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Agriculture



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Agriculture uses more space than any other sector. It has to meet a large number of expectations on the part of society, and is caught between the need to produce food and renewable raw materials and the shaping of the cultural landscape. It is therefore the subject of extensive media attention and strong political influence.

1 Significance, current challenges and classification

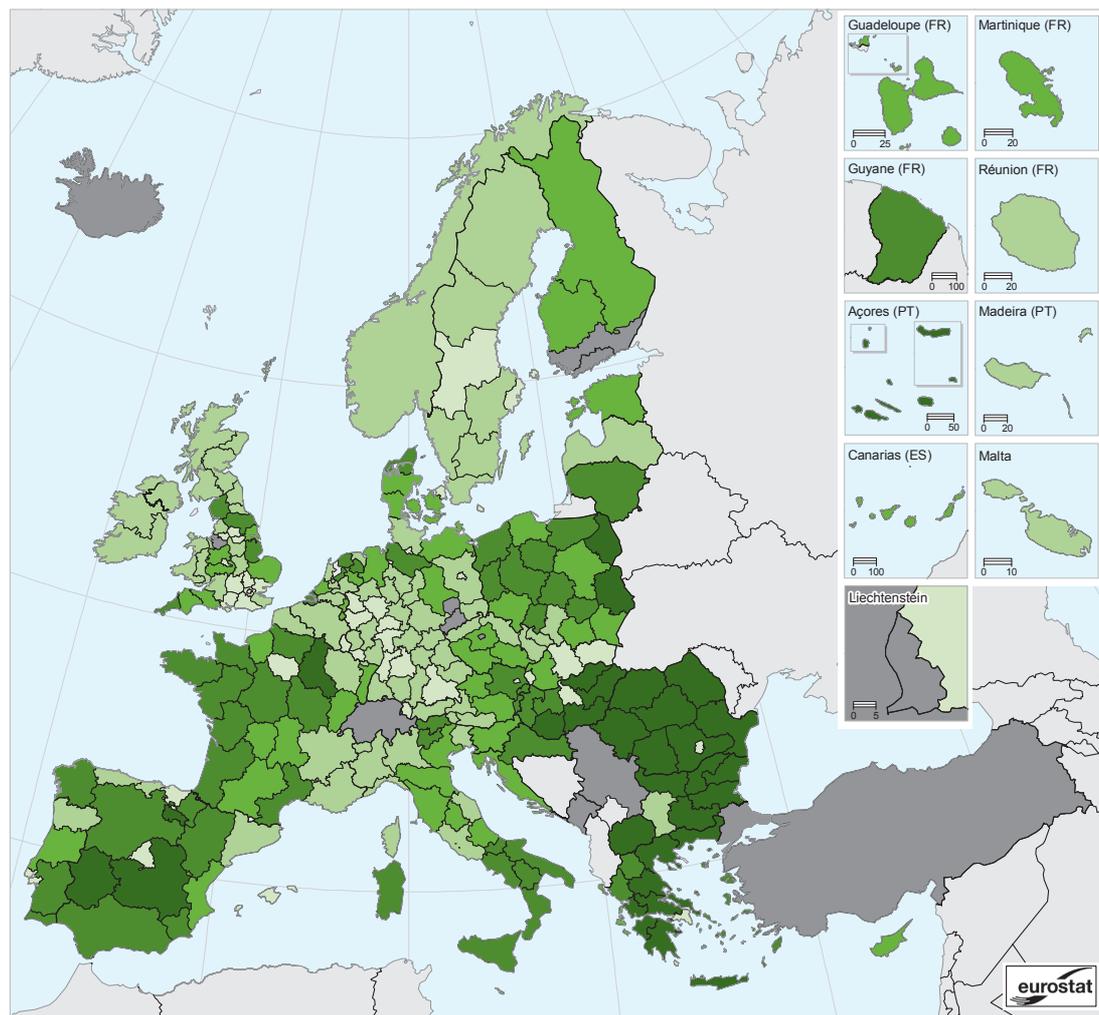
Together with ▷ *Forestry*, agriculture is the most important and most visible factor in relation to the use of space and how humans shape the landscape. In Germany, the land used for agriculture currently amounts to approximately 52% of the country's total land area, compared to 34% in Austria and around 25% in Switzerland (cf. *BMELV* [German Federal Ministry of Food, Agriculture and Consumer Protection] 2011; *BMLFUW* [Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management] 2013; *BLW* [Swiss Federal Office for Agriculture] 2013). This economic sector, which, together with forestry and fishing, forms the primary sector of an economy that uses nature directly, is subject to diverse framework conditions at various political and economic levels and complex, often contradictory expectations on the part of society. These indirectly determine the establishment of mainly economic incentives and with regard to the composition and intensity of production within a sector also the design of the space used by the respective economic sector.

Besides its main task of producing sufficient quantities of high-quality food, agriculture produces a series of renewable raw materials that are further processed by various branches of industry. In addition, it produces a series of intangible goods (▷ *Urban commons*) such as the preservation of the cultural landscape (▷ *Cultural landscape*), which have been of considerable importance for local recreation, tourism and the quality of life in industrialised countries for many decades, but which are also increasing considerably in importance in developing countries. Due to its enormous land requirements, it competes directly with other types of spatial uses. In western Europe as well as at a global level, agriculture therefore plays a substantial role in ▷ *Nature conservation* and ▷ *Sustainability* among other issues, due to the direct competition for space with the remaining tropical rainforests and other areas not previously used by humans.

The structure and function of agriculture has changed over the centuries according to the demands placed on it. The greatest challenges that the sector currently has to face at a global level are securing food supplies for a rapidly growing population, especially in developing countries, and replacing fossil-based raw materials in the industrial and energy sectors. In doing so, it carries out a balancing act between increased productivity and the expansion of cultivated areas around the world at the expense of other types of land use. In the European context, agriculture is experiencing increasing pressure to justify itself in view of the extensive state subsidy payments it receives (▷ *Agricultural policy*), the increasing demands for environmentally- and animal-friendly production methods and the criticism of interest groups in relation to development policy with regard to aspects of justice in the (food) trade with the Third World (cf. Wesseler/Zilberman 2014).

Agriculture plays a special role as an economic factor for generating an income sufficient for survival and for securing food supplies in the traditional economic systems in the Third World. In the course of industrial development, the economic importance of these factors in central Europe declined sharply from the 19th century. Agriculture's share of value creation in the gross domestic product of Germany, Austria and Switzerland amounted to 0.9% (*BMELV* 2011), 1.5% (*BMLFUW* 2013) and 0.7% (*BLW* 2013) in 2010. At the regional level, this proportion can be significantly higher (c.f. Fig. 1).

Figure 1: Agriculture's share of the regional gross value creation in the EU in 2011

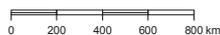


(% of total value added)

EU-28 = 1.4

- < 0.5
- 0.5 – < 1.5
- 1.5 – < 2.5
- 2.5 – < 5.0
- >= 5.0
- Data not available

Administrative boundaries: © EuroGeographics © UN-FAO © Turkstat
 Cartography: Eurostat — GISCO, 04/2014



(¹) The former Yugoslav Republic of Macedonia: 2010. Poland: 2009. Belgium, Slovenia and Norway: national level. Guadeloupe (FR91), Martinique (FR92), Guyane (FR93) and Réunion (FR94): estimates. Portugal: provisional.

Source: Eurostat (online data code: agr_r_accts, aact_eaa01, nama_r_e3vab95r2 and nama_gdp_c)

Source: Eurostat 2015

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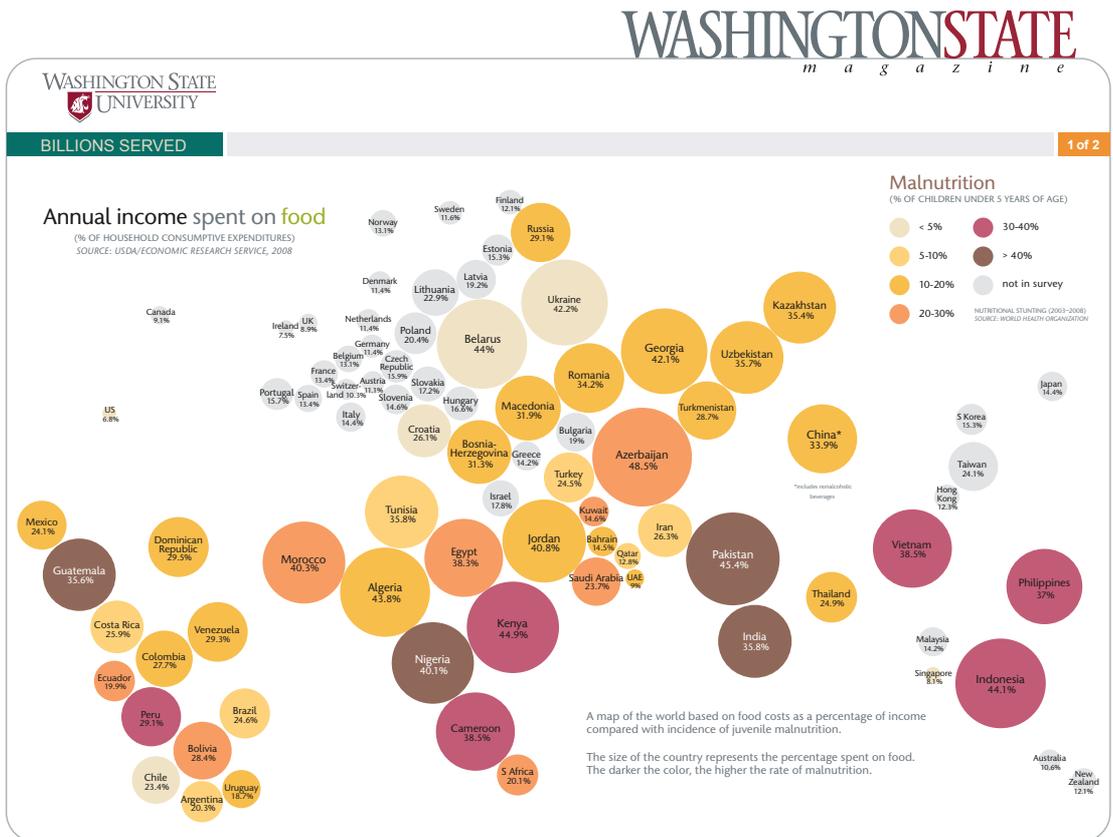
The ▷ *Globalisation* of the world economy, which has been increasing since the end of the 20th century, represents a further fundamental impetus for increasing the division of labour in the cultivation and processing of food and renewable raw materials as well as a correspondingly more intensive world trade (cf. Federico 2005), which has a lasting influence on ▷ *Spatial development* worldwide and causes a fundamental change in the use of space by agriculture. This development has far-reaching implications for national policymaking. Because cultivation areas and centres of further processing and consumption are located in geographically distant countries, decisions in national or regional economic policy with regard to sustainability, ▷ *Security of raw materials supply*, energy policy or environmental policy can have consequences for those trading partners.

Agriculture in western Europe has been characterised by profound changes in production technology and structures since the early 20th century. Although there has been a slight decline in cultivated areas in all German-speaking countries for decades, due to the expansion of the transport infrastructure and the settlement structure, etc., a rapid and substantial increase in productivity through mechanisation, breeding, fertilisation, plant protection, IT use, etc. has resulted in a significant increase in production output. A strong decline in the number of farms together with a moderate decline in employees led to a fundamental redesign of rural areas (▷ *Rural Areas*) with fewer but larger and more mechanised farms. Their production methods tend to use more extensive areas of land and thus change the appearance of the ▷ *Landscape*. As a result, agriculture has also lost its significance as the dominant employment and economic sector in the rural areas of western Europe.

This far-reaching structural change in western Europe (cf. EC 2013) is due to the increases in productivity as well as a series of other economic phenomena, of which Engel's law is one of the most important. This law, discovered by the Saxon statistician Ernst Engel, describes the fact that with increasing income a private household spends a correspondingly lower proportion on food. An average household in German-speaking areas currently spends around 11% of its income on food. This proportion tends to be higher, the less economically developed a country is, i.e. the lower its average household income is (cf. Fig. 2).

As a result of this development and the increasing scarcity of fossil-based raw materials in the industrial and energy sectors, a more pronounced dovetailing of agriculture with upstream and downstream areas, which manufacture agricultural inputs such as fertilisers or machines or which process the raw materials that are produced, can be observed in industrialised countries. This development ranges from the contract cultivation of patented plant varieties to the generation of ▷ *Renewable energies*. Because of its production of renewable raw materials, agriculture is an important stakeholder in what has become known as bio-economy – a political vision to meet the upcoming challenges with a sustainable and bio-based economy.

Figure 2: Proportion of the annual household income spent on food



Source: Sorensen 2011: 42 et seq.

In addition, agriculture must meet a series of demands by society that are subject to constant change as society changes (▷ *Social change*). Agriculture is often the focus of media debates relating to the quality and safety of food and of many interest groups that try to influence public discussion and political decision-making in their favour. Agriculture played a pioneering role in European unification (▷ *European Union*), as it is one of the policy areas that was first transferred to the European level (cf. Fennel 1997) and was later joined by other policies, such as the ▷ *European regional policy*.

The agricultural sector of industrialised countries differs greatly from that of emerging countries in eastern Europe and Latin America or developing countries in Africa. The agricultural potential that still exists there means that these countries can play a key role in the future in increasing the necessary production of both food and raw materials.

The knowledge required to successfully stride the path into the future is made available by a large number of institutions (▷ *Knowledge society*). In German-speaking areas, these are universities such as the University of Natural Resources and Life Sciences in Vienna, ETH Zurich or the Weihenstephan Science Centre and public institutions such as Agroscope, the Friedrich Loeffler Institute, the Julius Kühn Institute, the Thünen Institute or the Leibniz Institute for Agricultural Development. At the international level, the Food and Agriculture Organisation of the United Nations (FAO) and the Advisory Group on International Agricultural Research (CGIAR) are key stakeholders.

2 Agriculture and value creation

Agriculture has always produced a series of raw materials directly from natural resources, which serve as the basis for human nutrition or as raw materials for other goods. That is why it had a much greater macroeconomic importance before the age of industrialisation than it does today. Thanks to considerable biological and technical progress, the production of raw materials used for the generation of energy and for industrial purposes has been growing in the Western world since the 1970s. Brazil and the European Union (EU) have played a pioneering role in this context for years, by using bioethanol produced from sugar cane or biodiesel made from rapeseed as fuel. This development brings agriculture closer to its pre-industrial production structure, but has triggered intense social debates under the striking slogan 'tank vs. plate' (cf. Burdick/Waskow 2009).

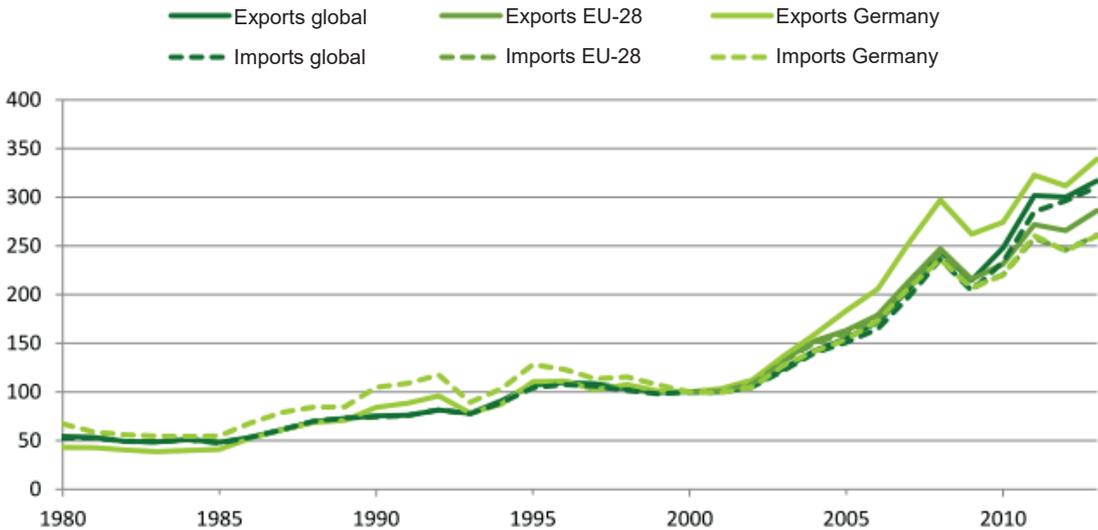
In the context of balancing the competition between food and raw material production, agriculture has a crucial role to play in ensuring a sufficient quantity and quality of food with the aim of making production as sustainable as possible. Food security through domestic production and world trade is of paramount importance in Third World countries in the Middle East and Africa, where famine often breaks out due to climatic events and armed conflicts. Since this issue was resolved decades ago in the western European context, compliance with quality standards in production and processing has become the decisive issue, with several food scandals such as BSE, EHEC or Nitrofen gaining widespread public attention (cf. Meyer-Hullmann 1999).

Agricultural areas and buildings are often ideal locations for solar systems or wind turbines, used for energy production. In Germany, the state subsidies for biogas plants in the last two decades resulted in an intensive expansion of this area of the ▷ *Energy industry*, which changed both the appearance of the cultural landscape and the income base of farmers. The conflict between the use of the area for food production on the one hand and raw material and energy production on the other hand will be decided in the medium-term by the economic profitability of the competing types of use and has a lasting effect on the land market (▷ *Land market/land policy*).

The globalisation of the economy and the liberalisation of world trade through a series of international agreements within the framework of the World Trade Organisation (WTO) have led to an increasing international division of labour and specialisation, so that there are sometimes immense differences between regions for raw material production, processing and consumption. The international trade of agricultural goods has grown massively (cf. Fig. 3) and is mainly carried out through ▷ *Maritime traffic* as well as through ▷ *Air traffic* for perishable goods and thus depends considerably on the ▷ *Infrastructure*. As a result, food prices on different continents

influence each other to a greater extent and are increasingly connected to the development of energy prices (cf. Busse/Brümmer/Ihle 2011), since the production of a number of agricultural inputs also requires large amounts of energy.

Figure 3: Development of trade in agricultural products (2000 = 100)



Source: The authors, based on WTO 2014

3 Production factors

Soil is a particularly important production factor in agriculture, thus the land market, land policy and land law (\triangleright *Land law*) are of fundamental relevance for the sector. In addition, the image of agriculture is largely determined by the shift from the intensive use of human labour to capital-intensive technology such as breeding, fertilisation, crop protection or IT-controlled mechanisation.

In pre-industrial as well as in less industrialised economic systems, agriculture represents the most important employment sector, whereas this has fundamentally changed in today's industry- and service-based societies such as in western Europe. In the Third World, human labour is significantly cheaper than in western Europe, hence labour is the main input in agricultural production instead of capital; accordingly, the sector plays a decisive role in generating income.

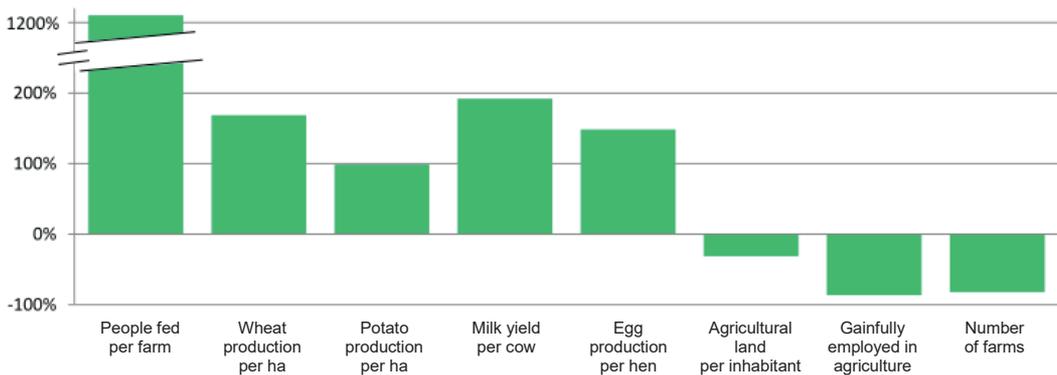
Around 640,000 people are currently employed in agriculture in Germany (cf. Destatis 2013: 337 et seq.). The sector employs around 1.6% of the total workforce, which is a decrease of almost 40% compared to 1991 (cf. Destatis 2012), meaning it is only of minor importance for the \triangleright *Labour market*. The agricultural labour market has several particularities. In western Europe, many seasonal workers from eastern Europe or north Africa are needed during the summer months, mainly for the manual labour-intensive harvest of fruit and vegetables (cf. Holst/Hess/

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Cramon-Taubadel 2008). In 2010, the number was around half of the permanent employees in Germany (cf. *BMELV* 2011). A second job and family employment play an important role.

The production processes in western European agriculture have changed profoundly in the course of the rapid structural change towards intensified mechanisation in the last decades. Accordingly, productivity increased greatly. For example, the amount of wheat produced per hectare increased from 1.9 tonnes in 1900 to 7.3 tonnes in 2012. In the same period, the potato yield increased from 13 to 44 t/ha and the milk production of a single cow from approximately 2,200 to 7,200 litres per year. Agricultural production has increased sharply in industrialised countries, whose land reserves are scarce in contrast to those of developing and emerging countries. Whereas a German farm produced food for around ten people in 1900, this amount had increased to 131 people in 2010 (cf. *DBV* [German Farmers' Association] 2012: 18 et seq.). Figure 4 illustrates the change in selected productivity indicators for German agriculture in 2010 compared to 1950. To cope with the future challenges mentioned above, agriculture will be dependent on further technological progress and innovation whilst taking \triangleright *Sustainability* into account (cf. Barrows/Sexton/Zilberman 2014), since the potential for expanding arable land is limited due to suitability criteria such as climate, soil quality, and water resources.

Figure 4: Change in productivity in German agriculture



Source: The authors, based on *DBV* 2012: 8 et seq.

4 Social pressure

Due to the food production it ensures, agriculture is of essential importance for human survival. At the same time, it is the decisive factor in shaping the landscape in western Europe and is by far the largest user of natural resources. It thus has substantial influence on the \triangleright *Common good*, since in addition to the production of food and raw materials, it provides society with the abovementioned \triangleright *Urban commons* as the direct or indirect consequences of its production processes.

Therefore, it is the centre of a complex network of interests and expectations on the part of \triangleright *Civil society*. On both a national and a global level, this includes not only diverse economic demands, but also ecological concerns such as \triangleright *Soil conservation*, \triangleright *Flood protection* and ethical issues such as animal welfare or GM of living organisms (cf. Bennett/Chi-Ham/Barrows et al. 2013),

as well as securing the quality of life in rural areas and maintaining its scenic attractiveness and recreational value for ▷ *Tourism*. In western Europe, for example, there are numerous associations and organisations whose interests relate to agriculture and which are struggling at the political level to implement those interests in the process of agricultural policymaking.

Agriculture is thus the subject of intense debate in society. At this point some of the most important debates from the last decades should be mentioned; these did not only affect the type and extent of land use in the EU, but are of global importance due to international agricultural trade. Since the 1980s, the intensification of food production through *intensive livestock farming* has been closely associated with milk lakes, butter mountains, agricultural overproduction, monocultures and the impoverishment of the landscape. Organic farming, which emerged around the same time (cf. Lakner 2009), direct agricultural marketing, the discussion of the impact of international agricultural trade on the climate (e.g. food miles, cf. Pretty/Ball/Lang et al. 2005) or the idea of ‘slow food’ as a reaction to the popularity of fast food are counter-movements that tend towards small-scale traditional rural land use. Likewise, the public is also interested in the social justification for the level of subsidies that are given to this sector and strongly influence its direction, intensity and use of space. The use of genetically modified organisms (GMO, cf. Venus/Kalaitzandonakes/Wesseler 2012) as well as the introduction of the biological fuel E10 are intensely debated.

Questions pertaining to the preservation of tropical rainforests, the protection of the earth’s climate, fair trade with the Third World or the displacement of the cultivation of local food by export-oriented raw materials (‘cash crops’, cf. Maxwell/Fernando 1989) influence the use of space overseas. Recurring famine disasters in Africa attract the same amount of public attention as the large-scale appropriation of agricultural land in developing and emerging countries publicised by non-governmental organisations (cf. Braun/Meinzen-Dick 2009). High food prices, which fluctuate greatly, are discussed in the media and in politics in connection with ethical questions about the extent of the influence of financial investors (cf. Pies/Prehn/Glaub et al. 2013) on a potentially substantial intensification of production and the expansion of areas claimed for agriculture in the medium-term.

5 Policymaking

Due to the direct effects of agricultural production on the common good, the sector is structured by means of ▷ *Agricultural policy*. The state often intervenes in economic mechanisms in order to enforce national minimum or maximum prices for food or to secure minimum incomes for agricultural producers by means of various measures. However, due to the diversification of its production portfolio, agriculture is increasingly influenced by other policy areas such as ▷ *Energy policy* or ▷ *Environmental policy*, as well as by European regional policy (▷ *European regional policy*), land policy (▷ *Land market/land policy*), ▷ *Agricultural planning* and spatial planning.

Financially, agricultural policy is currently the most important policy area within the EU. In the multiannual financial framework for the period 2014–2020, almost 39% of total EU spending will go to agriculture or rural areas (cf. EC 2014). Given the financial potential, the development of the Common Agricultural Policy (CAP) in Brussels is subject to the influence of numerous interest groups.

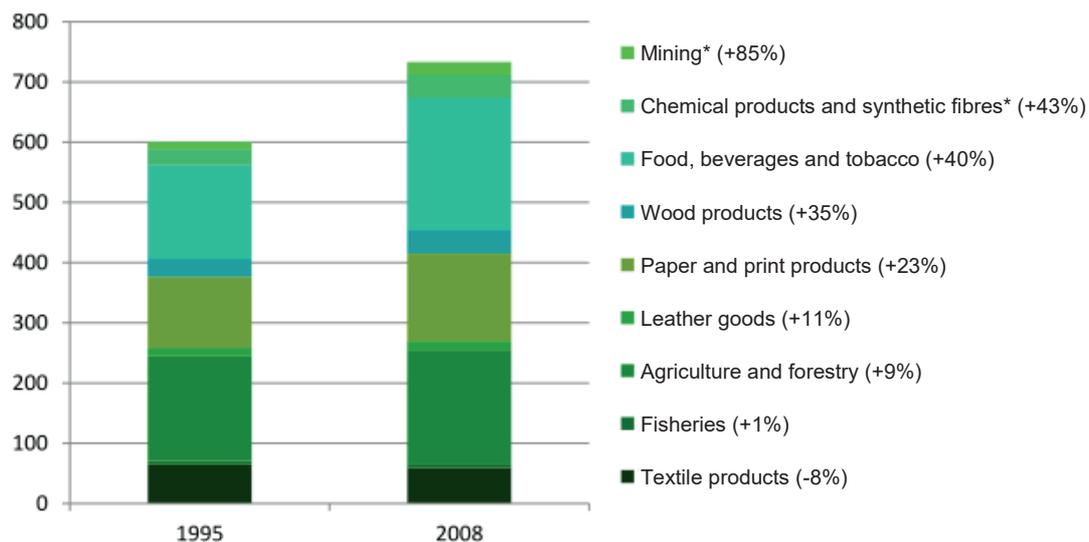
At the international level, agricultural policy is frequently used specifically to give groups of voters and social interest groups financial preference, to exert influence on the economy and to exert pressure in the context of international relations. Unlike in developing countries, the agricultural sectors of industrialised countries often receive high government subsidies and are thus able to significantly influence the international agricultural trade. The pronounced economic policy protection that the national agricultural sectors received in the second half of the 20th century was and is being liberalised significantly with the aim of promoting the international division of labour within the framework of the WTO and GATT negotiations, which means that agricultural producers in particular receive less tax-funded support and, together with consumers, are to a greater extent subject to price developments in world markets. Nevertheless, numerous politically determined non-tariff trade barriers, such as extensive quality standards, make it difficult for Third World countries to access the markets of industrialised countries. The dismantling of such obstacles therefore has considerable development and political potential. To a limited extent, the EU is trying to use bilateral trade agreements such as 'Everything but Arms' to provide targeted trade policy stimuli for the poorest developing countries.

6 Agriculture as the key component of the bioeconomy

Against the background of the expected scarcity of the fossil-based raw materials which currently form the main basis of the industrial economic system, the concept of a bioeconomy based on renewable raw materials has been developed, discussed and promoted at the political and scientific level in the EU, the US and other countries for several years. This vision aims to secure prosperity while taking into account the restrictions and challenges mentioned above and at the same time to prevent negative environmental impacts in the interest of the quality of life of future generations (cf. OECD 2009).

Agriculture plays a central role in this configuration, as together with ▷ *Forestry* it represents the leading economic sector for the production of such goods (cf. Efken/Banse/Rothe et al. 2012). For the development of the bioeconomy, it is important that the range of raw materials produced by these sectors will increase in breadth and volume and that the growth seen in past decades (cf. Fig. 5) will surge. It is expected that the production of raw materials that are not used as food will undergo considerable boosts in the future. In the long term, this will mean that the integration of the entire primary sector on a national and international level with a large number of industrial and scientific areas will greatly increase in diversity and intensity. Both land use and food production will be impacted in the long term.

Figure 5: Development of value creation in the economic sectors of the bioeconomy (in € billions)



Note: For the sectors marked with *, approximately 20% of the value creation can be attributed to the bioeconomy.

Source: The authors, based on the Eurostat 2013

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