

From Tradition to Innovation. Skill Needs in the Agri-Food Sector

Martin Mulder, Wageningen University

martin.mulder@wur.nl; www.ecs.wur.nl; www.mmulder.nl

Please quote as: M. Mulder (2008). *From Tradition to Innovation. Skill Needs in the Agri-Food Sector*. Paper presented at Agora Thessaloniki XXVII 'Skills for Europe's future' on February 21, 2008. 15 pages.

Purpose

To review new future skill needs in the agri-food sector.

Design/methodology/approach

A secondary analysis of European labour market data is performed, literature on developments in the agri-food sectors is analysed, ten international key experts in this field are consulted by asking them to review and present the developments in the sectors and to formulate consequences for new skill needs, and an interactive workshop is organised to exchange views on the developments and skill needs.

Findings

The labour market in the agri-food market is decreasing, but the complexity of the work is increasing. Transversal developments in the sectors are related to stronger regulation, sustainability, globalisation, competition, climate change, dealing with various publics, working in chains and networks, technological innovation and the ageing workforce.

Examples of skills found are the ability to learn from conflict, to realise innovation in networks, to think out-of-the-box, to creatively find and use opportunities, having international market knowledge, the ability to deal with national and international trading systems, logistics, and intercultural communication, and many others. The skills needs described vary significantly by business model.

Practical implications

Educational institutions, but also organisations in the agri-food sector themselves, can use the overview of new skill needs to create new training and development programs.

Originality/value

No sectoral skill needs study at European level has been done before. Further research is needed to get more specific information which is relevant for the various subsectors and countries in the EU.

Keywords

Skills, training needs, agri-food sector, sector development

Paper type

Research

Abstract

The core question of this contribution is: ‘What are the consequences of the developments in the agri-food sectors on future skills needs?’ The contribution first of all gives information about the context of the study, the Skillsnet project, and the design of this project. It also specifies the way the information was collected.

It is argued that the agriculture and food manufacturing sectors are very diverse, not only in terms of size of organisations, but also regarding the sectors within agriculture and food manufacturing, the sectors outside primary production and food manufacturing, and the categories, content, and level of the jobs involved. Major developments in the sectors are described, and after that a wide variation of generic skills needs is reviewed. Finally the conclusions are formulated.

Introduction

What are the consequences of the developments in the agri-food sectors on future skills needs? That, in short, is the central question in this paper. For long the agriculture and food production sectors were out-of-fashion, having a negative image, and sometimes hostile reactions of the public. However, with the tighter regulations on the environment and animal welfare, and the notion that outsourcing of primary production and manufacturing of food products to low wage countries may not be sustainable, together with the latest World Development Report (World Bank, 2007) which stressed the importance of agriculture for poverty reduction, the sector is on the rise again. The many, sometimes astonishing, innovations in the sector also create curiosity, and educational programs in the life sciences and natural resource management arise with attractive titles and content. European policy making also made a shift from the purely industry-driven primary production to an integrated vision on agriculture and rural development (Hortet Tarroja, 2006).

This contribution first of all will give a bit more detail about the context of the study, the Skillsnet project, the design of this project, and the way the information was collected. Next, we argue that the sectors about which we report are very diverse, not only in terms of size of organisations, but also regarding the sectors within agriculture and food manufacturing, the sectors outside primary production and food manufacturing, and the categories, content, and level of the jobs involved. Next, we will go into major developments in the sectors, and after that the generic consequences for skills needs are reviewed. Finally the conclusions will be formulated.

The Skillsnet Agri-food project design

Cedefop commissioned a Skillsnet project on Agri-food and Forestry-Wood. Literature in these fields was selected and studied. A paper was prepared to describe the field and the necessity to identify future skills needs in these sectors. Experts were selected by contacting key stakeholders in the sectors mentioned, amongst which the EU employers and employee organisations, the Directorate of Agriculture and Rural Development of the European Commission, Industry, and experts from agricultural, food and forestry education. The experts were asked to prepare a paper on the

developments in their respective fields, such as in European agriculture, rural development, food manufacturing, fisheries (Raben Olrik, 2006), organic production (Timmers, 2006), consumer risk perception (Brennan, 2006), and education provision, and to conclude with an outlook on future skill needs in these fields. The experts were selected on the basis of their European or global view and their broad information basis regarding the fields mentioned. The experts presented their papers in an interactive workshop, with plenary presentations and discussions on all sectors involved first, and in two parallel sessions, one for the agri-food and the other on the forestry-wood sector. In total about 40 experts were involved in this exercise. The report of this project is in print, and this paper is a synthesis of the results presented for the agri-food sector. This sector was best represented in the project. Readers who are interested in the forestry-wood sector are suggested to read the final report, or to visit the website of Skillsnet to consult the papers that were presented (http://www.trainingvillage.gr/etv/Projects_Networks/Skillsnet/events.asp?idnews=2144; accessed: 31-01-2008).

For the collection of information the following skills observatories within the EU were consulted (all accessed on 31-01-2008):

- The Austrian Qualification barometer (http://bis.ams.or.at/qualibarometer/top_berufsbereich.php?id=69)
- The project ‘Anticipating the Quantitative Educational Needs in Vocational Education and Training’ of the Finnish National Board of Education.
- The Irish Expert Group on Future Skills Needs (<http://www.skillsireland.ie/>)
- The sectoral knowledge centers Aequor (food and environment sector) (http://www.aequor.nl/aequor/pages/v_english/frmset.asp), SVO (meat sector) (<http://www.svo.nl/english/home.asp>), and CBL (food trade, including retail) (<http://www.cbl.nl/english/>).
- The UK sector skills councils Improve (Food and drink manufacturing and processing sector) (<http://www.improveltd.co.uk/>), and Lantra (environmental and land-based industries) (<http://www.lantra.co.uk/>)
- The National Observatory of Employment and Training in the Czech Republic (<http://www.nvf.cz/observatory/enindex.htm>)
- The FreQueNz Network on ‘Early identification of skills needs’ in Germany (<http://www.frequenz.net>)
- The Observatoires prospectifs des métiers et des qualifications in France (<http://www.interef.com/ateliers/observatoires/presentation.htm>)
- The Fafo in Norway (<http://www.fafo.no/indexenglish.htm>), and its project Qualification (<http://www.fafo.no/english/avf/avfkomp.htm>), competence, and continuing-and vocational education, which conducts studies amongst others on learning and conditions of learning in working life, the competence market - supply and demand, impact of education and training on wages, career development and employability, social partner cooperation on the competence reform, and lifelong learning.

Diversity in the agri-food sector

When we reflect on the transition of the agri-food sector, we have to take into account that the socio-economic structure and employment outlook is very diverse. On the one hand we have the individual small-holder who uses traditional production methods,

and on the other hand there are the multinational food companies who employ tens of thousands of employees around the globe. The diversity in terms of the structure of the agriculture, forestry and fishing sectors and the manufacturing sectors is very visible in the NACE classification

(<http://forum.europa.eu.int/irc/dsis/nacepacon/info/data/en/NACE%20Rev%202%20and%20correspondences.rtf>) (accessed 31-01-2008).

Furthermore, the agri-sector is also referred to as the agri-food complex, indicating that it goes beyond primary production (farming), and includes trade, industry (such as food and feed manufacturers), private services (such as banks, insurance companies, sectoral organisations and associations) and public services (legislation and regulation regarding product quality and public health) regarding agriculture and food production.

And finally, the workers in this complex have very diverse occupations at very different levels, from the low educated subsistence farmer to the PhD in bio-nanotechnology or geo-information systems. The multitude of occupations which exists within these sectors is visible in the International Standard Classification of Occupations (1988 version), which lists over 100 occupations that exist in the agri-food sector. These are categorised in:

- elementary occupations, such as farm-hands and labourers;
- service workers and shop and market sales workers, such as shop, stall and market salespersons and demonstrators (in the food retail sector);
- skilled agricultural and fishery workers, such as gardeners, horticultural and nursery growers, and dairy and livestock producers;
- craft and related trades workers, such as agricultural- or industrial-machinery mechanics and fitters and bakers, pastry-cooks and confectionery makers;
- plant and machine operators and assemblers, such as wood-processing-plant operators, and dairy-products machine operators;
- technicians and associate professionals, such as safety, health and quality inspectors, life science technicians, agronomy and forestry technicians and farming and forestry advisers, buyers, and appraisers, valuers and auctioneers;
- professionals, such as biologists, botanists, zoologists, and agronomists;
- legislators, senior officials and managers, such as production and operations managers in agriculture, hunting, forestry and fishing, production and operations managers in manufacturing, supply and distribution managers, research and development managers, managers of small enterprises in agriculture, hunting, forestry and fishing, and managers of small enterprises in manufacturing.

The International Standard Classification of Occupations 2008 (ISCO-08) of the International Labour Organisation, agreed in December 2007 (<http://www.ilo.org/public/english/bureau/stat/isco/docs/resol08.pdf>; accessed 31-01-2008) shows comparable variety.

So, when we speak of future skills needs in the agri-food sector, we have to be aware of the diversity within this sector regarding the stratification of the sector of agriculture and food production, of the fact that other sectors that go beyond the primary and industry sector are part of the agri-food complex, and of the fact that we then speak of a wide variety of jobs and basically all education levels in the related fields. It has also to be taken into account that there is wide variation between

agricultural and food production practices across the EU, ranging from subsistence farming to large scale industrial production.

Since it is impossible to give an overview of future skill needs in all individual categories of the agri-food sector, we will present the major developments and generic consequences for the skill needs.

Employment trends and prospects in the sectors

Despite the huge diversity mentioned, general employment trends and prospects in the sectors are presented.

First of all it can be noted that the total employment in agriculture in the EU 15 in 1995 was 7,3 million persons, whereas in 2005 this was 9,5 million persons in the EU27. This can largely be attributed to the fact that in Romania and Poland employment in agriculture is much higher than in the member states of the EU 15 (see Figure 1). In general, employment in agriculture is decreasing. For the EU15, the decrease in employment in agriculture between 1995 (7.263.500) and 2003 (6.325.030) is 13%. The decrease in the EU25 between 2003 (9.859.320) and 2005 (9.490.820) is 4%.

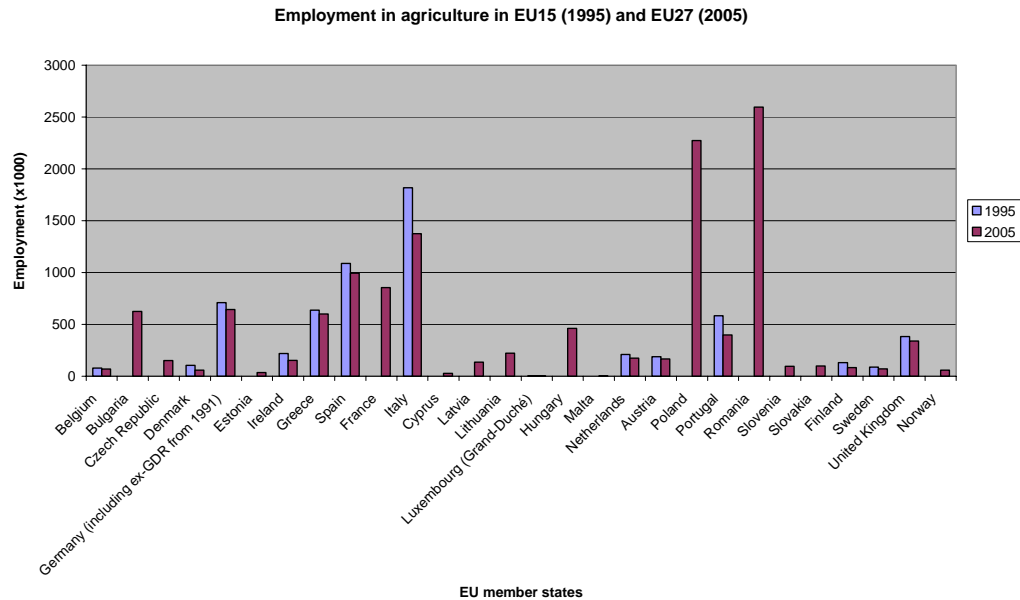
It is expected that because of restructuring, much of the subsistence farming in Romania and Poland will also be decreasing, and that many current job holders in agriculture will leave that sector to start a new livelihood, for instance in entrepreneurship in other sectors.

Figure 1 Employment in agriculture in the EU 15 (1995) and the EU 27 (2005) and Norway (Source: Eurostat EUROFARM data, last updated 19 June 2006).¹

(Note: For 1995, data for BG (Bulgaria), CZ (Czech Republic), ES (Estonia), FR (France), CY (Cyprus), LV (Latvia), LT (Lithuania), HU (Hungary), MT (Malta), PL (Poland), RO (Romania), SI (Slovenia), SK (Slovakia) and NO (Norway) are not available; Luxemburg: data for 1995: 5,33; Malta: data for 2005: 4,06).

¹

http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1996,39140985&_dad=portal&_schema=PORTAL&screen=detailref&language=en&product=Yearlies_new_agriculture&root=Yearlies_new_agriculture/E/E1/E11/eda20240 (accessed April 20, 2007).



Regarding the food industry, employment figures show that in 2004 4,7 million persons were working in this sector in the EU27. For the EU25 this figure was 4,4 million persons. In 1999 this figure for the EU25 was 4,6 million persons. So there is a slight decrease in employment in the food sector in the EU25.

Figure 2 shows that the highest employment in the food sector is in Germany, France, and the United Kingdom. Poland, Italy and Spain also have relatively large numbers of employment in the food industry.

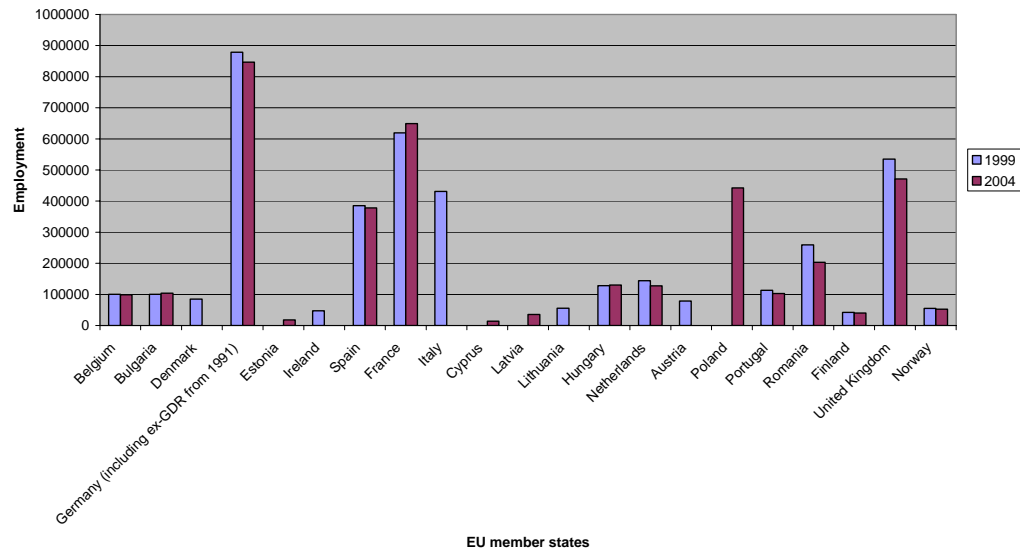
Some remarks about Figure 2 must be made as many data is missing. For Denmark: data for 2004 is confidential; data for 2002: 85133. For Estonia: data for 1999 is not available; data for 2000: 20307. For Ireland: data for 2004 is confidential: data from 2003: 49438. For Cyprus: data for 1999 is not available; data for 1998 data: 9884. For Latvia: data for 1999 is confidential. For Lithuania: data for 2004 is confidential; no data for previous years either. For Austria: data for 2004 is confidential; data for 2001: 77965. For Poland: data for 1999 is confidential; data for 1998: 467255. For Luxemburg: data for 1999 and 2004 is confidential. For Greece: data is not available for 1999 and 2004. For Sweden: data is confidential for 1999 and 2004. For the Czech Republic: data is confidential for 1999 and 2004. For Slovakia: data for 1999 is not available; data for 2004 is confidential; data for 2002: 46936. For Slovenia: data for 1999 is not available; data for 2004 is confidential. For Malta: data for 1999 is confidential; data for 2004 is not available.

Figure 2 Employment in the food industry in the EU 27 and Norway (1999 and 2004) (Source: Eurostat, NACE Division 15: Manufacture of food products and beverages - Input indicators) ²

²

http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1996,39140985&_dad=portal&_schema=PORTA

Employment in the food industry EU27 in 1999 and 2004



From further analyses (based on the 2004 data), which are not included in this chapter because of space limits, it is clear that there is also a wide variation in employment across sectors in different member states. Italy, Spain (both >350.000) and Portugal (>250.000) are the member states with relatively the largest proportions of employment in crop production. France (>200.000), Romania (>150.000) and also Spain (about 130.000) have the largest proportions of employment in animal farming. Poland and Romania (both > 150.000) are the two outliers regarding employment in mixed farming. Germany is the member state with the highest proportion of employment in agricultural services (>180.000), and Greece for hunting, trapping and game propagation, including related service activities (>50.000).

In total it can be concluded that the employment trends and prospects in the sectors are such that further decline in employment is expected. In the primary sector, the need for quality improvement, cost reduction and food security result in scale enlargements. Whereas the number of farms is reducing, (in the Netherlands the annual decrease of number of farms in the primary sector is on average 1.9% from 1990-1995, 2.8% from 1995-2000, and 3.2% from 2000-2005^{3 4}), the farms themselves grow bigger, leading to skills needs that are comparable with growing small and medium-sized companies. In the food production industry expensive labour costs are being cut by automate production processes. The developments in the

[L&screen=detailref&language=en&product=Yearlies_new_industry&root=Yearlies_new_industry/D/DO/section_d/division_15/eb_15inp](#) (March 28, 2007)

³ Berkhout, P. & C. van Bruchem (red.) (2006). *Landbouw- Economisch bericht 2006*. Den Haag: LEI. http://www.lei.dlo.nl/publicaties/PDF/2006/LEB/LEB_H07.pdf (Date of access: April 27, 2007).

⁴ More specifically: 'Over the last five years, the number of specialised intensive livestock productions in particular has diminished sharply (by over 5% per year), principally due to buying-up schemes to reduce the manure surplus. The numbers of greenhouse horticultural holdings and dairy farms have also fallen sharply, by almost 5% and more than 4% per year respectively. The reduction of the number of specialised arable farms remained limited to 2% per year.'
http://www.lei.dlo.nl/publicaties/PDF/2006/PR_xxx/PR_06_02.pdf (Accession date: April 30, 2007)

primary sector as well as in manufacturing are similar: process innovation leads to decreasing employment, and many of the remaining jobs become more knowledge intensive. In the high-tech precision horticulture sector this is sometimes referred to as knowledge farming (Hulsink, 2005).

Qualification levels of workers in agriculture, food and wood

Further data are available about the qualification levels of workers in agriculture and food sector. First of all, the qualification level of workers in agriculture can be compared with those of the industry and services sectors (see Figure 3). It can be seen that the percent of employed persons with a low qualification level is highest in the agriculture sector (47%), whereas this is less than half in the services sector (21%). The industry sector is in between with 29% of the employed persons with low qualification. The percent of employed persons in the agriculture sector with a high qualification is 6%, whereas this is 33% in the services sector. Again, the industry sector is in between with 17% of the employed persons with a high qualification. It is remarkable that the percentages of medium-skilled employees in the three sectors do not differ a lot: they vary from 47% in the agriculture and services sectors, to 54% in the industry sector. So, in all three sectors about half of the employed persons have a qualification at medium level, which makes this the largest group.

This picture confirms the double qualification strategy in the European labour market in a certain way. This qualification strategy states that there is parallel growth of and need for higher and lower level educated workers, and not just up-skilling. However, Figure 3 indicates a slightly modified meaning of this double qualification strategy, which is that higher versus intermediate qualification strategy is taking place, and needed.

Figure 3 Qualification level of workers in agriculture, industry and service sectors

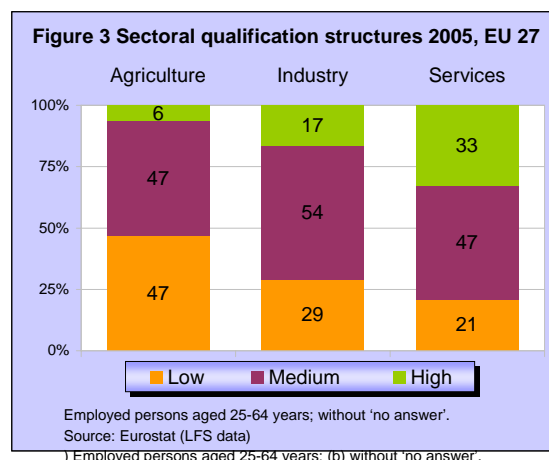
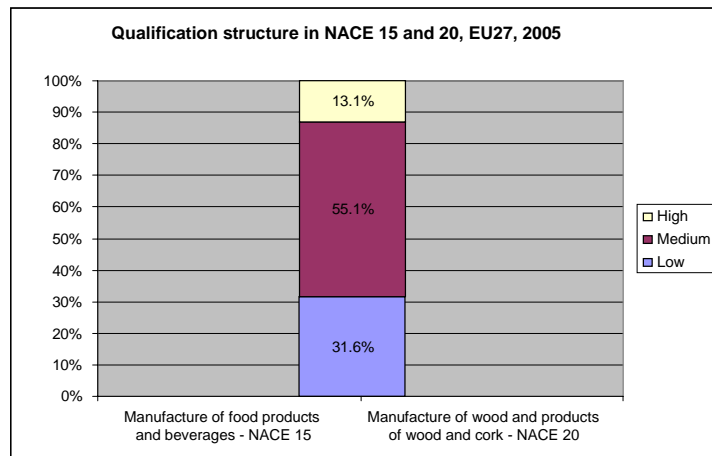


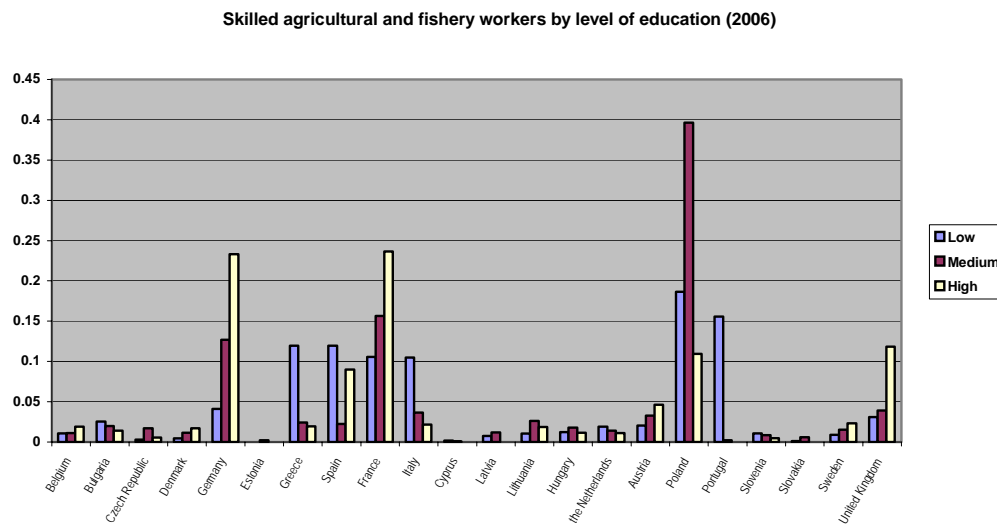
Figure 4 shows the breakdown in percentages of the qualification structure in manufacture of food products and beverages (NACE 15). For this sector, the general education level is higher than in agriculture, but lower than in industry.

Figure 4 Qualification level of workers in manufacture of food products and beverages NACE 15, EU27, 2005



A breakdown of the skills levels in the agricultural and fisheries sector across the EU25 in terms of low (Isced 0-2), medium (Isced 3-4) and high skills (Isced 5-6) (based on Eurostat data on 2006 shows a wide variation of the distribution of skills levels between member states (see Figure 5).

Figure 5 Employment by level of education of skilled agricultural and fishery workers EU27 2006 (Source: Eurostat, LFS; date of extraction: Fri, 27 Apr 07 12:33:06)



Lifelong learning in terms of participation in continuing education (also based on Eurostat data regarding 2002) in the agriculture sector is relatively low if compared with participation in industry and services. It is highest in Finland, the United Kingdom and Denmark, and lowest in Poland, Spain and Italy.

As a general conclusion it can be stated that the general skills level of workers in the agriculture and food sector is a concern, and that the future economy requires workers with higher initial vocational education levels, who are also active in the field of LLL.

Major developments

The agri-food sector faces dramatic changes (Gravemaker, 2006). New regulations of primary production are implemented, there is multifunctional use of the land by different stakeholders such as farmers, tourism and leisure organisations, service organisations and private persons for country-side living. For production, more and more licensing is needed, and, food production is taking place in supply chains and networks more and more. These chains and networks are being conducted by the leading retail companies to a large extent. Chain certification, legislation about chain liability, backward and upstream chain integration are relevant developments in this respect (Meerman, 2006). Innovation of products and processes are ongoing, for example in the field of nutri-genomics, and bio-nano-technology. ICT is getting more and more advances in logistics and transportation, for instance to support tracking and tracing of food products in the production chain. There is also the growing public concern about food safety and animal welfare, which regularly results in protests and other actions. At international level there is the big issue of competing claims on crops to fulfil different needs regarding energy production for the large energy consuming countries in the west, but also in China and India as emerging global economies on the one hand, and rural development and poverty reduction in third world countries. Think for instance of the maize, soy, sugar cane of palm fields, which are being used to produce lubricants in stead of feeding local communities. Furthermore, economic and labour market restructuring is taking place, meaning that subsistence farming will be more and more taken over by commercial or industrial farming, with all consequences for the management of natural resources involved and the carbon footprint as an effect of that. Also, international sourcing with huge environmental effects, scale enlargement, and the pressure on employee cost reduction, they all make the food sector extremely complex.

Generally speaking, the following major developments can be discerned.

- *Stronger regulation*
The last decades have shown various food crises, such as foot-and-mouth, BSE, pig pest, and the avian flue to name a few. But also food manufacturers have had various problems with a number their products, as a result of which they had to recall products from the supermarket. Prevention, food crisis management, and risk communication are essential regarding this development, and organisations that are better in doing this have a competitive advantage. To underscore the importance of food for public health, the EU has

established the European Food Safety Authority (the EFSA in Parma, Italy⁵). Systems regarding HACCP (Hazard Analysis and Critical Control Points) are being implemented to further control food safety.

- *Sustainability*
There is a rising consciousness (also because of The Inconvenient Truth of Al Gore) that the current production and consumption levels are not sustainable, and that the carbon-footprint needs to be reduced, that energy-use based on non-renewable resources need to be cut back, that food miles need to be diminished and that waste has to be processed in sustainable ways, for instance by Upflow Anaerobic Sludge (Lettinga, 1996). At company level this is referred to as corporate social responsibility. Sustainability also leads to new reporting practices in farms and companies, which is an additional burden for them.
- *Globalisation*
Fresh food is purchased from all over the world, which results in tighter logistics, the improvement of cold chains, e-access to auctions, and competitive targets. In the flower industry, auctions try for instance to reach supermarkets in one day.
- *Competition*
Competition is very much about price and quality. Winners will be those who can produce at the lowest cost and the highest quality. Cost reduction and quality improvement both demand higher skill levels too. It is not possible anymore to enter the high-end agri-food or forestry-wood sectors as entrepreneur without a thorough knowledge of the field (the products), management, marketing, and corporate strategy in the enterprise.
- *Climate change*
Climate change has many dimensions, and there are various skill needs emerging from that, and different educational responses to that (Mulder, 2007). Apart from the fact that climate change relates to environmental policy and technology, and creates a new sector and labour market, climate change can lead to the introduction of various new (plant and animal) diseases in the EU, which means that producers need to be alert to this, and that where needed, they can take appropriate action. But if the water levels will change, farming will undergo dramatic change, either by droughts or by excessive precipitation. Water management systems have to be designed, improved or renewed to cope with these changes. Also other protective measures need to be taken against extreme weather conditions, such as heavy snowfall or lower temperatures and frost.
- *Dealing with the public*
The public has diverse expectations of the agriculture and food sectors (Mulder & Eernstman, 2006). Expectations are amongst others: room for recreation in the countryside, an attractive landscape, animal welfare, diminishing use of chemicals for agriculture, a healthy environment, nature conservation, rural development, living in rural areas, food safety, and diversity. This means that primary producers, but also manufacturers, have to deal with a multitude of new actors. This consumes a considerable amount of time and energy, especially when there are conflicts between the actors.
- *Chains and networks*

⁵ <http://www.efsa.europa.eu/en.html>

There is hardly any room left for individual and small entrepreneurs who would like to go commercial. For these small-holders, cooperation at cluster, chains or network level is necessary (Bijman, Omta, Trienekens, Wijnands and Wubben, 2006). A cluster is a conglomerate of private and public organisations around a certain product. Small-holders can work together in co-operatives, who are linked to auctions of large manufacturers, wholesale of retail organisations.

- *Technological innovation*
There is a continuing technological innovation going on in the food sectors. In crop production, robots are being developed for automatic harvesting (which is very labour intensive), in food production bio-nanotechnology is being used for health and lifestyle purposes, and in the fisheries new technologies are being introduced on vessels. However, the amount of technological innovation is spread differently across different sectors and subsectors.
- *Ageing workforce*
In various subsectors, the workforce is ageing. For jobs which become obsolete this is less of a problem, but for jobs which need new young workers, it is. An example of this situation is the fisheries, in which there is a need for new skilled workers.

Skills needs

These developments lead to various new skill needs. Some of these are already articulated, others are more relevant in the coming years. Where and when they will be applicable depends on the specific context.

- Tighter regulations implies that entrepreneurs, managers and workers in the sectors need higher skill levels.
- Sustainability requires problem solving, conflict, innovation, out-of-the-box thinking, creativity.
- Global sourcing and trading leads to increased skill needs in fields like international market knowledge, national and international trading systems, logistics, and intercultural communication.
- Climate change leads to new jobs and skills regarding environmental policy and technology, recognizing, curing and preventing novel animal and plant diseases, and water management and other extreme meteorological conditions which need to be reflected.
- Dealing with the public, or rather, publics, implies new communication skills. Times are gone that farmers do not speak with others, like colleagues, the public, representatives of various stakeholder groups, for days. Communication is getting more and more intense, the stakes are getting higher, and actors in the agriculture and food production sectors need skills in interacting with multiple stakeholders. A new role is emerging, which is aimed at facilitating multiple-stakeholder problem analysis and decision making processes.
- Working in chains, networks and clusters create new skill needs regarding cooperation on the basis of contracts and mutual trust, whereas many actors

are used to compete based on mistrust. Actors also need to realise that cooperating in a cluster can protect the survival and growth of that cluster on a global scale. Skills regarding handling relative autonomy are important here as well.

- Innovation obviously creates new skill needs, for instance in food microbiology, biotechnology, bio-nano-technology, remote sensing, geo-information science, aquatic ecology, entomology, nematology, and quantitative veterinary epidemiology. Innovation needs innovation competence, and other skills mentioned under the heading of sustainability. Learning skills themselves are also crucial when it comes to innovation.
- The ageing workforce implies an increased attention for life long learning of workers, not only by just taking up some new information to stay current, but also by learning fundamentally new ways of thinking and action. Workers in the sectors of agriculture and food production especially face radical innovation, since market may disappear, production methods may not be sustainable, and economic conditions may deteriorate and regulations may increase which may lead to a point in which business-owners need to take another course.
- Furthermore, the sectors are characterised by complexity and knowledge intensity, and scale enlargement. This means that higher education levels for the entrepreneurs and workers in the sectors are needed, as well as more task differentiation in middle management.
- The skills needs described here vary significantly by business model (Martin, 2006), and the development scenario that will unfold (Andersen, 2006). There will most likely be Farming for fun, Food production for regional specialities, Large scale Dairy Production, Up-scaling Organic Farming, Farming for Eco-tourism, Farming for Care, Farming for Environmental Education.

To sum up, the following generic and transversal skills can be discerned. Implementing new business models; entrepreneurship; trustful co-operation in competitive areas; administration resulting from new regulations; implementing sustainable forms of energy use; realising provisions for rural leisure facilities; preserving the cultural countryside heritage and (eco-) tourism; country-side living; creating and maintaining health care services in refurbished farms; producing regional food specialties; realising nature conservation; using persuasive communication; creating rural hospitality services; realising product innovation; creating service businesses in rural areas; dealing with internal organisation and human resources management; dealing with international marketing; getting to know new and current ways of financing the enterprise; working with advanced systems of logistics; implementing strategic systems of finance and control; getting to know and handle asset management, including skills with dealing with the construction and property consultancy sector; acquiring knowledge about international law and regulations, such as trade tariffs and barriers, trade regulations regarding quantities and quality control; dealing with importing and exporting organisations; creating foreign establishments; communicating with foreign authorities and market organisations, such as export associations; intercultural communication with local managers and employees; effectively working on national, regional and local labour relations; dealing with the issues regarding backward supply-chain integration; creating and implementing process innovation; in-cluster co-operation and knowledge sharing; interdisciplinary understanding; searching for collective cost reduction and quality improvement in

alliances and innovation projects, political sensitivity; corporate social responsibility and integrity; Hazard Analysis and Critical Control Points; implementation, operating and maintenance of new production and harvesting devices; knowledge-sharing and together with that, knowledge-protection against hostile competition; and ensuring intellectual property. These are all rich fields of new skills needs for pertain to various sub-sectors in the agri-food domain.

Conclusions

Above we have described the diversity of the agriculture and food manufacturing sectors, labour market characteristics, major developments and emerging skill needs. We conclude that the agri-food sector faces job losses, qualitative changes in the work, restructuring of the labour market, higher skills levels needed, and the need for life long learning because of the ageing working population and continuously accelerating rate of change.

Space limits further more detailed elaboration of skill needs in certain occupations and roles, but in various studies we found all kinds of these needs, especially in entrepreneurship (Lans, Biemans, Verstegen & Mulder, 2007; Mulder, Lans, Verstegen, Biemans & Meijer, 2007), agricultural consultancy (Shim, 2006), professionals in open innovation teams (Du Chatenier, Biemans, Verstegen & Mulder, 2007), and professionals in the agri-food sectors having to deal with various expectations of the public (Mulder & Eernstman, op cit).

Further empirical research is needed by using primary data collection regarding the skill needs by using a stratified sampling technique. This will yield more specific information from certain sectors in certain local, regional, national or supra-national circumstances, for more specific job categories and educational fields and education levels. Such research requires a long-term perspective to be able to assess gradual and revolutionary changes in skill needs.

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