innovations are diffused all around the national economy (companies do not migrate abroad in order not to lose state support). A positive example of such policy is Taiwan (Berger and Lester 2005). Thanks to its national investments into semiconductor research, Taiwan has become a global leader in this field.

However, extensive state support of R&D works has a number of major weaknesses. One of them is a difficulty in discontinuing of unpromising research due to a relatively greater ease of spending public money and lack of private owner supervision. Moreover, workers of state institutions may be less motivated (as someone else will reap profits of their work), and the public sector also, perhaps for the same reasons, appears to have problems with breakthrough inventions (Stefik & Stefik 2004). An example of Taiwan only signals the possible benefits, without guaranteeing their attainment. The government of that country made a good choice of an industry in which Taiwan, for a number of reasons,

Figure IV.38. **GDP shares of venture capital funds in OECD countries; 2012**


*Source: OECD*

had a comparative advantage. Neither Poland, nor any other country can follow exactly the same path, and discovering of the Polish equivalent of Taiwanese semiconductors would be difficult. Meanwhile, research carried out by state institutions in an unspecified direction would only intensify the problems discussed above.

Overcoming the weaknesses of private management of R&D programs without further complications related to organizing them by the state is a challenge really worth undertaking. It would require developing of a cross-company communication network that would minimise distrust, improve coordination and prevent the most successful companies from migrating abroad. Let us just focus on two examples. A state can encourage companies to get engaged in collective actions and mutually exchange their outcomes in the form of intellectual property. Such cooperation could be conducted in the form of a R&D consortium established under state auspices (see e.g. Sakakibara 1997). Another example (Breznitz 2007) is the concept of an Israeli state agency (OCS) which assumes financing of the US companies' R&D programs, as long as they are conducted within the territory of Israel. This strategy allowed for initiating valuable contacts with global leaders, which resulted in starting cooperation not only in the field of research. Examples from various countries show that the fundamental role in the process of supporting innovation has been played by small agencies operating on the margins of the public sector. This applies to American DARPA (Whitford and Schrank 2011), Irish NSD (O'Riain 2004), and Finnish and Israeli agencies, which are going to be discussed below in more detail.

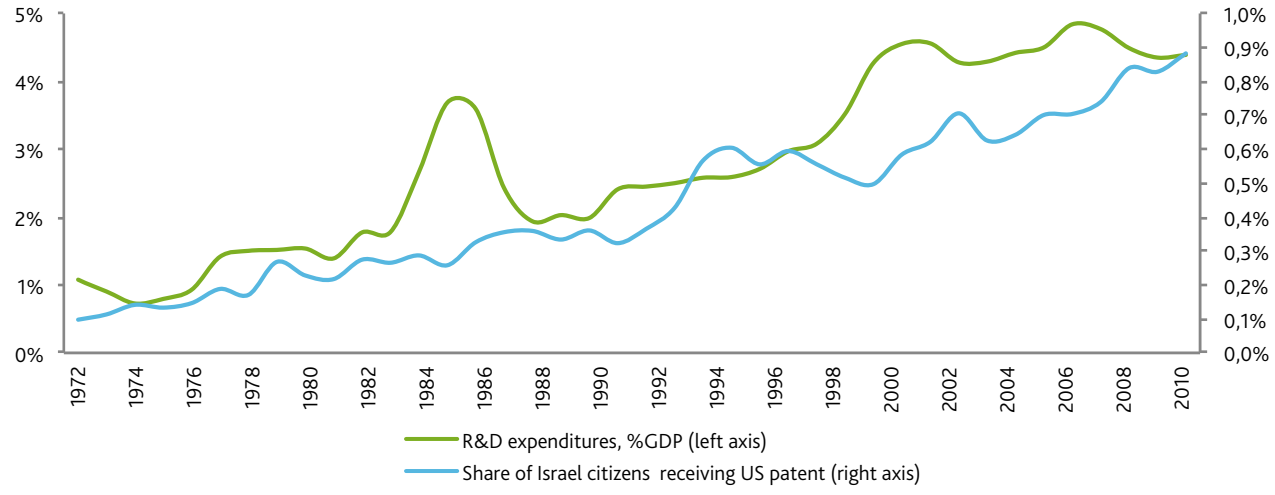
## EFFECTIVENESS OF SMALL AGENCIES

In case of Finland, the state industrial policy in the 1970s and 1980s was focused on supporting traditional industrial branches, such as, most of all, heavy industry (i.e. copper, steel and chemical), and the country's major export destination was the USSR. In 1980 the proportion of high-tech exports was only 3.3% of the overall export volume, which was half as little as it is currently in Poland. In 1968, in order to commemorate the Bank of Finland's 50th anniversary, Sitra foundation was established and provided with a broad range of authorities in the area of boosting competitiveness by financing of R&D projects conducted by private companies. Sitra, whose operations were financed from endowment of EUR 145 million, used to grant companies loans intended for R&D. The loans were granted only on the condition that concepts had been approved of by Sitra's experts, and were repaid only if newly developed products turned out to be successful. During the first ten years of Sitra's operations, it targeted its support mostly at those industries that were underrepresented in Finland, like for example electronics industry which received ca. 25% of such funds. Contemporary mainstream companies were not much interested in this kind of support due to its limited value, and were rather focused on obtaining state support via traditional channels. At the same time, Sitra tried to promote a new R&D model among decision-makers, political and economic elites, and then attract major companies. These efforts resulted in establishing in 1984 another agency named Tekes, whose budget was several times higher, and which could co-finance much larger R&D projects.

After emergence of its competitor, Sitra being a smaller agency, focused on supporting development of the venture capital (VC) market by establishing of the Finnish Venture Capital Organisation in 1990. The organisation's aims included lobbing investors and politicians in order to overcome mental and legal barriers preventing development of VC funds. As a result, within ten years' period, Finland exceeded all EU Member States in terms of GDP share of investments in development of new projects, and it still remains one of the world leaders (Figure IV.38).

VC funds also play a key role in the Israeli economy. In 2012, the GDP proportion of VC funds intended for new projects was nine times as high as it was in Finland (and over two hundred times as high as it was in Poland). Meanwhile, in the first half of the 1970s, the average R&D expenditure did not exceed 1% of the

Figure IV.39. **GDP proportion of the R&D expenditure in Israel and patents registered by Israeli citizens in the US; 1972-2013**




*Source: own elaboration based on Trajtenberg (2002), the data gathered by the World Bank, Index Mundi and U. S. Patent and Trademark Office*

GDP, and the number of patents registered by Israeli citizens in the US approximated the figure that is now reported in Poland (Figure IV.39). Over the past forty years, Israel has increased its share in the number of patents registered in the US tenfold, thus attaining the result which is thirty times as high as reported in Poland, despite its population being four times smaller.

In 1969, the Office of Chief Scientist (OCS) was established at the Ministry of Trade, whose objective was to maximise R&D investments. Apart from providing direct support, which until the beginning of the 1980s had been insignificant, the OCS's main task was communicating to both private and public sectors the importance of research. At the beginning of the 1990s, the OCS managed to launch three programs aiming at supporting innovation i.e. Technological Incubators, Yozma and MAGNET.

Thanks to such efforts, VC market and IT sector in Israel developed better than in Finland, although Finland reported better diffusion of R&D results across the entire economy. Despite such differences, the results of operations of small development agencies in both countries have been very positive, regardless of major institutional differences. This indicates that the solution can also be applied in countries with lower quality of human capital. Such findings differ from those which were formulated by Algan and Cahuc (2006) analysing a Danish flexicurity model, which, in their opinion, could not be successfully implemented without changing social attitudes.

The small agency model becomes endangered if the value of state investments increases. According Breznitz i Ornston (2012), small agency budgets have the following advantages:

- Positive attitude towards risk resulting from small amount of money at stake,
- No alternative to co-financing from the private sector,
- Main focus is on innovation not commercialisation of the research findings, because scaling the project beyond development of working prototypes is financially impossible,
- Abandonment of unpromising ventures due to insufficient funds for continuous support,
- Low level of interest on the part of interest groups,
- Lower prestige of agencies makes their operations less attractive to politicians.

A large distance from political centres, and resulting independence, give small research agencies more freedom in experimenting with innovations. There is no time pressure, not much bureaucracy or excessive controls. Although salaries are similar to those obtained elsewhere in the public sector, agency workers gain an opportunity to get well-paid jobs in the future, if their projects are implemented in private companies. This makes agencies less attractive as 'employers of last resort' for political activists, since greater material benefits are ultimately attained only by those who possess innovative competencies that can be proven on the market.

An important aspect of operations of development agencies both in Finland and Israel was convincing the private sector about viability of R&D investments. A small budget was also helpful here, as convincing entrepreneurs was a necessary condition for initiating large scale R&D processes – the agency alone would be unable to finance them. Reluctance of entrepreneurs towards R&D in Poland was highlighted by participants of the expert panel, who observed that the key reason why companies chose not to invest into R&D is their lack of confidence that such endeavours would anyhow affect their situation.

Meanwhile Professor Breznitz, during a seminar held in June by the Warsaw University and the National Bank of Poland (Breznitz 2014) warned Poland against the risk posed by exaggerated budgets of research agencies, including, in particular, high EU subsidies. In his opinion, strengths of small budgets automatically translated into weaknesses of big ones i.e. increased interest of politicians and interest groups, and prolonged support of unpromising ventures. Negative consequences of increased budgets can be observed both in Finland and Israel. Since 1999 Sitra has been dealing with 'social innovation' by implementing political tasks in the area of healthcare and local government reform. In 2004 a former Prime Minister had been put on the helm of Sitra, which implied that a number of ex-politician also joined the agency. Meanwhile, in Israel a purely scientific assessment of projects was abandoned in 2010, and public financing was radically reduced in the case of companies reporting over 100 million USD annual turnover. In some cases the OCS funds were used to bail out falling companies.

## 4.4 ADAPTATION THROUGH EDUCATION

For at least thirty years, the premium for performing skilled jobs has been increasing. As mentioned in chapter 2.2., in the future this tendency may reverse, however it may turn out to be just the opposite. Therefore, it would be advisable to prepare for a more pessimistic scenario. On the other hand, a number of skills will lose their importance – so is there any point in mastering them just like past generations did? Moreover, the requirements for future employees will be higher, also in other respects. All in all, considering the future labour market situation, nowadays of topmost importance appears to be the question of education.

The contemporary education is not well-tailored to the new reality. As it was highlighted by Bitner and Kamińska, (2014) an system of education in Poland has been deeply rooted in the paradigms of a 'perfect school' and 'perfect student'. The first of these paradigms assumes that a perfect school is a one that teaches a dozen or so obligatory subjects at a decent level, and the objective of the state is to create and maintain thousands of such schools. The perfect school is attended by a perfect student i.e. the one who learns all subjects taught at the ideal school to get the best grades.

Obviously, this model has its flaws – young people are unable to master too many subjects that are nowadays regarded as obligatory, and schools fail to maintain the highest teaching standards during all classes. The core of the problem is maladjustment of the majority of students' and teachers' talents by forcing them to share knowledge in a strictly prescribed manner. As a consequence, many potential talents are wasted as in case of students who, despite being unable to deal with the overburdened curriculum, may have extraordinary non-academic or practical skills. On the other hand, the best students, also including prospective innovators, do not get enough opportunities for showing their talents overwhelmed by the routine.

Moreover, in many curricula, also including those co-financed by the EU, technical professions are nowadays presented as most desirable in the future. However, in the world full of new technologies with rapidly changing and unstable labour market, where instantly mechanised jobs are replaced by new ones, forecasting of labour demand is extremely difficult. Hence, it is important for the education system to focus not on specific skills useful in specific jobs, but rather on capabilities that would allow young people to quickly adapt to the changing circumstances.

Reforms should be introduced gradually. In a short-term perspective pilot programs including gradually increasing groups of students can be launched with a support of researchers carefully monitoring the results. Engaging of the private sector, which is more likely to experiment and use innovation, into the process is worth considering. Only in a long-term perspective it will be possible to introduce new teaching methods on a broader scale. Both short- and long-term objectives of the reform should take into account the following three main aspects:

- promoting innovation,
- adapting to new conditions and the changing labour market,
- educating specialists.

Moreover, it is worth to look at the attributes most useful on the labour market as defined by Cowen (2013) and WISE SARA (Bitner and Starościk 2014).

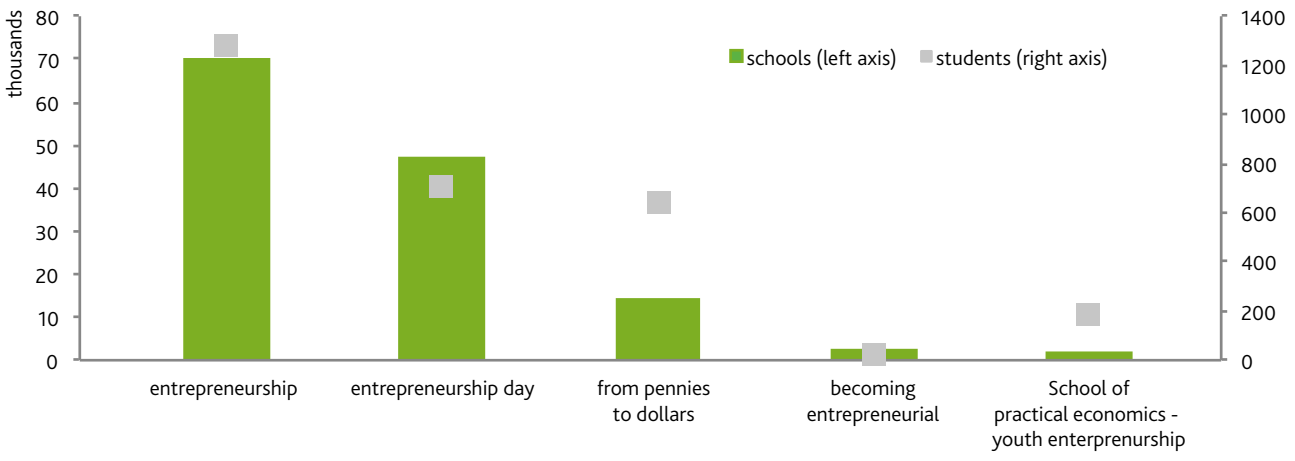
The proposed implementation of the key objectives of the reform has been divided into four parts:

### 1. Modern technologies in teaching.

Modern technologies should perform the key role in the course of implementation of the above proposals. A good example would be the methods promoted by Salman Khan (twenty-minute films explaining specific topics). They allow students to gain knowledge at their own pace and in convenient manner, and give teachers an opportunity to focus on practical exercises with their students during classes (hence, today's homework and class work would swap places), and the same time, providing them with a feedback about their students' perseverance and progress. Such information could follow students throughout their entire educational career, and, most likely, become an interesting supplement to their diplomas. Similar methods are deployed by Coursera platform which offers adult courses, promoting an idea of lifelong learning and ongoing improvement of one's qualification at no extra costs (the courses are available free of charge).

Unfortunately, the majority of free online educational materials for those who are willing to improve their qualification are available in English. Meanwhile, the European Survey on Language Competences (ESLC) conducted in 2011 revealed that the level of English in case of more than half of junior high school students is A1 or lower. This result points out to an unconditional necessity of raising level of language teaching starting from the initial stages of education. Only part of Khan Academy films is available in Polish. However, the awareness of the existing tools such as Coursera or Khan Academy is non-existent. Hence, the first step which can immediately be taken in order to improve the level of education and lifelong learning is reviewing the available resources for teachers, students and anyone wishing to improve their qualifications.

Figure IV.40. **Participation in selected programs held by the Polish Junior Achievement Foundation**




*Source: Bitner i Kamińska (2014)*

## 2. New skills and methods

In order to simplify the process of gaining new skills that are necessary in the rapidly changing world by the students, the authors claim that a number of areas need to be reformed. First of all, approach to teamwork should be revised. Although at present, teamwork is taught as part of curriculum, it practically consists of just a few people working, with others being passive. In order to increase efficiency of projects, we should make sure that the assignment cannot be completed by just one or two persons. The composition of groups should also be planned in advance in order to leverage competition across different groups, ensure diversification and complementariness of skills. This will foster interaction between students and allow them to practice their soft skills, necessary in the contemporary labour market.

Secondly, we should also pay attention to another marginalised, but very important area of education i.e. entrepreneurship trainings. The subjects that are being taught in Poland, i.e. Basic Enterprise and Economics in Practice are unique in the European context. The former one is meant to teach students some fundamental skills (writing a CV and letter of application, opening of a bank account, etc.), while Economics in Practice should guide students throughout all stages of a business undertaking i.e. idea, planning, implementation and evaluation. Unfortunately, the emphasis on teaching encyclopaedic knowledge that is typical of the Polish education system, combined with the lack of qualified teachers result in lowering of the quality of classes, and non-fulfilment of all program objectives. Moreover, despite the Ministry of Education's plans, online business games and student microenterprises are still rarities at schools. Such student activities are promoted worldwide by the Junior Achievement Foundation, and by the Polish Junior Achievement Foundation [Fundacja Młodzieżowej Przedsiębiorczości]. All such actions should be regarded as standard, and not as an exception, and be conducted at much more schools than nowadays (cf. Figure IV.40).

## 3. Diversification and specialisation of schools

The current system of education promotes obtaining university education, and over 40% of junior high school graduates attend general secondary schools (cf. Figure IV.41). Due to unattractive offering of vocational and technical high schools they often cherish a mistaken conviction that even the poorest university degree is a guarantee of better salaries than a well-trained occupation.

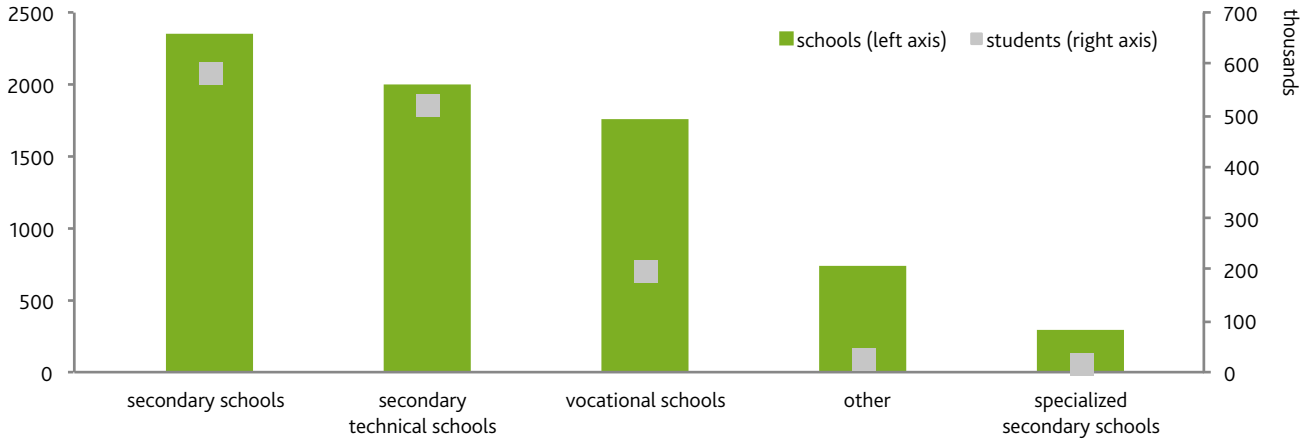
In order to reverse such trend, it is necessary to create a system that would offer more diversified career development opportunities, and to improve the quality of vocational and technical education. Moreover, career guidance should be available at earlier stages and more extensively.

## 4. Changes of the university education system

In the case of university education, an initiative aimed at aligning teaching curricula with the requirements of the labour market in the context of new technologies is the qualification framework. The European Qualification Framework (EQF) is a method allowing for description of competencies attained through university education, which allows for comparing achievements of students in different countries and institutions. The EQF is a foundation for the National Qualification Framework (NQF). Implementation of NQF-based curricula was initiated during the academic year 2012/2013.

Despite the fact that NQFs have their numerous benefits, such as more transparency and possibility to compare diplomas, promotion of lifelong learning or student mobility, reforming of descriptions is not likely to solve all the problems faced by the entire educational system in Poland. NQF in its current shape seems to more resemble a 'covering' of the current system of the higher education, than a real reform. What is more, among numerous problems, the most serious drawback is the adjustment of standards and requirements to the 'possibility of obtaining effects by the least talented student'.

Figure IV.41. **Numbers of students and upper-secondary schools; 2012**




*Source: GUS*

This approach leads to a dramatic decrease in the quality of education in case of university studies. This is particularly detrimental to the process of training specialists, an objective which should guide the reforms.

Reforming of the third-stage university studies i.e. PhD courses is of topmost priority. Raising requirements and quality of education is very important. A concept that might facilitate such processes are the Central PhD Studies. Having a centre that would attract talented people coming from all over Poland would be particularly useful in the case of social sciences such as e.g. economics where a dialogue, interactions and cooperation between scientists are the key for success, even though the resources allocated for educating PhD students are very limited. This solution would solve the problem of financing third-level studies, without compromising the quality of education, and providing the most talented students with career development opportunities, research trips, access to the latest technologies, etc.

It needs to be emphasised that innovative and educational policies are strongly complementary. Training of new technology experts and increasing of the skill levels before expected changes occur is pointless, if there exists no actual market demand for such skills. For this reason it is important to support innovation which creates demand for a properly skilled workforce. On the other hand, launching an innovative project is much more difficult without properly educated staff. Hence, educational and innovative policies should be used in conjunction.

## FIGURES

## TABLES



## BOXES



## DIAGRAMS

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# Recommendations for Public Policy

Even though the Great Recession of the end of the first decade of the 21st century moved the priorities of labour market policies to the short-term challenges, connected with a sharp worldwide increase of unemployment and the risk of economic recovery not leading to the employment growth (resulting in the so called jobless growth), the ability to respond to the challenges set by the medium- and long-term processes resulting from technological progress, demographic processes, globalisation and climate change, is of great importance to the future of the European labour markets, including Polish one. Those require a response both when it comes to the factors influencing the demand for labour, as well as the policies forming the supply side, i.e. economic activityand human capital.

In the coming decades the dominant phenomenon of the labour markets in the developed countries will most likely be a so called employment polarisation, i.e. a relative increase of the labour demand for both the skilled workers and those low-skilled ones performing elementary jobs, accompanied by a relative decrease in the labour demand for workers with average qualifications. This process, advanced the most in the United States and present in Western Europe, is not yet distinct in Poland, however it will probably accelerate. Because the polarisation results from technological progress, replacing jobs undergoing computerisation and automation, we should not succumb to the illusion that it is possible to effectively challenge it, especially in an open, globalised economy. Nevertheless, creating the conditions favouring creation of highly productive jobs with simultaneous provision of adequate support for the groups of workers that are placed in an unfavourable position as a result of polarisation, is a challenge for the public policy. The expenditure on research and development should go up – international experience indicate that increased public investments in this area are followed by the growth of private expenditure, so that the enterprises operating in Poland could move up the global production chain and create highly productive and highly paid jobs. One of the possibilities is to fund one or more small agencies supporting research and development with a great autonomy, following the example of a Finnish Sitra or Israeli OCS from the first several years of their operation, even before they grew and became known. At the same time, it is necessary to reasonably spend the EU funds intended for research and development, taking into account in particular the innovation risks brought by high budget. It is also advisable to create the incentives for the enterprises to participate in the activities engaging different organisations and to share the effects their work in the form of intellectual property, following the example of the research and development consortia under the auspices of the state.

Concurrently, increasing innovation, with a positive effect in the form of the growth in the number of highly productive and highly paid jobs, may give rise to the increase in income inequalities, so to compensate for uneven distribution of benefits, increase of the tax system progressiveness may prove to be necessary. Moreover, since one can expect growing polarisation and increase in tertiary education premia, one should consider introducing payment policy for higher studies. To avoid the exclusion from educational system of the persons from poorer families, this should be accompanied by the introduction of a developed system of loans and exemptions for the poor. The analyses conducted both in the second edition of Employment in Poland, and the Employment in Poland 2011 – Labour and Poverty, show that supporting social mobility is a major challenge for public policy. Strong relationship between the education of parents and their children, reflected in their outcomes on the labour market, points to the necessity of educational support especially for the persons from the deprived groups. The most effective activities in this area refer to the youngest children – supporting early education is crucial for future educational and professional results. Further development of nursery and kindergarten care and supporting their quality should be the main direction of these activities, however it is important to provide financial accessibility (currently in prevailing number of cases the fees for nurseries and kindergartens are not differentiated depending on the parents' income, which may constitute a considerable barrier for the parents with low earnings).

At the same time, it is necessary to modernise educational model at every level, so that bigger focus is put on the skills such as: the ability to think flexibly, reasoning and problem solving, critical thinking, independence, creativity, soft skills, ability to work as part of a team and conscientiousness. It is particularly essential to modernise the vocational training system.

The changes occurring in the age structure of labour force in Poland require appropriate adjustment of the socio-economic policy. Actions directed at supporting longer economic activity, addressed mainly at persons aged over 50, will be an essential issue. Their effectiveness will, nevertheless, depend on the comprehensive approach to the problem and a whole set of supplementing initiatives, taken at various levels. In the context of the presented analyses, the reforms of the institutional environment sealing the benefit and pension system, limiting the possibilities to withdraw from the labour market early, seem to be of key importance. This means in particular the need for a reform of the uniformed services, mining and agricultural pension systems, so that the effective retirement age of these professional groups equals to the retirement age in the general pension scheme as soon as possible. What is also crucial is reforming of partial pensions, so that they do not act as an early half-pension, through introduction of the requirement of part-time work while receiving the partial pension, and also adjusting the pension system and the system of preretirement benefits to the conditions created by raising the retirement age in the general system.

What remains essential is the efficiency improvement of the ALMP activities. It is difficult to fairly assess the effectiveness of newly introduced changes in the Act on the promotion of

employment and the labour market institutions, intended for profiling of activities offered to the unemployed, however, they do not take into consideration the specificity of the problem of the persons aged over 50 (and particularly the persons aged over 60 years old) on the labour market. Another issue is upgrading of competences and qualifications of elderly people, which mainly refers to the cohorts of the 50 and 60 year olds. As it has been indicated in the report, the gap in their skills as compared to younger people is significant, which to a large extent is reflected in the decrease of their chances to find a job if they are dismissed. Supporting life-long learning, which was only a slogan in Poland so far, requires more effective actions, both on the supply side (improvingquality of educational offer, mechanisms, governing the training market) as well as on the demand side (persons aged over 45 still do not feel the need to retrain and make them aware of the benefits of further education and and their needs should be a priority for the policy in this respect).

The activities engaging the employers in increasing the economic activity of the elderly and maintaining their employment are equally important. The role of employers is mainly to introduce changes adjusting their HR policy to the demographic changes, which should include both the improvement of the quality and working conditions for the people aged over 50, as well as a better policy enabling the cooperation of the multi-generation team and the flow of knowledge, skills and experience between younger and older employees. The activities enabling overcoming the stereotypes of the workers aged over 50 are the responsibility of central and local policy. Those would be the incentive for both, the employers to maintain the jobs, as well as for the employees themselves, contributing to their greater faith in the possibilities and benefits of working longer. Also the coordination of the active labour market policy with healthcare policy is necessary. Wider use of medical checkups, supporting physical activity and healthy life style is a common interest of both fields of the public policy, and the coordination of the activities in this area may bring numerous benefits.

Crucial challenges are set by the need to counteract the causes and results of climate change. The so called green jobs are already a phenomenon on the labour market, even though they still lack still unanimous definition and statistics. Since their importance will likely increase, the actions at the government level leading to the development of the Polish definition of green jobs should be undertaken, and also the most important statistical data on the subject should be gathered. Green jobs can be well paid, attractive and safe. Their characteristics depend to a large extent on the sector, in which they are created. As illustrated by the international examples, to make the created jobs permanent, investment in green jobs should be extended over a long period of time as opposed to the high one-off expense. A stability of the legal provisions and the predictability of governmental actions are also important for the sector. The government should support these enterprises and technologies, the activity of which in the long term will become commercially viable, and it should ensure legal stability. A significant factor of the success of green transformation is an availability of the labour force with proper skills. International experience shows that this is a prerequisite. Currently Poland faces shortages of certain desired qualifications, especially in the field of scientific skills, which are necessary to create environment-friendly innovative technologies. This is yet another premise for the modernisation of educational system.

Green modernisation phenomenon may also constitute a chance for the poor, rural regions; it will help to solve the problems connected with the unemployment, lack of perspectives for the young people, and also to ensure the good condition of the environment and the access to clean energy. Unfortunately, the tools enabling to use this chance were not functioning properly so far. The use of EU funds very often consisted of organisation of trainings, that did not satisfy employers' needs. Working of the local employment agencies is far from perfect: theofficials of employment agencies often have little knowledge of green jobs despite the existence of this phenomenon in their regions. Employment agencies do not see the green transformation as a possibility to lower the unemployment. This may be due to their short-term thinking and lack of knowledge with respect to long--term perspectives, which on the one hand means the necessity to organise campaigns that would also raise the awareness of the public officials, but also the employers, with respect to the importance of green jobs, and on the other hand, the need to systematically identify the demand for skills expected in the future, both at a national and local level.

There is considerable investment carried out in many countries to counteract the excessive use of the environment. The analysis presented in part three shows that in case of Poland this type of interventions are justified not only for ecological reasons, but also from the point of view of the economy: these create additional employment and favour the GDP growth. However, for these effects to occur the governmental action is necessary. Not all of the technologies are equally beneficial: for example CCS is a costly solution which creates a burden for the labour market. What is more, the method of financing of green modernisation is particularly important. Thus, the government should make investment in green economy, acting not only in accordance with the environment, but also with other elements of the sustainable development: economic and social growth. The government should also finance the investment in a proper manner, for example increasing labour taxation is not advisable. The choice of technologies should be based on the economic analysis: one should invest in energy-efficiency and RSE, and CCS should be treated as a technology to be introduced as the last, when alternative methods of emissions reduction will already be exhausted. Despite that, further studies should be conducted, and the CCS demonstration projects should be introduced at the European scale, since the implementation of this technology may be indispensable in the long term.

# Methodological annex

# ANNEX TO PART 1

## A1. THE TASKS PERFORMED AS PART OF THE PROFESSION

### Table AX.1. Main type of task in the profession.

| No. | Occupation | Task type |
|---|---|---|
| 111 | Legislators and senior officials | interpersonal |
| 112 | Managing directors and chief executives | interpersonal |
| 121 | Business services and administration managers | interpersonal |
| 122 | Sales, marketing and development managers | interpersonal |
| 131 | Production managers in agriculture, forestry and fisheries | interpersonal |
| 132 | Manufacturing, mining, construction, and distribution managers | interpersonal |
| 133 | Information and communications technology service managers | interpersonal |
| 134 | Professional services managers | interpersonal |
| 141 | Hotel and restaurant managers | interpersonal |
| 142 | Retail and wholesale trade managers | interpersonal |
| 143 | Other services managers | interpersonal |
| 211 | Physical and earth science professionals | analytical |
| 212 | Mathematicians, actuaries and statisticians | analytical |
| 213 | Life science professionals | analytical |
| 214 | Engineering professionals (excluding electrotechnology) | analytical |
| 215 | Electrotechnology engineers | analytical |
| 216 | Architects, planners, surveyors and designers | analytical |
| 221 | Medical doctors | analytical |
| 222 | Nursing and midwifery professionals | interpersonal |
| 223 | Traditional and complementary medicine professionals | interpersonal |
| 224 | Paramedical practitioners | analytical |
| 225 | Veterinarians | analytical |
| 226 | Other health professionals | routine cognitive |
| 227 | Specialists in laboratory medicine | interpersonal |
| 228 | Other specialist in health care | interpersonal |
| 231 | University and higher education teachers | analytical |
| 232 | Vocational education teachers | interpersonal |
| 233 | Secondary education teachers | interpersonal |
| 234 | Primary school and early childhood teachers | interpersonal |
| 235 | Other teaching professionals | interpersonal |
| 241 | Finance professionals | analytical |
| 242 | Administration professionals | interpersonal |
| 243 | Sales, marketing and public relations professionals | interpersonal |
| 244 | Real estate market specialists | interpersonal |
| 251 | Software and applications developers and analysts | analytical |
| 252 | Database and network professionals | analytical |
| 261 | Legal professionals | analytical |
| 262 | Librarians, archivists and curators | interpersonal |
| 263 | Social and religious professionals | analytical |
| 264 | Authors, journalists and linguists | analytical |
| 265 | Creative and performing artists | analytical |
| 311 | Physical and engineering science technicians | analytical |
| 312 | Mining, manufacturing and construction supervisors | interpersonal |
| 313 | Process control technicians | routine manual |
| 314 | Life science technicians and related associate professionals | nonroutine manual |

| | | |
|---|---|---|
| 315 | Ship and aircraft controllers and technicians | nonroutine manual |
| 321 | Medical and pharmaceutical technicians | routine cognitive |
| 322 | Nursing and midwifery associate professionals | routine cognitive |
| 323 | Traditional and complementary medicine associate professionals | interpersonal |
| 324 | Veterinary technicians and assistants | routine cognitive |
| 325 | Other health associate professionals | routine cognitive |
| 331 | Financial and mathematical associate professionals | routine cognitive |
| 332 | Sales and purchasing agents and brokers | interpersonal |
| 333 | Business services agents | interpersonal |
| 334 | Administrative and specialized secretaries | routine cognitive |
| 335 | Regulatory government associate professionals | interpersonal |
| 341 | Legal, social and religious associate professionals | interpersonal |
| 342 | Sports and fitness workers | interpersonal |
| 343 | Artistic, cultural and culinary associate professionals | interpersonal |
| 351 | Information and communications technology operations and user support technicians | analytical |
| 352 | Telecommunications and broadcasting technicians | nonroutine manual |
| 411 | General office clerks | routine cognitive |
| 412 | Secretaries (general) | routine cognitive |
| 413 | Keyboard operators | routine cognitive |
| 421 | Tellers, money collectors and related clerks | routine cognitive |
| 422 | Client information workers | routine cognitive |
| 431 | Numerical clerks | routine cognitive |
| 432 | Material-recording and transport clerks | routine cognitive |
| 441 | Other clerical support workers | routine cognitive |
| 511 | Travel attendants, conductors and guides | interpersonal |
| 512 | Cooks | routine manual |
| 513 | Waiters and bartenders | interpersonal |
| 514 | Hairdressers, beauticians and related workers | routine manual |
| 515 | Building and housekeeping supervisors | routine manual |
| 516 | Other personal services workers | routine cognitive |
| 521 | Street and market salespersons | interpersonal |
| 522 | Shop salespersons | routine cognitive |
| 523 | Cashiers and ticket clerks | routine cognitive |
| 524 | Other sales workers | interpersonal |
| 531 | Child care workers and teachers' aides | nonroutine manual |
| 532 | Personal care workers in health services | nonroutine manual |
| 541 | Protective services workers | routine cognitive |
| 611 | Market gardeners and crop growers | nonroutine manual |
| 612 | Animal producers | nonroutine manual |
| 613 | Mixed crop and animal producers | nonroutine manual |
| 621 | Forestry and related workers | nonroutine manual |
| 622 | Fishery workers, hunters and trappers | nonroutine manual |
| 631 | Subsistence crop farmers | nonroutine manual |
| 632 | Subsistence livestock farmers | nonroutine manual |
| 633 | Subsistence mixed crop and livestock farmers | nonroutine manual |
| 634 | Subsistence fishers, hunters, trappers and gatherers | nonroutine manual |
| 711 | Building frame and related trades workers | nonroutine manual |
| 712 | Building finishers and related trades workers | nonroutine manual |
| 713 | Painters, building structure cleaners and related trades workers | nonroutine manual |
| 721 | Sheet and structural metal workers, moulders and welders, and related workers | routine manual |
| 722 | Blacksmiths, toolmakers and related trades workers | routine manual |
| 723 | Machinery mechanics and repairers | nonroutine manual |

| | | |
|---|---|---|
| 731 | Handicraft workers | routine manual |
| 732 | Printing trades workers | routine manual |
| 741 | Electrical equipment installers and repairers | nonroutine manual |
| 742 | Electronics and telecommunications installers and repairers | nonroutine manual |
| 751 | Food processing and related trades workers | routine manual |
| 752 | Wood treaters, cabinet-makers and related trades workers | routine manual |
| 753 | Garment and related trades workers | routine manual |
| 754 | Other craft and related workers | nonroutine manual |
| 811 | Mining and mineral processing plant operators | routine manual |
| 812 | Metal processing and finishing plant operators | routine manual |
| 813 | Chemical and photographic products plant and machine operators | routine manual |
| 814 | Rubber, plastic and paper products machine operators | routine manual |
| 815 | Textile, fur and leather products machine operators | routine manual |
| 816 | Food and related products machine operators | routine manual |
| 817 | Wood processing and papermaking plant operators | routine manual |
| 818 | Other stationary plant and machine operators | routine manual |
| 821 | Assemblers | routine manual |
| 831 | Locomotive engine drivers and related workers | nonroutine manual |
| 832 | Car, van and motorcycle drivers | nonroutine manual |
| 833 | Heavy truck and bus drivers | nonroutine manual |
| 834 | Mobile plant operators | nonroutine manual |
| 835 | Ships' deck crews and related workers | nonroutine manual |
| 911 | Domestic, hotel and office cleaners and helpers | routine manual |
| 912 | Vehicle, window, laundry and other hand cleaning workers | routine manual |
| 921 | Agricultural, forestry and fishery labourers | nonroutine manual |
| 931 | Mining and construction labourers | nonroutine manual |
| 932 | Manufacturing labourers | routine manual |
| 933 | Transport and storage labourers | nonroutine manual |
| 941 | Food preparation assistants | routine manual |
| 951 | Street and related service workers | interpersonal |
| 952 | Street vendors (excluding food) | interpersonal |
| 961 | Refuse workers | nonroutine manual |
| 962 | Other elementary workers | routine cognitive |

*Source: Own elaboration based on LFS data and O*net*

# ANNEX TO PART 2

## A2. SUCCESSION OF PROFESSIONS STUDY – SAMPLE CHARACTERISTICS AND THE CLASSIFICATION OF PROFESSIONS

### SAMPLE DESCRIPTION

Succession of Profession Study has been carried out through telephone interviews (CATI) on a random sample of 2000 persons aged 30-39. The structure of the respondents with respect to sex, level of education, province (voivodeship) and the class of place of residence reflects the structure of the Polish population from the 2011 National Census.

After weighing, 51% of the observations are women, and 49% are men. When it comes to education, the largest group comprises the persons with MA education or higher (34%), and the smallest – the persons with lower-secondary education or lower (2%). In the study results description BA, Eng. and MA education has been aggregated into one level. The respondents have been divided into 4 groups considering the size of the place of residence; largest group of respondents lived in the cities with a population of 10 000-100 000, and above 10 000 (ca. 33% in both cases). The largest group of respondents came from Mazovian province (voivodeship) (14.2%), and the smallest from Lubuskie province (voivodeship) (2.6%). Most of the respondents were employed for the last 3 months (89%), and the unemployed and economically inactive persons constituted groups of equal size (5.6% each).

Table A2.1. Socio-economic characteristics of the Succession of Profession Study respondents

| Socio-economic characteristics of respondents | | % of the sample | weighted % of the sample |
|---|---|---|---|
| sex | female | 53.10 | 50.56 |
| | male | 46.90 | 49.44 |
| age | 30 | 12.87 | 13.57 |
| | 31 | 5.76 | 6.70 |
| | 32 | 4.34 | 5.04 |
| | 33 | 4.22 | 5.12 |
| | 34 | 13.41 | 16.26 |
| | 35 | 5.86 | 5.06 |
| | 36 | 6.72 | 5.77 |
| | 37 | 6.97 | 5.87 |
| | 38 | 12.37 | 11.33 |
| | 39 | 27.47 | 28.87 |
| education level | MA or higher | 37.85 | 33.58 |
| | BA | 6.90 | 6.47 |
| | engineer's degreee | 3.75 | 3.41 |
| | secondary general | 9.95 | 10.11 |
| | secondary vocational or postgraduate | 20.75 | 19.65 |
| | basic vocational | 19.65 | 24,66 |
| | lower-secondary or lower | 1.15 | 2.14 |
| class of the place of residence | countryside | 18.40 | 18.88 |
| | city < 10 000 | 13.85 | 14.97 |
| | city 10 000-100 000 | 32.40 | 33.24 |
| | city > 100 000 | 35.35 | 32.90 |
| province (voivodeship) | Lower Silesian | 6.10 | 7.61 |
| | Kuyavian-Pomeranian | 4.05 | 5.15 |
| | Lubelskie | 5.25 | 5.06 |
| | Lubuskie | 3.00 | 2.62 |
| | Łódzkie | 6.60 | 6.39 |
| | Lesser Poland | 7.00 | 8.64 |

| | | | |
|---|---|---|---|
| | Mazovian | 17.70 | 14.12 |
| | Opolskie | 2.95 | 2.74 |
| | Subcarpathian | 5.80 | 5.38 |
| | Podlaskie | 3.00 | 3.15 |
| | Pomeranian | 5.10 | 5.75 |
| | Silesian | 15.30 | 12.65 |
| | Świętokrzyskie | 3.00 | 3.37 |
| | Warmian-Masurian | 3.80 | 3.94 |
| | Greater Poland | 7.05 | 9.08 |
| | West Pomeranian | 4.30 | 4.36 |
| economic activity | employed | 87.55 | 88.86 |
| | unemployed | 6.65 | 5.59 |
| | inactive | 5.80 | 5.55 |

*Source: own work.*

## CLASSIFICATION OF PROFESSIONS

The respondents were divided into groups of professions according to the Polish Classification of Professions and Specialities,[1] which is based on the International Standard Classification of Occupations ISCO elaborated by the International Labour Organisation. 39 large groups were created, among which the most numerous one was the healthcare specialists group (7.57%). For the sake of clarity of the study findings, the description includes the division of employees into 5 groups with respect to the skills they possess: skilled white-collar workers, unskilled white-collar workers, farmers, skilled blue-collar workers and unskilled blue-collar workers. This is the division proposed in 2008 by ILO[2] and elaborated for the use of the study to identify farmers. Skilled white-collar workers constitute nearly half of the sample (46.6%), and then unskilled white-collar workers (25.0%), skilled blue-collar workers (21.5%), unskilled blue-collar workers (2.9%) and farmers (2.3%).

**Table A2.2. Professional structure of the Succession of Profession Study respondents.**

| | Major groups† | | Sub-major groups† | the weighted % of the sample | | |
|---|---|---|---|---|---|---|
| | | | | current occupation | last occupation‡ | acquired profession |
| 1. skilled cognitive | 1. MANAGERS | 11 | Chief executives, senior officials and legislators | 1,94 | 0,24 | 1,41 |
| | | 12 | Administrative and commercial managers | 0,80 | 0,74 | 0,35 |
| | | 13 | Production and specialized services managers | 1,94 | 1,49 | 1,32 |
| | | 14 | Hospitality, retail and other services managers | 0,51 | 0,26 | 0,34 |
| | 2. PROFESSIONALS | 21 | Science and engineering professionals | 5,65 | 0,63 | 5,46 |
| | | 22 | Health professionals | 8,79 | 0,38 | 7,74 |
| | | 23 | Teaching professionals | 8,17 | 4,01 | 6,71 |
| | | 24 | Business and administration professionals | 3,03 | 3,12 | 2,56 |
| | | 25 | Information and communications technology professionals | 1,03 | 0,69 | 0,79 |
| | | 26 | Legal, social and cultural professionals | 4,97 | 1,23 | 6,53 |
| | 3. TECHNICIANS AND ASSOCIATE PROFESSIONALS | 31 | Science and engineering associate professionals | 3,14 | 2,32 | 5,16 |
| | | 32 | Health associate professionals | 3,71 | 2,25 | 3,63 |
| | | 33 | Business and administration associate professionals | 6,17 | 3,69 | 4,69 |
| | | 34 | Legal, social, cultural and related associate professionals | 2,06 | 0,91 | 1,66 |
| | | 35 | Information and communications technicians | 2,91 | - | 3,33 |

1 *Announcement of the Minister of Labour and Social Policy of 24 February 2014 on the communication of a uniform text of the Ordinance of the Minister of Labour and Social Policy on the classification of professions and specialities for the needs of the labour market and the scope of its use (Journal of Laws of 6 June 2014, item 760).*

2 ILO 2008. *International Standard Classification of Occupation. Structure, group definitions and correspondence tables*, ILO, Geneva.

| | | | | | | |
|---|---|---|---|---|---|---|
| 2. unskilled cognitive | 4. CLERICAL SUPPORT WORKERS | 41 | General and keyboard clerks | 3,66 | 6,81 | 1,87 |
| | | 42 | Customer services clerks | 0,63 | - | 0,43 |
| | | 43 | Numerical and material recording clerks | 1,60 | 1,16 | 0,32 |
| | | 44 | Other clerical suport workers | 0,91 | 0,33 | 0,09 |
| | 5. SERVICE AND SALES WORKERS | 51 | Personal service | 6,11 | 11,18 | 6,94 |
| | | 52 | Sales workers | 7,08 | 22,24 | 5,00 |
| | | 53 | Personal care workers | 0,51 | 0,22 | 0,17 |
| | | 54 | Protective services workers | 0,86 | 0,93 | 0,26 |
| 3. farmers | 6. SKILLED AGRICULTURAL, FORESTRY AND FISHERY WORKERS | 61 | Market-oriented skilled agricultural workers | 1,83 | 2,62 | 1,54 |
| | | 62 | Market-oriented skilled forestry, fishing and hunting workers | 0,23 | - | 0,24 |
| | | 63 | Subsistence farmers, fishers, hunters and gatherers | 0,06 | 0,92 | 0,04 |
| 4. skilled manual | 0. ARMED FORCES OCCUPATIONS | 03 | Armed forces occupations, other ranks | 0,91 | 0,32 | 0,30 |
| | 7. CRAFT AND RELATED TRADES WORKERS | 71 | Building and related trade workers, excluding electricians | 3,37 | 5,34 | 4,02 |
| | | 72 | Metal, machinery and related trade workers | 3,31 | 2,77 | 5,48 |
| | | 73 | Handicraft and printing workers | 0,57 | 2,12 | 0,75 |
| | | 74 | Electrical and electronic trades workers | 2,51 | 0,30 | 2,17 |
| | | 75 | Food processing, wood working, garment and other craft and related workers | 3,03 | 8,15 | 5,12 |
| | 8. PLANT AND MACHINE OPERATORS, AND ASSEMBLERS | 81 | Stationary plant and machine operators | 1,71 | 2,38 | 0,84 |
| | | 82 | Assemblers | 0,17 | - | 0,23 |
| | | 83 | Drivers and mobile plant operators | 3,60 | 1,06 | 2,29 |
| 5. unskilled manual | 9. ELEMENTARY OCCUPATIONS | 91 | Cleaners and helpers | 0,57 | 3,97 | - |
| | | 93 | Agricultural, forestry and fishery labourers | 1,31 | 4,12 | 0,72 |
| | | 94 | Food preparation assistants | 0,06 | 0,59 | 0,06 |
| | | 96 | Refuse workers and other elementary workers | 0,40 | 0,53 | 0,19 |
| | | | No occupation | 0,17 | - | 9,25 |
| | | | Number of observations | 1751 | 209 | 1960 |

*Comments: † According to Polish Classification of Professions and Specialties, 2014*
*‡ Applies only to unemployed*
*Source: own calculations based on Succession of Professions Study.*

# ANNEX TO PART 3

## A1. SUSTAINABLE DEVELOPMENT LEXICON

**Adaptation to climate change** – operations aiming at the adaptation to the predicted effects of climate change that should be implemented together with the actions reducing the greenhouse gas emissions.

**Agenda 21** – programming document, which presents the manner of development and implementation of the sustainable development programmes into local life. It was adopted on the initiative of the United Nations in 1992 on the 2nd Conference in Rio de Janeiro.

**Air quality** – the assessment made in relation to legally adopted air quality standards, so the permitted levels of substances, which have to be reached in the air in a certain period of time.

**Carbon footprint** – the sum of greenhouse gas emissions caused directly or indirectly by a given person, organisation, event or product.

**Carbon leakage** – moving the production to the countries with lesser obligations with respect to climate policy or due to the domestic production phase-out.

**CCS (Carbon Capture and Storage)** – the technology, by means of which carbon dioxide is captured and stored.

**Circular economy** – when all the produced items may be used again, i.e. designing the goods with the use of materials that will later make it easier to disassembly the product and use the materials again.

**Climate protection** – the activity aiming at maintaining certain status of the climate.

**Coal gasification**– the process consisting in the total coal to gas conversion with the use of oxygen (air) and steam, occurring at 800–2000 °C and under atmospheric pressure or under pressure.

**Counteracting climate change** – activity aiming to stop the changes in the environment (caused by human activity) that have an impact on the climate.

**CSR (Corporate Social Responsibility)** – the concept according to which enterprises in the phase of building their strategy voluntarily consider social interests and environmental protection, as well as the relations with various groups of stakeholders.

**Earth Summit** – United Nations Conference concerning the Environment and Development, which was held in 1992 in Rio de Janeiro.

**Ecology** – the science related to the structure and the functioning of nature, dealing with the study of interactions between the organisms and their environment.

**Energy conservation** – consists in reducing energy consumption by limiting the use of energy-consuming goods.

**Energy efficiency** – the relation of the size of effect created by a certain device to the amount of energy consumption necessary to achieve this effect.

**ETS – European Emission Trading Scheme** – the system of trading with carbon dioxide emissions. Since the reform adopted in 2008 by the countries of the European Union, there is an obligation to purchase the allowances for CO2 emissions, after using the allowances granted to the European Union Member States.

**Europe 2020 strategy** – EU strategy for growth for the period of 2010-2020 as to emerge from the crisis and create the conditions for more competitive economy with higher employment rate.

**Externalities** – occur when the good production or consumption directly influences the enterprise or consumers who do not buy and do not sell this good (environmental pollution, noise, crowd).

**GHG abatement (Greenhouse gas abatement)** – the strategies consisting in identification of the possibilities to mitigate climate changes through emission reduction and the calculation of the costs of such activities.

**Green economy** – the path of socio-economic development pursuing the objectives of sustainable development in a more effective manner, which is supposed to ensure proper relations between economy and ecosystems.

**Green growth** – environmentally and socially sustainable development, particularly with respect to investing in infrastructure and new technologies, which would be the key elements of the low-carbon economic growth.

**Green public procurement** – means the policy under which public entities include the ecological criteria and/or requirements to the procurement process.

**Jevons paradox** – illustrates a phenomenon occurring in the technological development process, when the growing productivity of energy generation increases the consumption of this energy as well.

**Kyoto Protocol** – international treaty supplementing the United Nations Convention on climate change and at the same time international agreement on counteracting global warming. It was negotiated in 1997 in Kyoto, and came into force in 2005.

**Land rehabilitation** – restoring the value in use and the natural values of the areas devastated and degraded due to human activity.

**Lisbon strategy** – development plan of the EU adopted in 2000 aiming at making Europe the most dynamic and competitive economic region in the world.

**Nuclear energy** – energy generated in the processes of nuclear fission of uranium and plutionium atoms. It involves the release of heat used to generate steam converted into mechanical energy in secondary circulation in the process of thermal expansion in the turbine, which drives the generator producing electricity.

**Organic farming** – system of management with a sustainable plant and animal production, the production should combine environment-friendly management methods.

**Our Common Future** – report of the World Commission on Environment and Development from 1987 claiming that the existence of present generations may continue without jeopardising the growth possibilities of future generations.

**Passive buildings** – buildings construction standard characterised by very good thermal insulation parameters to minimise energy consumption during building operation.

**Rebound effect** – the effect consisting in increasing the consumption of natural resources despite the productivity growth of their use.

**Renewable energy sources** – energy sources, resource of which is renewed in a short period of time.

**Rio+20** – United Nations Conference on Sustainable Development, which took place on 20-22 June 2012 in Rio de Janeiro.

**Sustainable development** – it allows to guarantee that the current growth will not jeopardise the growth possibilities of future generations.

**Sustainable energy mix** – the composition of energy sources, in which the reductions concerning the use of fossil fuels occur.

**Sustainable transport** – activities aiming at reducing the strict minimum of the negative impact of the transport on the environment (change of the means of transport, the use of alternative fuels).

**UN agencies** – organisations bound by the agreements with the United Nations, which actively support the development socio-economic world.

**UN reports** – documents published by the United Nations describing and commenting current affairs and problems.

## A2. LIST OF ABBREVIATIONS

**CCS** - Carbon Capture and Storage

**CFC** - chlorofluorocarbon

**$CO_2$** – carbon dioxide

**ESF** – European Social Fund

**EU-ETS** – The EU Emission Trading System

**GWh** – gigawatt hour (=3 600 000 000 000 J)

**ILO** – International Labour Organization

**IPCC** - Intergovernmental Panel on Climate Change– the organisation founded in order to assess the risk connected with the human impact on the climate change.

**kWh** – kilowatt hour (=3 600 000 J)

**MAD** – Ministry of Administration and Digitization

**Mtoe** – Million tonnes of oil equivalent

**MWh** – megawatt hour (=3 600 000 000 J)

**Non-ETS** – sectors not covered by the EU ETS

**RSE** – renewable sources of energy

**PPP** – Purchasing Power Parity

**PEA** – District (Poviat) Employment Agency

**PV** – Present Value

**R&D** – Research and Development

**STEM** – Science, technology, engineering and mathematics

**$tCO_2e$** – Tonnes of $CO_2$ Equivalents

**TWh** – terawatt hour (=3 600 000 000 000 000 J)

**VAT** – Value Added Tax

## A3. MACROECONOMIC MODELLING METHODS

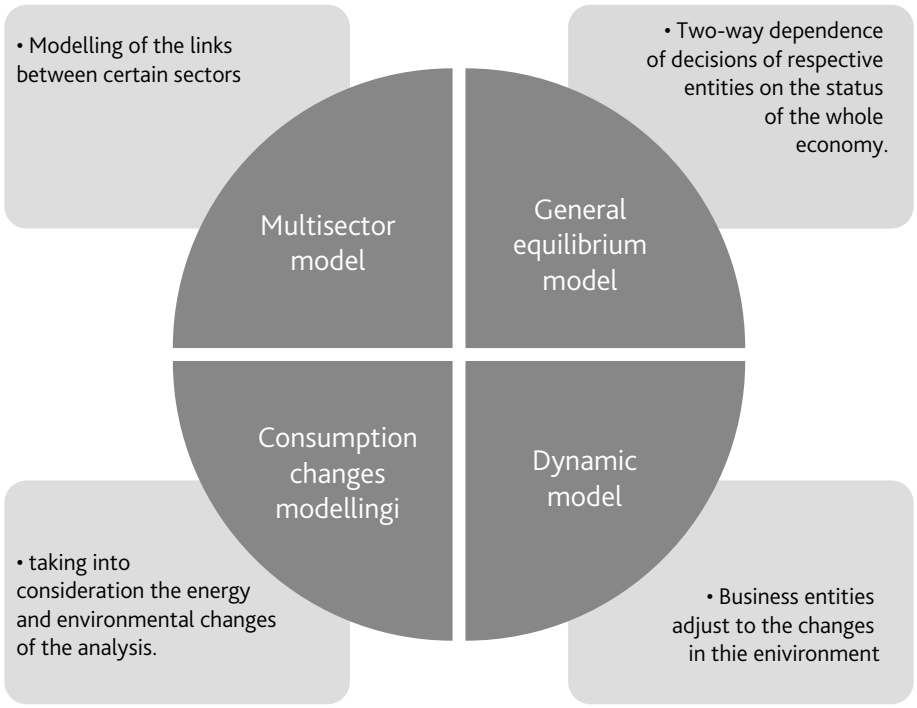
### A3.1 MEMO2 MODEL SPECIFICATION

MEMO (Macroeconomic Mitigation Options) model has been prepared as part of the works on the World Bank report (World Bank 2011) devoted to the low-emission transformation of the Polish economy until 2030. This is a dynamic, stochastic model of general (DSGE) taking into account the use of energy and emissions generated as a result of economic activity. This enables the analysis of macroeconomic effects of implementing the activities for the reduction of energy consumption and greenhouse gas emissions. For the purpose of this report the updated second version of the model, MEMO II, has been used.

The modelled economy consists of entities which are related to each other: households maximising their wealth, enterprises maximising the profit and the state, which imposes taxes (CIT, PIT, VAT and taxes on wealth) and spends money coming from the budget on the investments, consumption and social transfers. These entities meet on three markets: the labour market, the capital market and the commodities market. The production and consumption cause carbon dioxide emission, which is modelled at the level of sectors and households. In the production process the enterprises use the labour and capital resources, intermediate products and energy.

The important advantage of MEMO II model from the perspective of the green jobs analysis is the modelling of the labour market taking into consideration its deficiencies resulting in unemployment. Owing to this, it is possible to assess the impact of environment-friendly restructuring of the economy on the employment in Poland over the next decades.

Chart A3.1. MEMO macroeconomic model




*Source: Bukowski et al. (2013)*

## A3.2 LEVERAGES

### Table A3.1. Leverages used in MEMO2 model

| Area | Leverages | The scale of the one-off intervention | The years of respective interventions |
|---|---|---|---|
| buildings | deep thermal upgrading | 10 million m2 | 2015/20<br>2025/30<br>2035/40 |
| | new, energy-efficient buildings | 10 million m2 | 2015/20<br>2025/30<br>2035/40 |
| waste | waste incineration plant | 5 plants | 2015/20<br>2025/30<br>2035/40 |
| industry – CCS | CCS steelworks | 1 installation | 2035/40 |
| | CCS cement factory | 1 installation | 2035/40 |
| | CCS refinery | 1 installation | 2035/40 |
| | CCS production of ammonia | 1 installation | 2035/40 |
| transport | fuel-efficient passenger cars<br>(2015/20 level 2, 2025/30 level 3, 2035/40 level 4) | 100 000 vehicles | 2015/20<br>2025/30<br>2035/40 |
| | passenger cars – hybrid plug-in | 100 000 vehicles | 2025/30<br>2035/40 |
| energy | nuclear energy | 1 GW | 2025/30<br>2035/40 |
| | wind - land | 1 GW | 2015/20<br>2025/30<br>2035/40 |
| | wind - sea | 1 GW | 2015/20<br>2025/30<br>2035/40 |
| | distributed energy (PV) | 1 GW | 2015/20<br>2025/30<br>2035/40 |
| | coal + CCS | 1 GW | 2025/30<br>2035/40 |

*Source: WISE Institute own work.*

## A4. IN-DEPTH PERSONAL INTERVIEWS' SCENARIO

### A4.1 REPRESENTATIVES OF ENVIRONMENTAL TECHNOLOGY SECTOR

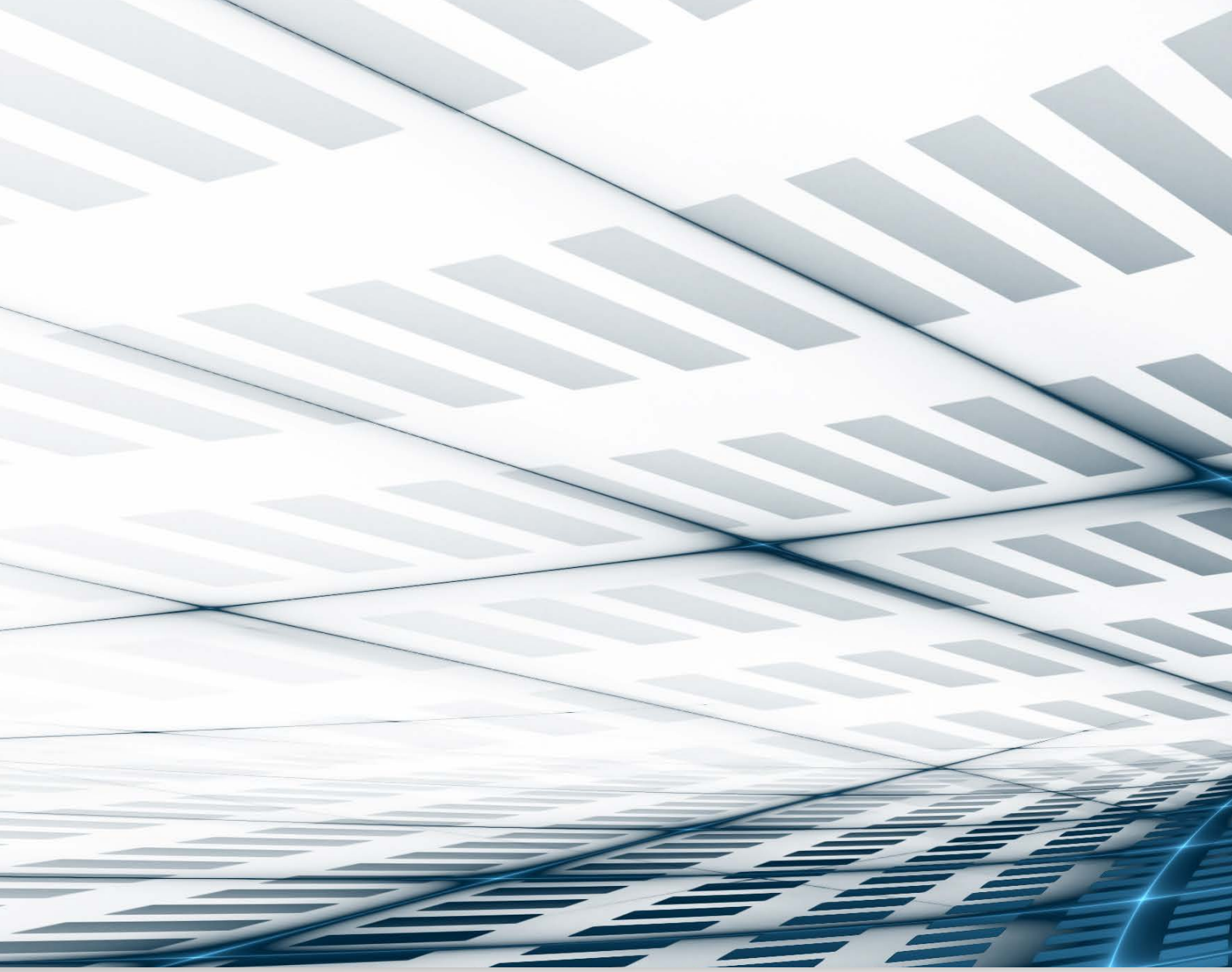
| General issues |
|---|
| What is the estimated number of employees in the sector in Poland?<br>In how many enterprises do they work?<br>What is the condition of the sector? And what trends are expected in the future?<br>Does the development of the sector pose a threat to the jobs in other sectors? Will it be complementary to them? How will it influence the net number of jobs in the economy?<br>What percentage of these are the jobs connected with conducting research and development works?<br>What is the condition of the sector as compared to other European countries?<br>Where do most of these jobs develop? (specific areas or regions, city / village)<br>Do the entrepreneurs employ local labour force or are the workers brought from other regions of Poland or from abroad?<br>To what extent are the changes in employment connected with the implementation legislative changes? |
| Working conditions |
| What are the working conditions in the sector?<br>What is the level of salaries as compared to the national average?<br>Do the employers provide any additional benefits? (e.g. life insurance)<br>Are those jobs permanent? What type of contract is the basis for their employment? |
| Skills |
| What are the specialist skills and competences necessary to perform this work?<br>Does the formal education of employees play a significant role in the performance of work?<br>What is the availability of potential workers on the labour market?<br>Do the potential workers, both graduates as well as the persons in the labour market, possess skills necessary to perform this work, or are any additional trainings needed? |

## A4.2 REPRESENTATIVES OF THE SECTORS OTHER THAN ENVIRONMENTAL TECHNOLOGIES SECTOR, WHICH MAINTAIN JOBS CONNECTED WITH ENVIRONMENTAL PROTECTION

| General issues |
|---|
| How long have the jobs connected with sustainable development been there? They constituted a response to what needs?<br>What tasks do they include?<br>How many persons perform tasks with respect to sustainable development? In how many cases is it their main task (more than 50% of the time)? |
| **Employees involved in sustainable development activities** |
| Does the formal education of employees play a significant role in the performance of work?<br>What are the specialist skills and competences necessary to perform this work?<br>What is the education of sustainability department employees?<br>Is it difficult to find sustainability specialists on the labour market? Do the potential workers, both graduates as well as the persons in the labour market, possess skills necessary to perform this work, or are the trainings necessary? |
| **Sustainability projects** |
| Who is responsible for setting objectives with respect to sustainability at the level of the unit? In what manner?<br>In what manner are sustainability projects implemented? How long do they last on average?<br>Do you use the knowledge and experience acquired by the employees of other P&G units, including the units in other countries, when implementing the sustainability projects? How does this cooperation look like?<br>In what manner are the sustainability solutions implemented in the production processes?<br>To what extent are the sustainability solutions elaborated and implemented directly by the employees in the unit, and to what extent are they elaborated and implemented by external companies?<br>Did the introduction of sustainability solutions result in the change in employment or in the changes of the structure of employees? In what manner? |

## A4.3 REPRESENTATIVES OF DISTRICT (POVIAT) EMPLOYMENT AGENCIES WORKING IN DISTRICTS WITH GREEN JOBS

| General issues |
|---|
| What are the working conditions in the sector?<br>What is the level of salaries as compared to the national average?<br>Do the employers provide any additional benefits? (e.g. life insurance)<br>Are those jobs permanent? What type of contract is the basis for their employment? |
| Labour demand \| Green investments in the region |
| Is the impact of green investments on the employment in district (poviat) or region visible?<br>To what extent is it connected with new legal acts or with the change in already existing ones?<br>Do the employers turn to the Agency in case of this type of work, or do they bring their workers from other regions?<br>Does the development of green sectors in the region result in the unemployment rate growth?<br>Do you get job offers from green sectors?<br>What are the conditions offered?<br>What is their situation as compared to other offers available in the Agency?<br>Are the green sector jobs popular among the beneficiaries of the Agency?<br>Are there any traineeships offered (temporary employment) or is there a possibility to find permanent jobs? |
| Skills |
| What are the skills and qualifications expected by the employers from potential workers?<br>Do the PEA beneficiaries have adequate skills to work at this position? Are they ensured by formal education?<br>Are there any activities undertaken to acquire such skills, like trainings or courses?<br>Are there any activities of this kind planned for the future?<br>Are the EU funds used to organise such trainings/courses? |



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