International comparison of product supply chains in the agri-food sector:
determinants of their competitiveness and performance on EU and international markets

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Review of recent developments in the agri-food sector

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Abstract

The paper provides a review of recent developments on the world and local agri-food markets. Possible consequences for the EU agri-food supply chains and for their performance on international and domestic markets are discussed. By revising recent literature the most important trends were detected and their effects on the competitiveness of the EU agri-food chains evaluated.

On the one hand, the complete fulfilment of altering consumption patterns, due to diet changes, amongst others as a result of growing incomes, as well as the increasing demand for organic and 'healthy' food products is a great challenge to EU agriculture. On the other hand, trade liberalisation is creating new competition for the EU, while world markets with their growing price volatility are increasing the price risk of production and the income variability for farmers. In addition, EU agriculture is facing a fierce structural change induced by new technologies, the public request for traceability and accountability, and the resulting necessity of capital. Nevertheless, new income opportunities for the sector arise from these trends as well, one of them being further product diversification through branding and labelling.

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Executive Summary

In the course of the report trends and developments of the past 20 years affecting global and local agri-food markets and their possible consequences, positive as well as negative, for the EU agri-food supply chain and for its competitiveness on international and domestic markets are presented and discussed. This is important, because the changes impact the future competitiveness of all elements of the supply chain in the short and the long run. The research was conducted by reviewing recent literature. The main developments in the last 20 years that have had and probably will have positive and/or negative impacts on the competitiveness of EU agri-food supply chains on international and domestic markets are:

- ***Diet changes*** (because of rising incomes in developing countries and growing urban population) towards higher-valued food products are likely to favour the EU's well developed food processing industry, but might lead to import substitution through the expansion of food processing capacities in emerging countries and thus to new competitors (especially from the BRICS).
- ***New technologies and an increasing level of technology and mechanization in agricultural production*** are likely to benefit the EU's food supply chain due to its relatively good accessibility to necessary capital. Considering this trend, agricultural employment is expected to further decrease, especially in developed countries.
- ***Growing price volatility*** may enhance the relative competitiveness of the EU, since EU producers and consumers might be less affected by an increase in the price risk of agricultural production, since they have better access to bank loans than competitors from developing countries.
- ***Expansion of private food standards*** in combination with R&D, fostering the ***diversification of food products***, allows enterprises, with the essential research and quality control infrastructure as well as the necessary amount of market power (mainly large EU and US conglomerates), to create global brands and use ***branding*** to increase their value added.
- ***Proliferation of public food quality standards and safety regulations*** like the ***EU quality schemes***, e.g. PDO/PGI certification, are most likely to create import barriers and restricted niche markets with high and sometimes unrealizable food quality requirements for foreign competitors, thus favouring domestic (EU) and local enterprises.
- ***Public demand for traceability and transparency*** across the supply chain might increase the competitiveness of the EU due to good institutional as well as infrastructural conditions for ***effective logistics*** and ***tighter vertical integration and coordination.***
- ***Higher openness of agri-food markets*** due to trade liberalisation will probably increase agricultural exports from competitive EU enterprises, but might lead to domestic market share losses for uncompetitive EU food companies to non-EU players (especially from the BRICS).

- ***Increasing demand of consumers for organic food products*** might favour competitors from developing countries, since the production is less technology based and more cost-saving for them, allowing them to increase their exports on the European Single Market, if they are able to meet the quality requirements and have reasonable trade access.

On the basis of this report and its results, more detailed analyses of the trends affecting agri-food production and markets will be conducted in the course of the COMPETE Project.

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List of Abbreviations and Acronyms

BRICS:	Brazil, Russian Federation, India, China and South Africa
BSE:	Bovine Spongiform Encephalopathy
CAP:	Common Agricultural Policy
DG-SANCO:	Directorate General for Health and Consumer Affairs
DNA:	Deoxyribonucleic Acid
EC:	European Commission
ECB:	European Central Bank
EFSA:	European Food Safety Authority
EU:	European Union
FAO:	Food and Agriculture Organization of the United Nations
FAOSTAT:	Online database of the FAO Statistical Division
FSA:	Food Standards Agency
GATT:	General Agreement on Tariffs and Trade
GDP:	Gross Domestic Product
GMO:	Genetically Modified Organisms
HACCP:	Hazard Analysis Critical Control Points
MERCOSUR:	Southern Common Market
MIST:	Mexico, Indonesia, Republic of Korea, Turkey
NAFTA:	North American Free Trade Agreement
NGO:	Non-Governmental Organization
PDO:	Protected Designation of Origin
PGI:	Protected Geographical Indication
R&D:	Research and Development
SFP:	Single Farm Payments
Tiger Cub:	Indonesia, Malaysia, Philippines and Thailand
TFP:	Total Factor Productivity
TNC:	Transnational Corporation
TSG:	Traditional Specialities Guaranteed
UK:	United Kingdom
USA:	United States of America
USDA:	United States Department of Agriculture
UV:	Ultraviolet
WTO:	World Trade Organization

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1 Introduction

The very ambitious goal of the EU, stated in the Lisbon Agenda of 2000, to make the EU "the most competitive and dynamic knowledge-based economy in the world, capable of sustainable growth with more and better jobs and greater social cohesion" (EC, 2000) is a good example of how the term competitiveness entered policy reality on the European level. The Europe 2010 framework further fostered the idea, by seeking to improve the EU competitiveness through boosting education and research enhancing programs (EC, 2010).

In 2010, the European Commission reinforced the statement in the agenda of its Europe 2020 strategy by acknowledging that the EU has prospered through trade intensification. However, they warn that the EU is facing increasing competitive pressure on export markets and therefore has to improve the competitiveness of many of its industries (EC, 2010).

In particular, the competitiveness of the EU food industry was identified as a key aspect for a prosperous future, since the sector accounts for 5% of European value-added and 7% of total employment (EC, 2009). However, the business environment for the agricultural sector is altering rapidly. New, strong competitors from emerging countries like the BRICS are challenging the position of EU agri-food enterprises on international and domestic markets. Changing consumer patterns, demographic changes and environmental and sustainable issues concerning conventional agriculture are some of the other, urgent challenges facing agriculture. Consequently, the competitiveness of European agricultural production should be of high importance to policy makers, producers and consumers as well. Actions need to be taken to improve the social, environmental but also economic sustainability of agriculture and guarantee a future high quality EU agri-food sector.

So far several policy actions, as well as a dialogue with agents of the entire food supply chain, have been initiated by the EU to address agri-food industry competitiveness issues. The High Level Forum for a Better Functioning Food Supply Chain, consisting of selected Member states representatives, European food production enterprises, specific consumer interests representing NGOs and professional association, was established with a two year mandate by the European Commission to intensify communication between stakeholders (EC, 2009).

However, the concept of competitiveness is complex, since there is no commonly agreed definition of the term and the interaction between the factors affecting competitiveness is so far unclear. The COMPETE Project was established to support the EU in its aim to define and foster competitiveness of the domestic food supply chain on international and domestic markets. By comparing international product supply chains in the agri-food sector, the project is pursuing its goals to identify the determinants of competitiveness and to provide policy recommendations for a prosperous, future EU agricultural sector.

In the context of the COMPETE Project this paper's aim is to identify trends and developments in the past 20 years on global and local agri-food markets. Furthermore, the main developments in EU agri-food supply chains, the factors affecting the functioning of supply chains and their consequences for EU competitiveness will be discussed. This is important, because changes impact on the future competitiveness of all elements of supply chains in the short and the long run.

2 Environment for agri-food markets

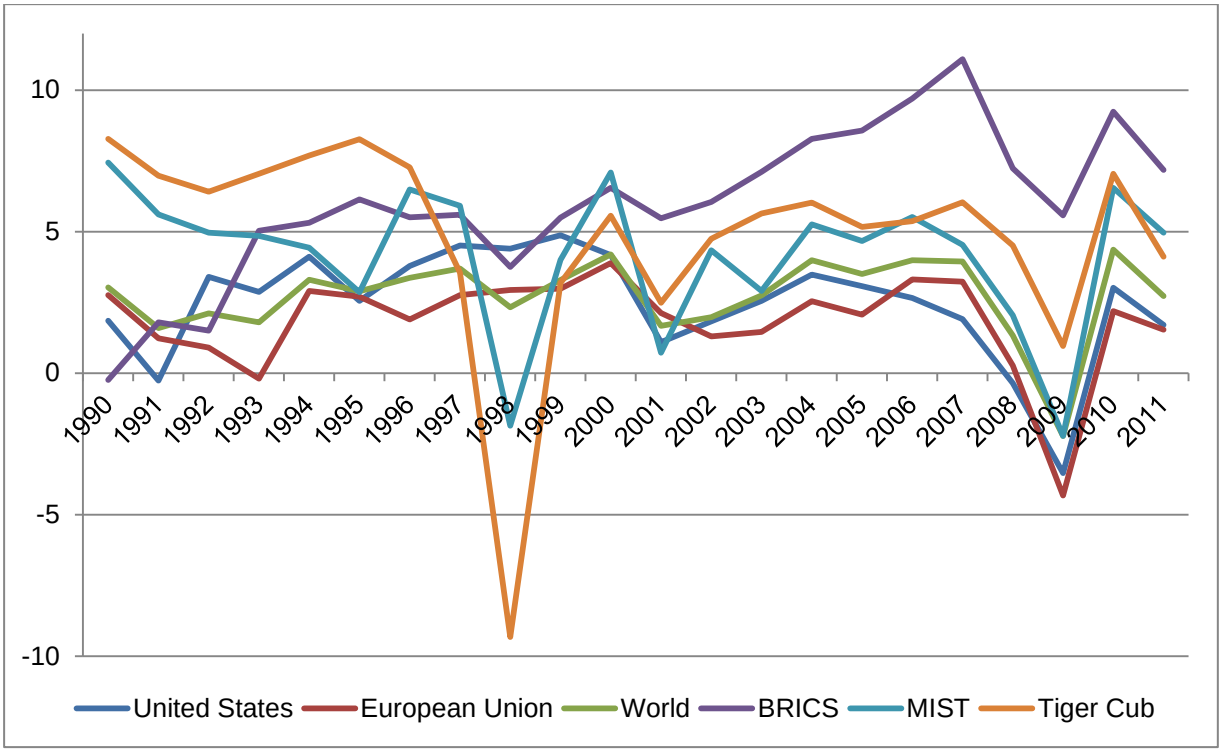
This chapter focuses on global economic developments, e.g. GDP per capita growth, policy changes affecting trade and agricultural production as well as price trends on world agri-food markets to present how the general business environment for the agri-food sector has altered over the past 20 years.

2.1 Global economic trends

2.1.1 GDP and GDP per capita development

The last 20 years have witnessed momentous changes in world trade and the global economy. The importance of developing and emerging countries in the world economy has grown. Since the beginning of 1990s the growth in developing countries' GDP has outstripped that of developed countries.

Figure 1: Annual Growth of GDP (in%) for selected countries and country groups



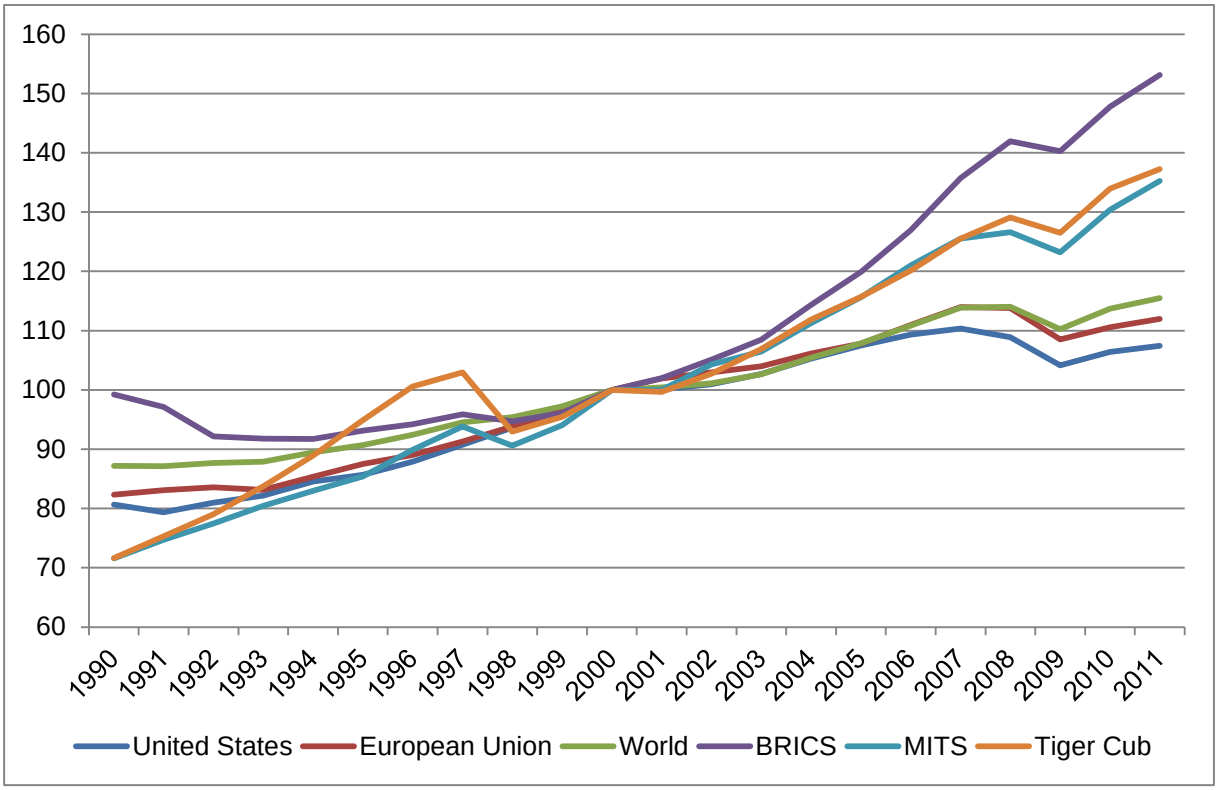
Source: Author's presentation based on data from World Bank, 2013.

Figure 1 presents the annual growth rates of GDP of the United States of America, the European Union, the World, BRICS (Brazil, Russian Federation, India, China and South Africa),

MIST (Mexico, Indonesia, South Korea and Turkey) and the Tiger Cub countries (Malaysia, the Philippines, Thailand and Indonesia) for the years 1990 to 2011. In 2011, overall global growth was measured at 2.7%. However, while the GDP of developing and emerging economies increased by 6.0 %, across the developed world growth was a meagre 1.5%. Growth in East Asia outstripped all other regions, averaging 8.0 % in 2011. Countries in Central and Eastern Europe rebounded from a tough 2009 (when the GDP of this region declined by 3.6%) to take second place in 2011, with growth marked at 5.3% (GFMAG, 2013).

The primary driving force behind high rates of global GDP growth in the last two decades were the BRICS countries, averaging an annual GDP growth rate of 6.0 % between 1990 and 2011. Especially, China (averaging annually 10.1%) and India (6.5%) lead the way, while Brazil (2.7%), South Africa (2.6%) and the Russian Federation (0.7%) experienced more modest annual growth rates over the past 20 years. Other emerging nations like the MIST and the Tiger Cub states also averaged respectively high growth rates of 4.9 % and 4.1 % during this period. The developed countries, e.g. the European Union or the USA, lost some shares of world GDP due to relative low GDP growth rates (1.8% and 2.4% respectively).

Figure 2: GDP per capita index in selected countries and country groups 1990-2011



Source: Author's presentation based on data from World Bank, 2013 (2000 = 100).

Over the observed period there have been two major economic crises with negative regional and global economic consequences (see Figure 1 and 2). The Asian financial crisis of 1997 and 1998, particularly affecting South-East Asia, caused a recession in the region. In particular, the Indonesian economy suffered with a 13.1% decline of its national GDP in 1998. The financial and bank crisis starting in 2007 had a negative impact on all national economies around the globe. Economic growth in developing countries like the BRICS slowed down,

e.g. from about 11.1% in 2007 to 7.2% in 2008. The EU, the USA, the MIST countries and the world overall experienced a recession. Since 2010 all observed regions have been growing again, but at a reduced speed with some national economies in the Eurozone remaining in deep economic crisis. For 2013 the European Central Bank's (ECB) overall GDP growth rate projection for the Eurozone varies between -0.2% and 1.4% (ECB, 2012).

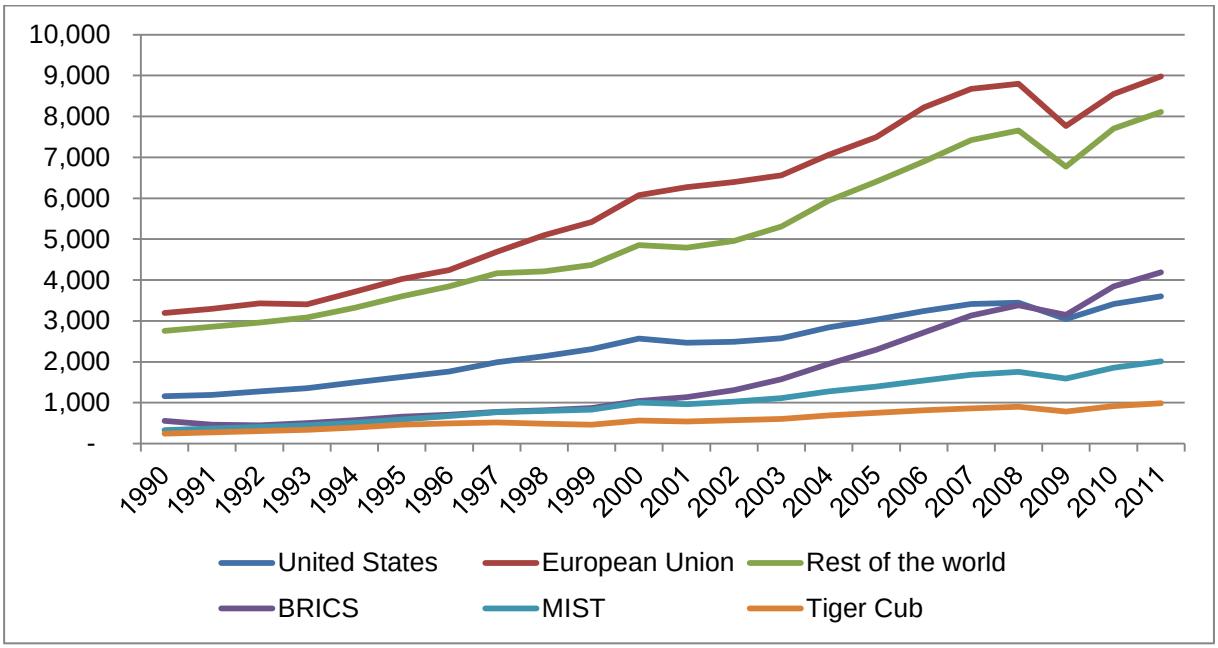
"In the years to come, developing countries, starting with Africa, are expected to grow three times faster than advanced economies. We are witnessing a massive "catching up" by developing countries" (Lamy, 2013).

2.1.2 Trade development

World trade in the last two decades grew at approximately 5% per annum. The WTO expects that after a relatively poor 2% growth rate in world trade last year, the volume of trade in 2013 will rise to 3.3%. The growth of trade by developed economies will be around 1%, whereas that of developing economies will be around 5% (WTO, 2013).

The increasing significance of the economies of emerging and developing nations can also be observed in the development of trade values. The BRICS almost quadrupled the value of their trade since 2000 from about $1.0 trillion to $3.8 trillion in 2010 (see Figure 3). Moreover the overall trade value of other emerging countries, e.g. MIST and Tiger Cub nations, rose more rapidly than of developed countries averaging respectively around 7.9% and 6.8% annual growth rates between 2000 and 2010. In comparison the EU averaged growth rates of about 5.9% over the same period of time, making it the world's largest trading bloc with a trade value of $8.5 trillion.

Figure 3: Total trade value of goods and services in countries and country groups (in constant 2000, billion US$)



Source: Author's presentation based on data from World Bank, 2013.

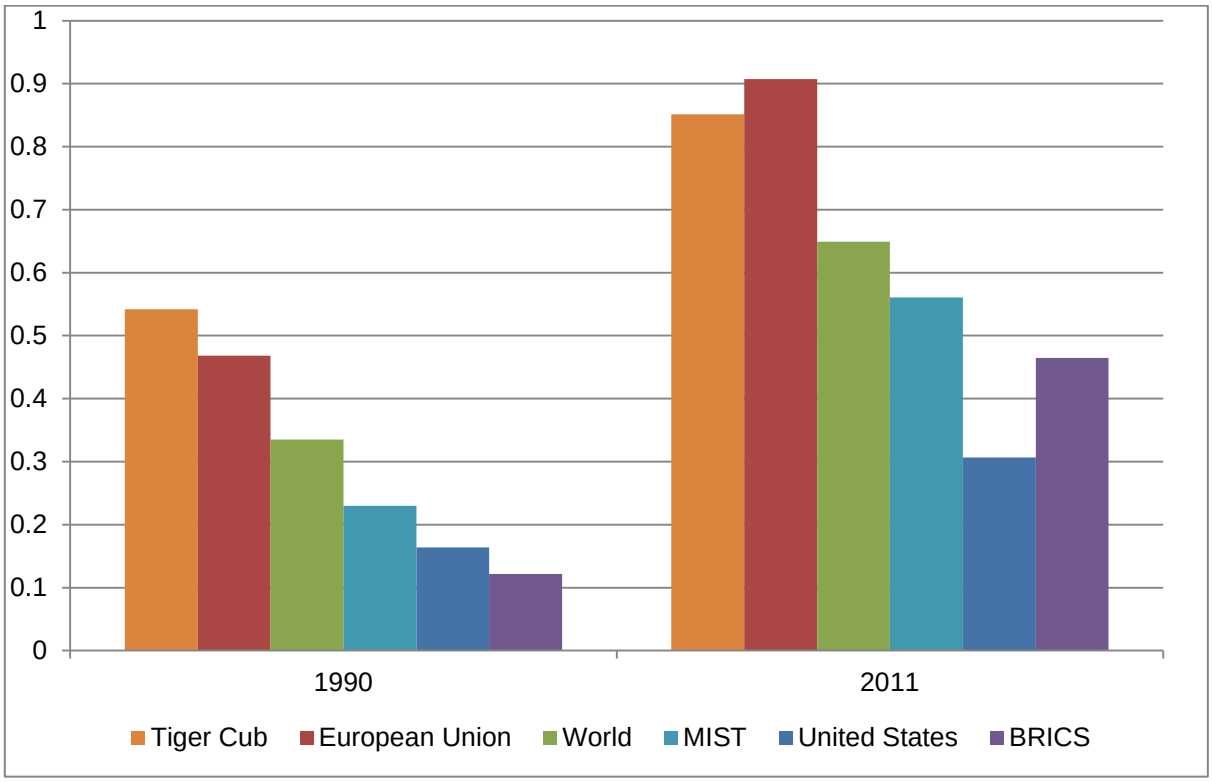
Furthermore, trade is of growing significance for the wealth of nations. The ratio of total trade value per capita to GDP per capita highlights this development (see Figure 4). In the emerg-

ing countries of the BRICS, MIST and Tiger Cub, as well as the European Union, the relationship between GDP per capita and trade value per capita intensified significantly in the last two decades.

The geography of trade is also changing. Twenty years ago, 60% of world trade was North-North, 30% was North-South and only 10% was South-South. By 2020, it is "expected that South-South trade will reach one-third of world trade" (Lamy, 2013).

The rise of new actors in world trade was initiated by innovations in communication and transport technology, which elongated the value chain to a global scale. The new global supply chains have been an opportunity for developing countries to become active members of the global economy. As a consequence of the progressive specialization, not only entire products or services are traded, but also tasks. In other words, the aim is not anymore to produce an entire good and trade it, but to generate value by contributing to a specific level of the production process or offering services (Lamy, 2013).

Figure 4: Total trade value per capita/GDP per capita (in constant 2000 US$) in countries and country groups



Source: Author's presentation based on data from World Bank, 2013.

2.2 Policy changes

2.2.1 Trade liberalisation and globalisation

"International trade liberalisation was one of the most important, if not alone the most important resource of this growth and the connected increase of welfare" (Jeníček, 2012, pp.128).

The establishment of the World Trade Organization (WTO) in 1995, as a successor institution to the General Agreement on Tariffs and Trade (GATT), was one of the keys to multilat-

eral trade liberalisation in the last two decades. By sanctioning member states for illegally restricting free trade among participants, the WTO tries to achieve its goals of decreasing trade discrimination and creating free access to markets. The aspired ideal state of free trade among all member countries is, in the view of the WTO, essential for enhancing economic stability and peace. The Doha round, succeeding the Uruguay round (1968-1994) and starting in 2001, has sort to further liberalise trade in specific, still restricted economic sectors like agriculture and services. However, progress to date has been meagre (Fergusson, 2011).

Several bilateral trade agreements have fostered trade liberalisation between specific countries or economic sectors. For example, Israel, Turkey and some former Soviet countries in Central and Eastern Europe, before becoming actual members of the EU, signed free trade arrangements with the EU in the last two decades (Moehler, 2007).

Regional trade agreements have played an even greater role in the liberalisation process of trade. Especially the forming of the EU as an economic and monetary union and its further enlargements have fostered intra-regional trade and account for a high amount of the value of international trade. The success of the EU has accelerated the formation of further regional trade arrangements like NAFTA or MERCOSUR. However, these blocks have not accomplished the same level of economic integration and free trade as EU member states (Mitra and Josling, 2009).

Global trade liberalisation efforts have nurtured the process of globalisation. Globalisation is an interacting social, political and economic global phenomenon. Advances in transport and communication technologies that lower transport and communication costs as well as policy changes regarding the cross-border transfer of people and goods have enhanced the worldwide exchange of cultures, ideas, people and commodities. However, by opening borders the single national state has lost power and can only accomplish effective policies in collaboration with other states on a regional or even global level (Jeníček, 2012).

Increasing worldwide trade in goods and services, as well as the growing mobility of capital, have altered national and global economies. There is almost no national economy, which is not integrated into world economy. Transnational corporations (TNC) increasingly control and govern world production chains that are decentralized and spatially diffused (Bonanno, 2004).

Also national and local actors and entrepreneurs are affected by globalisation in many ways. First of all, the reduction of trade restrictions and transport costs has improved access to foreign markets and competition on home markets. Second, local demand and demand patterns influence producers across the globe, enhancing the spread of economic crises and booms. Third, greater access to more and larger markets allows producers to realise comparative advantages, increasing the tendency towards the division of labour and product specialisation (Vošta, 2012).

2.2.2 EU level

2.2.2.1 EU enlargement process

In the last two decades, there were several rounds of EU enlargement. In 1995 Sweden, Finland and Austria joined the union increasing the number of members to 15. EU membership grew from 15 to 25 countries in 2004 and to 27 in 2007, bringing in most states of Central

and Eastern Europe. Croatia will join the EU on the 1st July 2013, making it the 28th Member State. Five other countries are recognized by the EU as official candidates for membership: Iceland, Macedonia, Montenegro, Serbia, and Turkey.

EU enlargement is a political as well as an economic process and acceding states must adopt all of the EU's rules (*acquis*). For new member countries, EU membership is not only about the removal of trade barriers and restrictions on merchandise, labour, capital mobility, but also about restructuring institutions and establishing new market conditions. Market players have to adapt to these changed conditions. The enlargement process means participation in an altered business environment for both 'old' and 'new' members. Accession to the EU has stimulated growth in agricultural trade between established and new Member States with foreign direct investment in the new member states and their exposure to increased competition fostering greater concentration, and consolidation processes (Gruescu et al., 2007).

2.2.2.2 CAP reforms

Since the early 1990s, EU enlargements, as well as the WTO efforts to nurture free trade in the agricultural sector, have put considerable pressure on the EU to reform its Common Agricultural Policy (CAP). The CAP's original goal was to make Europe autarkic in terms of food supply by applying market regulation methods, e.g. intervention prices, and introducing a common internal market and import restrictions. During the 1970s and 1980s, the CAP fostered massive overproduction and expanded its share of the European budget tremendously due to the escalating costs of export subsidies, and the purchase, storage and disposal of food surpluses. The first measures to curb production surpluses, e.g. the introduction of milk quotas were taken in the 1980s (Lowe et al., 2002).

The first major reform of the CAP, the so-called MacSharry reforms, was conducted due to internal budgetary and external pressure from the Uruguay Round of multilateral trade negotiations. Cuts in support prices for beef, oilseeds and grains and financially aided set-aside programmes to reduce overproduction were implemented. Nevertheless, European protectionism continued to exist in the form of direct payments and further accompanying actions, e.g. early retirement and environment protection programs, compensating farmers for price cuts (Swinbank, 1993).

In anticipation of the 2004 EU enlargement of ten mostly Central and Eastern European countries with a large share of their population active in agriculture, concerns were raised about the budgetary costs of the CAP, possibly absorbing up to 85% of the total budget, in the future. Furthermore, there was an increasing pressure by different interest groups to shift the focus of the CAP towards rural development, the implementation of food safety regulations as a consequence of food scares like BSE and the enhancement of environmental measures in agriculture. The Agenda 2000 reform limited the CAP budget to €40.5 billion per annum, plus an annual inflation of 2%, and further reduced intervention prices. Furthermore, direct payments could be modulated to pay for environmental schemes. In addition, the reform defined agriculture as 'multifunctional' indicating that it is not only about production, but that it has social, cultural, territorial and environmental significance and obligations for rural areas. Consequently, a second pillar of the CAP was introduced to foster rural development, alongside agricultural market regulation and support measures in the first pillar (Pezaros, 1999; Fouilleux, 2010).

In the 2000s two further CAP reforms, the 'Mid-term Review' of 2003 and the 'Health Check' of 2008 were passed. Due to consistent pressure from WTO negotiations, direct payments needed to be further decoupled from production. In addition, on-going food safety scares and environmental issues, e.g. ground water pollution, further increased public interest in the agricultural sector. A consequence was that the enormous budget for agriculture needed to be more justified by enhancing food quality and environmental aspects. As a result, the intervention prices for some commodities were further reduced and Single Farm Payments (SFP) were introduced in the 2003 agenda. To receive SFPs farmers have to fulfil certain environmental, food safety, social and animal welfare standards (Fouilleux, 2010).

The second reform of the 2000s defined four new challenges, climate change, biodiversity, water management as well as renewable energy, for European agriculture that should be met by an altered CAP. The 'Health Check' agreed to the abolition of milk quotas, in 2015, and compulsory set-aside. SFP are subject to further modulation, transferring budgetary resources from the first to the second pillar (Fouilleux, 2010).

The newest reform, targeting to prepare the CAP for the period 2014 to 2020, was a result of an intensive revision and debate process of the entire policy that started in 2010 with the publication of the EC's idea of European agriculture and future CAP and debates about the EU budgetary framework for the period 2014 to 2020. The publicized vision of the Commission was to continue the path of reforms started in 1992, but to shift towards a more land-based approach, instead of producer support (EC, 2013).

In the future, the CAP will have almost the same objectives as before, but focusing more on sustainability and competitiveness of the agri-food sector as well as effectiveness of the CAP. Nevertheless, the budget of the CAP was limited and will stay stable at the level of 2013 for the entire period. The result is that the spending for pillar one was decreased by around 1.8% and for pillar 2 by approximately 7.6% compared to 2011 budget. To improve targeting of CAP spending and thereby effectiveness, member countries are allowed to transfer around 15% of their budget between the pillars and decide solely themselves on the allocation of direct payments. Additionally, the instrument catalogue of pillar one was extended. The new instrument 'greening' (around 30% of the national direct payment envelopes) rewards farmers financially, who provide environmental goods, e.g. conservation of permanent grassland, and thus foster sustainability. The aspect of competitiveness gained attention, since production constraints will be abolished for a number of products, e.g. for milk and sugar. Competitiveness of EU agriculture sector is supposed to be enhanced by alleviating the formation of producer cooperation, reducing costs, improving the farmers' access to credits, and increasing the value-added by the primary sector, e.g. via product differentiation and on-farm processing (EC, 2013).

2.2.2.3 Sustainability

Agriculture, like many other economic activities, is increasingly assessed in terms of its sustainability. The Brundtland Declaration of 1987 defines sustainable development as "a development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987).

In recent decades, the agricultural sector has been dominated by the goal of improving productivity. This was achieved by intensifying agricultural production, causing a reduction of biodiversity through the creation of monocultures which contribute to global warming, water shortages and the loss of pasture lands. Pesticide overuse, food processing and packaging as well as the transport of imported goods over long distances are the most significant contributors to the non-sustainability of agri-food supply chains (Boye, 2012).

However, the demand side also negatively affects agriculture's sustainable capability. People around the world, primarily in developed, but nowadays increasingly in emerging and developing countries, shifted their diets from grains to meat and vegetables. The production of animal based foods requires the most land, consumes the most energy and is responsible for the highest greenhouse gas emissions per kilogram produced (Geeraert, 2013). For example, the diet of a Swede required in 2006 31% more energy, 25% more land and was responsible for 31% more greenhouse gas emissions compared to an average Swedish diet in 1960 (Geeraert, 2013). Therefore a world diet based on more animal products is a great challenge for sustainable agricultural production (Geeraert, 2013).

The EU's awareness of agriculture's great challenge, to meet the increasing demand of a growing and richer world population for food commodities and to produce simultaneously in a sustainable manner, is recognised in the Lisbon Agenda. The aim is to make the EU not only "the most competitive and dynamic knowledge-based economy in the world", but also to be "capable of sustainable economic growth with more and better jobs and greater social cohesion" (EC, 2000). This goal was further developed within the Europe 2020 strategy (EC, 2010) for becoming a smart, sustainable and inclusive economy.

2.2.2.4 Food safety regulations

From 1990 onwards the EU has witnessed, from both internal and external reasons, a substantial expansion of food safety regulations.

In the United Kingdom, the Food Safety Act of 1990 enshrined in law the requirement that food businesses have to show due diligence in ensuring that "all food meets consumers' expectations in terms of nature, substance and quality and is not misleadingly presented" (Food Standards Agency 2009). As a consequence, retailers created quality control measurements assuring food safety throughout the supply chain from the producer to the shelf by introducing actions, like traceability (Hobbs, 2002).

Food safety incidents, like BSE, resulted in intense public concern in the UK and forced governments to introduce measures to regain consumer trust. In the UK, this included the creation of the Food Standards Agency (FSA) (Hobbs, 2002; Knowles et al., 2007).

Several food exporting countries, like Canada or Australia, introduced or tightened food standards due to external factors. In the case of Canada and Australia this included securing the access to important markets, especially the US market, by adapting to food policies enacted in the main importing countries. Therefore institutions were established that are "responsible for inspection and quarantine services and for accreditation of Hazard Analysis Critical Control Points (HACCP) systems" (Hobbs, 2002, p. 78).

The principles of HACCP were also adopted in the EU in 1993. However, the European Commission shifted "responsibility for meeting EU Food Law requirements to the food industry, thus moving away from end product testing" (Knowles et al., 2007, pp. 49). Since the Mid 1980s, the EU has been committed to precautionary actions to guarantee consumer safety and environmental protection, e.g. the ban of growth hormones in beef production and residues from Genetically Modified Organisms (GMO). These policy measures often lead to tensions with international organisations like the WTO (Knowles et al., 2007).

Apart from obligating food businesses to have hygiene procedures in place that are based on HACCP, the EU enacted further institutional changes to enhance food quality and safety. The Directorate General for health and consumer protection (DG-SANCO) was created in 1999 and commissioned with the responsibility for European food safety issues. In 2003, the European Food Safety Authority (EFSA) was established. Furthermore, traceability and labelling measures were established designed to enable European consumers and competent authorities to check and trace a food product's production process (Knowles et al., 2007).

The implementation of food quality and safety standards throughout the supply chain and the increased need for traceability have tightened collaboration across the supply chain. In general, supply chain coordination has shifted from episodic trade relations to strictly organized vertical coalitions (Gereffi and Lee, 2009).

The new globally elongated and fragmented supply chains increase the risk of food hazards, the spatial aspect of their impact and complicate transparency as well as traceability along the supply chain. Agents from various food production regimes with diversified food safety regulations and control obligations are merged into one chain. Thus, accountability is obscured in the case of food safety problems. The harmonisation across different regulatory systems has yet to be established (Humphrey, 2006; Orden and Roberts, 2007).

2.3 World markets and price changes

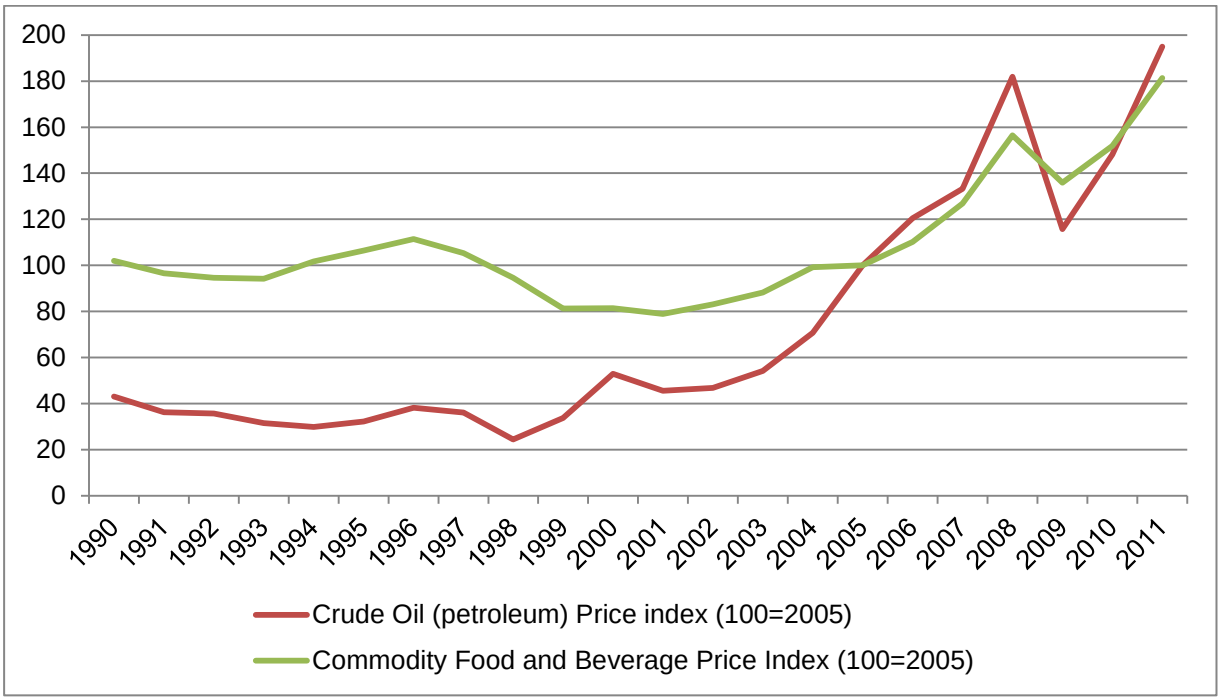
Since 1970 there have been a couple of peaks in the prices of food commodities, but prices have always reclined to previous levels. Recently world prices for food commodities (especially for grains and vegetable oils) increased rapidly (see Figure 5), causing food supply problems, primarily for low-income countries and their poor. It remains to be seen if this recent rise in food prices is temporary.

Current high agricultural commodity prices result from the combination of an increased demand and relatively slow growth in output. Yields rose by an average 2.0% per year between 1970 and 1990, but since 1990 their growth has slowed down to around 1.1% (Trostle, 2008). An increase in per capita income in developing countries further enhances demand by shifting diets from grains to meat (further increasing the demand for grains as feed) and vegetables (Trostle, 2008).

Another factor that has been rapidly increasing the demand for agricultural products over the last decade is the growth in biofuel production. The production of crop based fuels was fostered by the rising oil price and government policies, e.g. subsidies on bioethanol production in the USA and the mandate of the EU that biofuels ought to account for 10% of transportation fuel use by 2020. Figure 6 presents the projections of the USDA about the production quantities of Biodiesel until 2017. Recently also high world market prices for crude oil affect

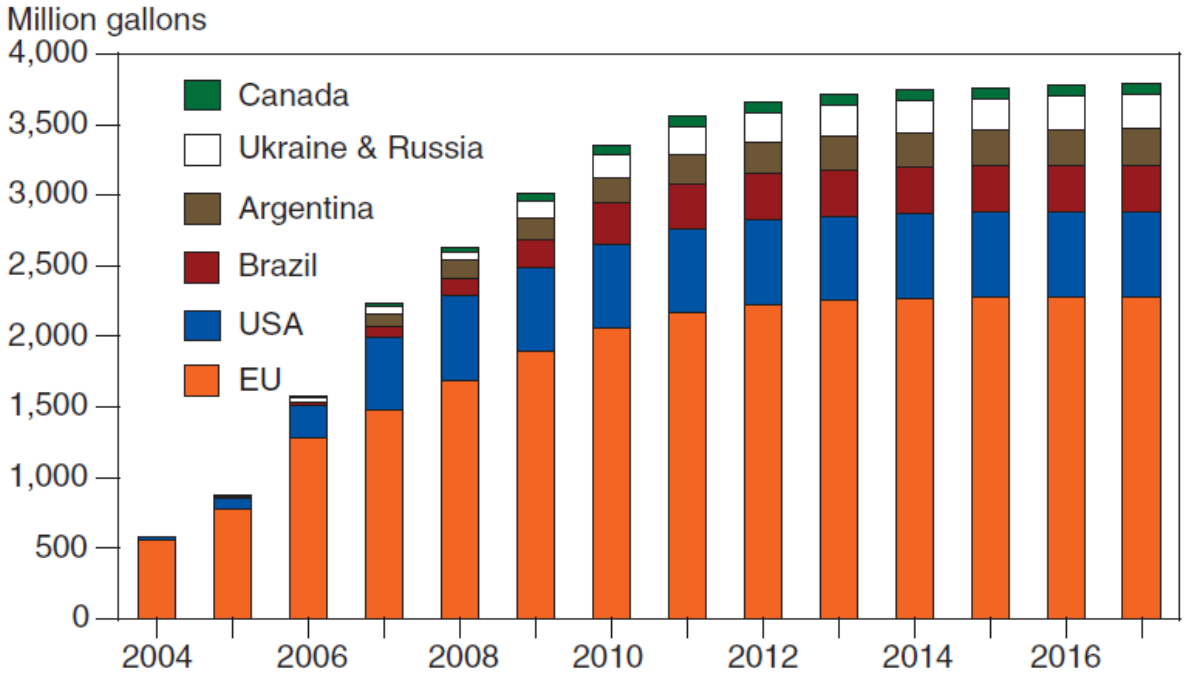
farmers and increase their costs for energy and hence overall production (Collier, 2008; EU, 2009/28).

Figure 5: Crude Oil and Commodity Food and Beverage Price indices 1990-2011



Source: Author's presentation based on data from IMF, 2013.

Figure 6: Projected biodiesel production in selected countries



Source: Trostle, 2008.

In addition, a devaluation of the US$, over the last years, also further boosting the oil price and therefore the use of biofuel as a substitute, enabled importing countries to increase their

food imports, since most world market prices for food commodities are denominated in US$. Consequently a rapidly growing demand for food commodities outpaces increases in supply, causing record high prices on the world market. In 2007 and 2008 prices rose further due to droughts around the globe and policies of some governments to restrict exports (Trostle, 2008).

The so-called food crisis was further fuelled by agricultural policies affecting the supply and demand of food. Notable policy measures, to discourage exports, included export bans for maize and rice in China as well as export taxes on various crops and beef in Argentina. This reduced the supply to international markets and increased price volatility. Furthermore, some countries like China introduced price control policies, fostering inefficiency in the domestic agricultural sector (von Braun and Torero, 2008).

Net-importing countries tried to increase their food supply by lowering import barriers. For example, Morocco decreased tariffs on wheat imports from 130 to 2.5%, while Peru abolished all tariffs on wheat and maize imports. Moreover, policy measures were enacted that made high-cost imports available to consumers at lower prices. Such policy changes increased demand even when world prices were escalating, further boosting the food crisis (von Braun and Torero, 2008).

“The threat of protectionism may be greater now than at any time since the start of the crisis, since other policies to restore growth have been tried and found wanting,” (Lamy, 2013). Experts like von Braun and Tadesse argue that free international food trade is necessary to have stable global food prices (von Braun and Tadesse, 2012).

However, the prices for food and beverage commodities did not only increase, but also their volatility rose. An increase in prices spreads to the retail level faster than price decreases. At the farm level greater price volatility affects production negatively by lowering producers’ income and their willingness to invest in production (von Braun and Tadesse, 2012).

Economic crisis like the financial and bank crisis always affect the agricultural sector: “Whenever banks, sovereign debt, exchange rates, and inflation enter crisis, the food market enters crisis too” (von Braun and Tadesse, 2012, p.33). For example, the financial crisis, starting in 2007, and by 2008 affecting the entire world, had the three major effects on agricultural production. First of all, investments in the agricultural sector declined, e.g. decreased purchase of machinery and fertilizer use, as the willingness of banks to loan money in economic instable times fell. Second, it’s expected that the crisis will reduce the demand for higher value production and increase the demand for basic commodities, since consumer income has been lowered. Third, market interventions of governments, e.g. export restrictions and granting subsidies to agricultural enterprises, might undo formerly achieved trade policy reforms in agriculture (Kadlečíková, 2012).

The financial crisis and the food crisis, interacting through their consequences for financial and economic stability and food security, have further intensified the suffering of the world’s poorest. FAO (2010b) estimates that the number of hungry and malnourished people increased by a further 140 million people due to the crises.

3 The food chain

In contrast to chapter 2, the following section concentrates on the agri-food chain in more detail. It presents and discusses economic, social, environmental and technological developments and trends of the past 20 years that affected the entire agri-food chain and constituent stages.

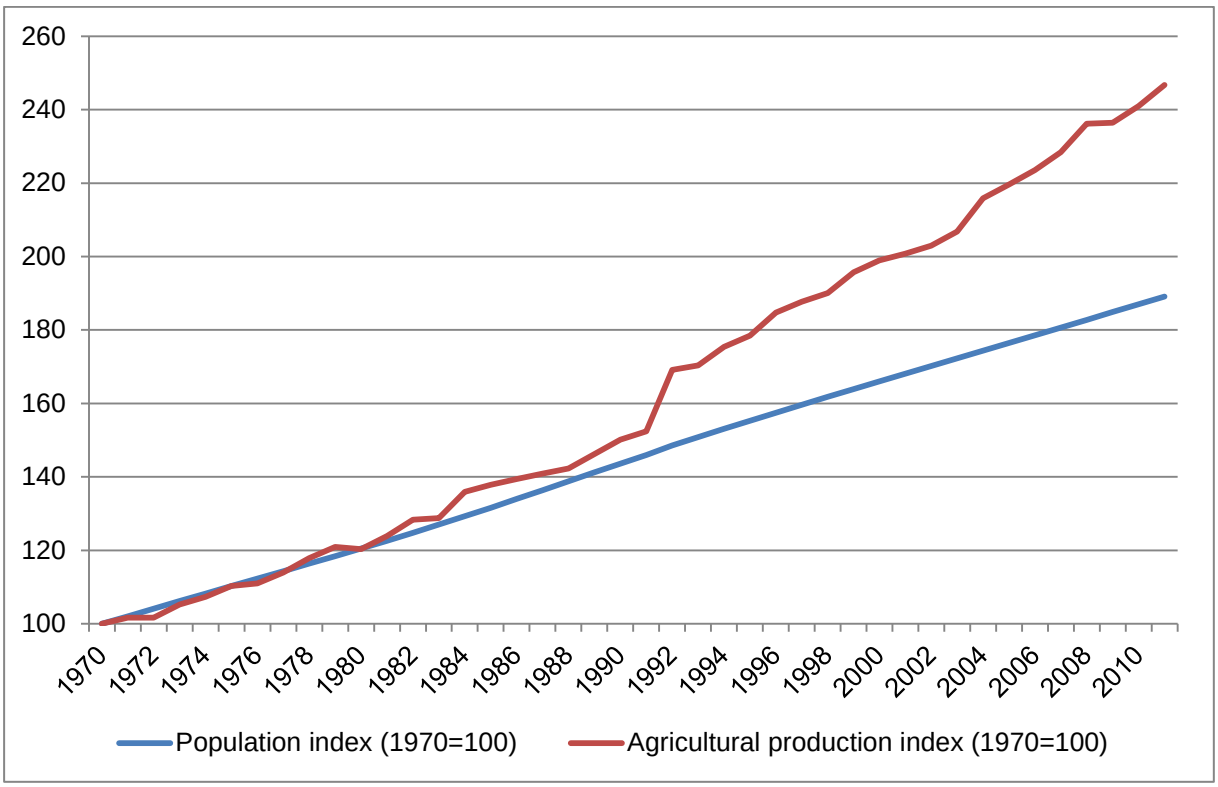
3.1 Agricultural markets

3.1.1 Supply

3.1.1.1 Agricultural commodities output and trade volume

Since 1970, the world's population has almost doubled, increasing from about 3.7 billion to around 7 billion in 2011. Growth rates for global agri-food output were even higher, averaging approximately 2.3% a year and nearly tripling the overall level of agri-food production during this period of time and hence compensating for population growth (see Figure 7). Interestingly, growth rates started accelerating in 1995 and average 2.4% between 2001 and 2010 (Fuglie and Nin-Pratt, 2013).Over the last four decades the growth in agricultural production has been greatest in emerging and developing countries which now account for a greater share of total world production. In 1965 the Soviet Bloc countries accounted for the major share (56%) of global agricultural production. 45 years later their share dropped to 32%, as a consequence of economic decline after the collapse of the socialist system and the emergence of new competitors from developing countries (Fuglie and Nin-Pratt, 2013).

Figure 7: World population index and agricultural production index 1970-2011

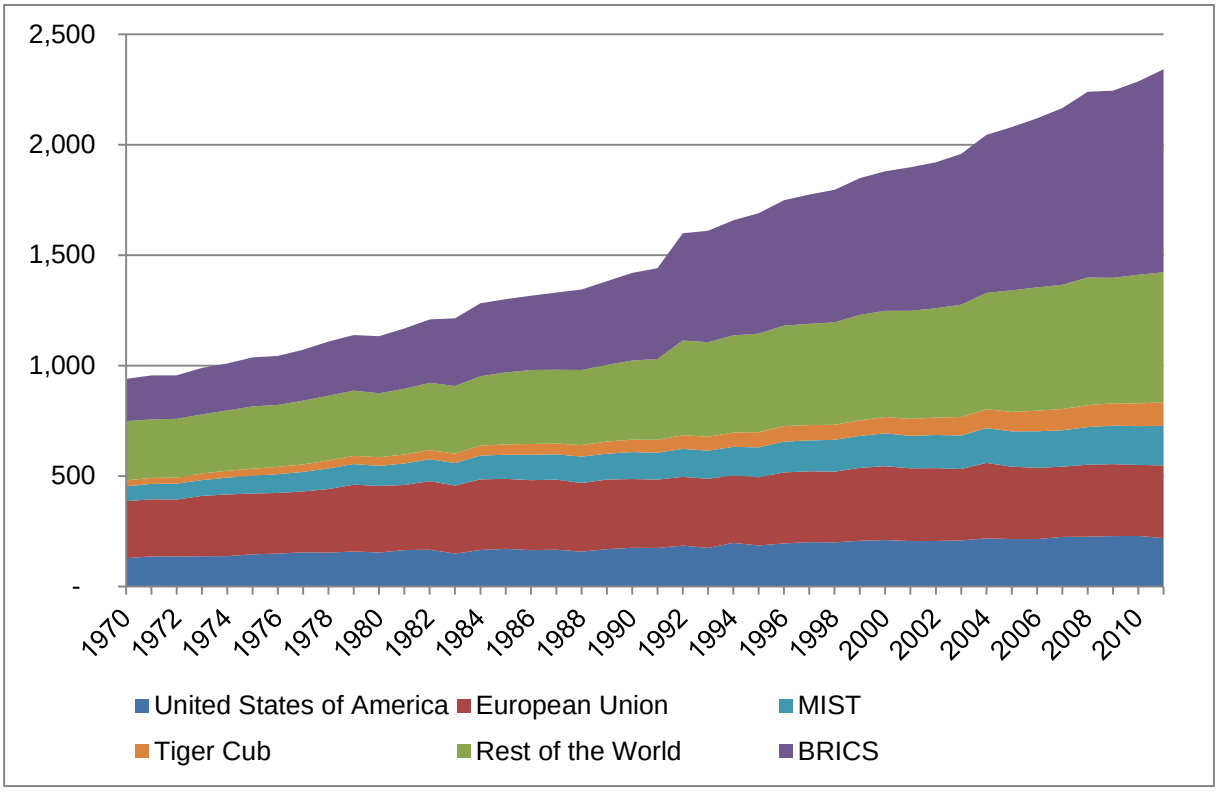


Source: Author's presentation based on data from FAO, 2013.

Specifically, the BRICS countries increased the value of their agricultural gross production from about $191 billion in 1970 to nearly $919 billion in 2010. Compared to this trend, the reported growth numbers for EU and US agricultural output seem relatively small, but still account respectively for $71 billion and $90 billion respectively (see Figure 8).

In 2001, O'Neill (2001) indicated the importance of four big emerging economies, Brazil, Russia, India and China, for the global economy and their economic potential. Today, their economic significance, especially concerning agriculture, is highly visible. In 2010, over 40% of agricultural value added (in current US$) was generated in BRICS countries. Other country groupings like the MIST or Tiger Cub economies also increased their agricultural production dramatically and respectively accounted in 2011 for about 7.8% and 4.7% of the value of global production (at constant 2004-2006 US$). Consequently more than half of the world's agricultural production is now being produced in emerging and developing countries. The number one agricultural producer in 2011 was China with almost 25% of the value of global agricultural gross production followed by the EU (14.4%), USA (9.6%) and India (8.3%) (FAO, 2013).

Figure 8: Agricultural gross production value (in constant 2004-2006, billion US$)



Source: Author's presentation based on data from FAO, 2013.

Emerging and developing countries achieved a drastic expansion of their agricultural output by increasing their capacities in agricultural research, disseminating improved technologies and practices to local farmers, and improving farmer education as well as rural infrastructure, allowing new technologies to be adopted more rapidly. All this led to productivity gains in agricultural production (Fuglie, 2013).

Although agricultural production grew faster than the world population over the last four decades, there are still almost 1 billion people malnourished. 98% of them live in developing

countries. Even though there are data that indicate a decrease in absolute figures (from 1.023 billion in 2009 to 0.925 billion in 2010), the FAO calls on governments to take further actions to reduce absolute poverty, e.g. increase investment in agriculture, expand safety nets and social assistance programs and enhance income-generating activities for the rural and urban poor (FAO, 2010a).

The tremendous growth in global agricultural supply, especially in emerging and developing countries, also affects agri-food producers in the EU. We are witnessing the entrance of new competitors on international and domestic markets, challenging the market shares as well as the revenues of EU enterprises. Improvements in competiveness are a key factor for EU agri-food producers to survive in this shifting market environment.

Table 1: Agricultural products, import, export and trade balance for selected countries and country groups (in million US$)

	1992			2010		
	Import	**Export**	**Balance**	**Import**	**Export**	**Balance**
USA	28,467	48,247	19,780	89,259	118,805	29,545
EU	190,078	176,544	-13,534	439,648	442,334	2,687
BRICS	29,347	26,779	-2,568	137,833	130,146	-7,687
MIST	17,161	10,971	-6,190	61,467	63,437	1,970
Tiger Cub	8,453	16,409	7,957	39,816	85,893	46,077

Source: Author's presentation based on data from FAO, 2013.

Table 1 presents figures relating to the value of agricultural imports, exports and balance of trade. As it can be seen, import and exports increased tremendously in all observed countries and country groups between 1992 and 2010. The EU more than doubled its imports, from $190 billion to $440 billion, as well as its exports, from $177 billion to $442 billion, evolving from a net importer to a net exporter. The value of agricultural imports and exports of emerging country groups grew disproportionately large compared to the value of domestic agricultural production. In the case of the BRICS, imports grew by around 370% and exports by around 386%, while the value of total agricultural production increased only by about 80%. In the MIST and Tiger Cub economies similar developments can be observed. Almost all of the selected countries and country groups have become net exporters for agricultural commodities. The one exception is the BRICS group due to a negative balance of $26 billion for the Russian Federation in 2010. The dramatically increasing figures for exports and imports indicate the greater openness of agricultural markets.

In addition to increasing global agricultural trade, the structure and geography of trade have also changed considerably. Trade liberalisation has caused the increased participation of developing countries in world trade and the reorientation of agri-food trade from 'east to west' (from former Soviet countries to the EU) in Central and Eastern Europe, altering the affected countries trade position from net exporters to net importers. The share of high-value exports (e.g. fruits, vegetables, fish, fishery products, etc.) has risen from 21% in 1980 to 41% in 2000 while the importance of tropical export commodities (e.g. coffee, tea, etc.) has decreased sharply (Swinnen and Maertens, 2007).

Table 2 presents import and export data for various agricultural product groups. Generally speaking, it can be observed that trade increased intensely in all selected countries and country groups as well as in all product groups. For the BRICS, imports and exports of all kinds of agricultural products increased tremendously in value, making them the greatest importers of bulk, semi-processed and processed goods. Prior to 2010, they used to be net exporters of all four product groups (see Table2). Today, the trade flows have changed. The BRICS remain only net exporters of processed goods. The EU almost doubled the value of imports and exports of all product groups. Nowadays it is a net importer for the same product groups as the BRICS, but has further strengthened its position as a massive net exporter of processed agricultural goods with a net value of around $20 billion.

Table 2: Import and export values for various types of agricultural goods (million US$)

	Imports			Exports		
	2000	**2005**	**2010**	**2000**	**2005**	**2010**
			USA			
total	**31,724**	**47,831**	**66,782**	**47,809**	**58,348**	**108,896**
bulk	4,440	5,373	8,614	18,466	22,924	46,295
horticulture	7,532	10,881	14,999	4,574	6,133	9,615
processed	5,372	8,055	13,363	17,231	20,418	35,176
semi-processed	14,381	23,521	29,805	7,537	8,874	17,809
			EU			
total	**44,359**	**68,134**	**97,752**	**33,650**	**49,518**	**81,039**
bulk	14,219	16,906	26,303	3,682	4,011	8,928
horticulture	8,089	14,581	18,698	2,186	3,779	6,960
processed	10,893	17,981	27,651	21,161	31,714	48,222
semi-processed	11,158	18,666	25,101	6,621	10,014	16,928
			BRICS			
total	**21,849**	**47,558**	**114,710**	**29,919**	**64,483**	**130,419**
bulk	7,523	16,514	40,292	8,940	17,586	35,478
horticulture	1,675	4,566	12,478	2,012	4,941	11,188
processed	6,190	12,930	32,428	12,124	28,645	55,402
semi-processed	6,461	13,549	29,512	6,844	13,310	28,351
			MIST			
total	**22,364**	**32,068**	**56,272**	**13,488**	**24,003**	**50,097**
bulk	9,077	10,183	19,741	2,178	2,256	3,963
horticulture	1,157	1,617	2,961	3,702	6,152	9,961
processed	4,341	7,209	13,661	4,604	8,080	15,552
semi-processed	7,788	13,058	19,909	3,005	7,515	20,621
			Tiger Cub			
total	**12,386**	**17,972**	**38,559**	**15,375**	**27,054**	**65,298**
bulk	5,007	6,259	12,771	2,534	3,717	8,263
horticulture	692	1,004	2,533	1,331	1,859	2,895
processed	2,867	4,677	11,407	4,574	7,322	14,743
semi-processed	3,820	6,031	11,848	6,936	14,154	39,396

Source: Author's presentation based on data from UN Comtrade, 2013.

The USA, in contrast, exports a net value of around $37 billion of bulk agricultural products. Furthermore, it should be noted that the Tiger Cub nations seem to have specialized on the production of semi-processed products with a substantial trade surplus in such goods

amounting to $27 billion in 2010. Overall, the EU, USA and the BRICS are great importers of unfinished products, but add value to the agricultural products in producing and exporting fully processed products.

Nevertheless, over the last decade there were no dramatic changes in the structure of trade. Most of the countries and country groups import and export more in quantity, but the shares of bulk, horticulture, semi-processed and processed goods have been almost the same. However, there is a general trend towards importing a smaller and exporting a bigger share of processed goods. Interestingly, in terms of the value of exports for the EU, the percentage of processed goods fell from 63% to 60% between 2000 and 2010, while the share of horticulture rose from 6% to 9%. The other two product groups, bulk (11%) and semi-processed (21%), accounted for almost the same percentage in 2000 and 2010.

Table 3: Food imports, exports and balances of selected countries and country groups (in million US$)

	1992			2010		
	Import	**Export**	**Balance**	**Import**	**Export**	**Balance**
USA	18,626	30,211	11,585	59,014	77,993	18,979
EU	138,941	128,310	-10,630	320,091	318,680	-1,411
BRICS	20,735	19,223	-1,512	59,562	94,753	35,191
MIST	9,394	7,145	-2,248	40,887	31,645	-9,241
Tiger Cub	5,129	8,414	3,285	28,287	28,831	544

Source: Author's presentation based on data from FAO, 2013

Table 3 presents data on food imports, exports and balances of selected countries and country groups. Overall food trade grew almost as much as the total value of agricultural trade. The USA more than tripled their imports from $18.6 billion in 1992 to $59.0 billion in 2010, while its exports increased in absolute figures even more, manifesting its importance as a food supplier to the world. Their position is challenged by the BRICS countries. They increased their export by around $76 billion, while their imports grew considerably slow in comparison by around $40 billion letting them become large net exporters instead of net importers. The EU's food imports grew by about 130% and its exports by 148% almost balancing them in 2010. The MIST countries increased their food trading deficit between 1992 and 2010 due to the growing negative balances of Indonesia (-$3.7 billion) and South Korea (-$10.8 billion).

3.1.1.2 Productivity development

In recent decades there have been a couple of trends that affected the productivity of the agri-food sector. The world's total economically active population in agriculture grew from 1.1 billion to 1.3 billion between 1990 and 2010. However, the figure rose only in developing and emerging countries (see Table 4). Nevertheless, the agricultural population grew slower than the total population, thus lowering their overall percentage. Developed countries like the USA and the EU experienced a sharp decrease in agricultural employment, primarily due to tremendous productivity gains. In the EU the number of people active in agriculture almost halved from 19.7 million to 10.7 million.

Table 4: Total economically active population in agriculture and its share of the total population in country groups

	1990		2010	
	Economically active Population (in 1,000)	Share of total population, in %	Economically active Population (in 1,000)	Share of total population, in %
USA	3,704	1.5	2,509	0.8
EU	19,695	4.4	10,714	2.1
World	1,146,983	21.7	1,307,133	19.0
BRICS	708,364	31.7	789,205	26.4
MIST	65,189	17.8	66,759	14.1
Tiger Cub	76,974	24.0	83,831	19.5

Source: Author's presentation based on data from FAO, 2013.

During the same period total utilised agricultural area also fell in developed economies. In the USA and the EU the total area decreased by around 3.8%, due to set-aside programs implemented to reduce overproduction and soil degradation. In the BRICS (25.3%), MIST (4.3%) and Tiger Cub countries (12.6%) the area increased. The tremendous growth of agricultural area in the BRICS group was due to vast land resources in Russia and Brazil, which were (re-) cultivated to expand the export volume of agricultural commodities (Carranca, 2003, Brosig et al., 2013).

Since the value of agricultural gross production in all of the observed countries or country groups increased even more than the agricultural labour force and area, productivity gains were achieved in both categories over the same period. As can be seen from comparing Tables 5 and 6, labour productivity increased more than land productivity in all countries and groups.

Table 5: Labour productivity (in US$) per worker in country groups

	1990	1995	2000	2005	2010
USA	47,287	55,677	68,008	77,246	91,172
EU	15,799	17,373	22,352	25,881	29,995
World	1,215	1,386	1,495	1,598	1,712
BRICS	560	728	823	946	1,109
MIST	1,870	2,019	2,172	2,349	2,628
Tiger Cub	730	870	895	1,047	1,224

Source: Author's presentation based on data from FAO, 2013.

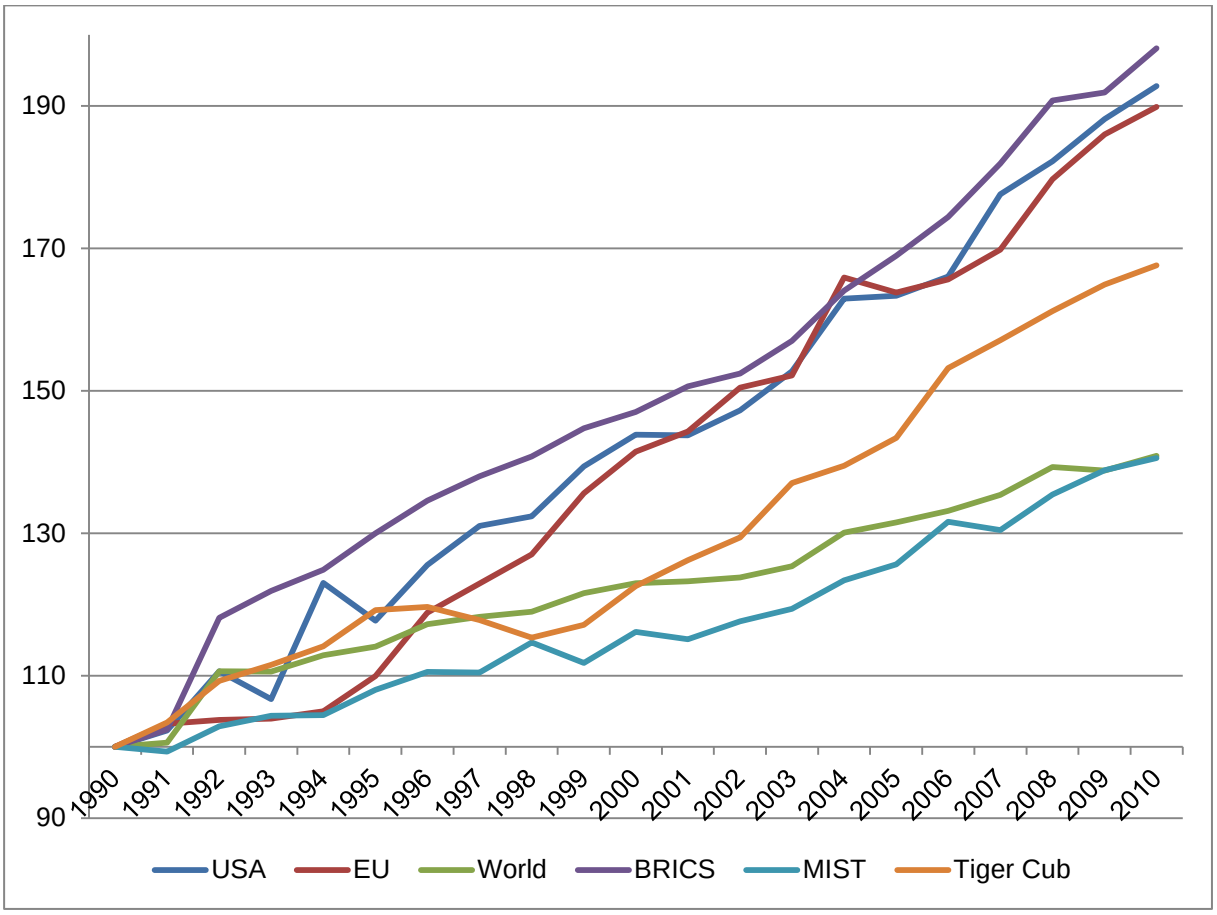
Table 6: Land productivity in US$ per hectare in country groups

	1990	1995	2000	2005	2010
USA	410	442	507	521	557
EU	1,597	1,531	1,681	1,744	1,715
World	288	337	374	414	457
BRICS	387	426	492	574	682
MIST	594	653	709	755	819
Tiger Cub	663	837	876	1,000	1,074

Source: Author's presentation based on data from FAO, 2013.

The USA (from $47,287 to $91,172 per worker), the EU (from $15,799 to $29,995 per worker) and the BRICS countries (from $560 to $1,109 per worker) almost doubled their labour productivity between 1990 and 2010 (see Figure 9). However the BRICS nations remain below the world average, because more than ¼ of their enormous population is still working in the agricultural sector and the rise in agricultural employment consumes some labour productivity gains. The BRICS account for more than 60% of the world's total economic active population in agriculture.

Figure 9: Labour productivity indices for country groups 1990-2010 (100=1990)

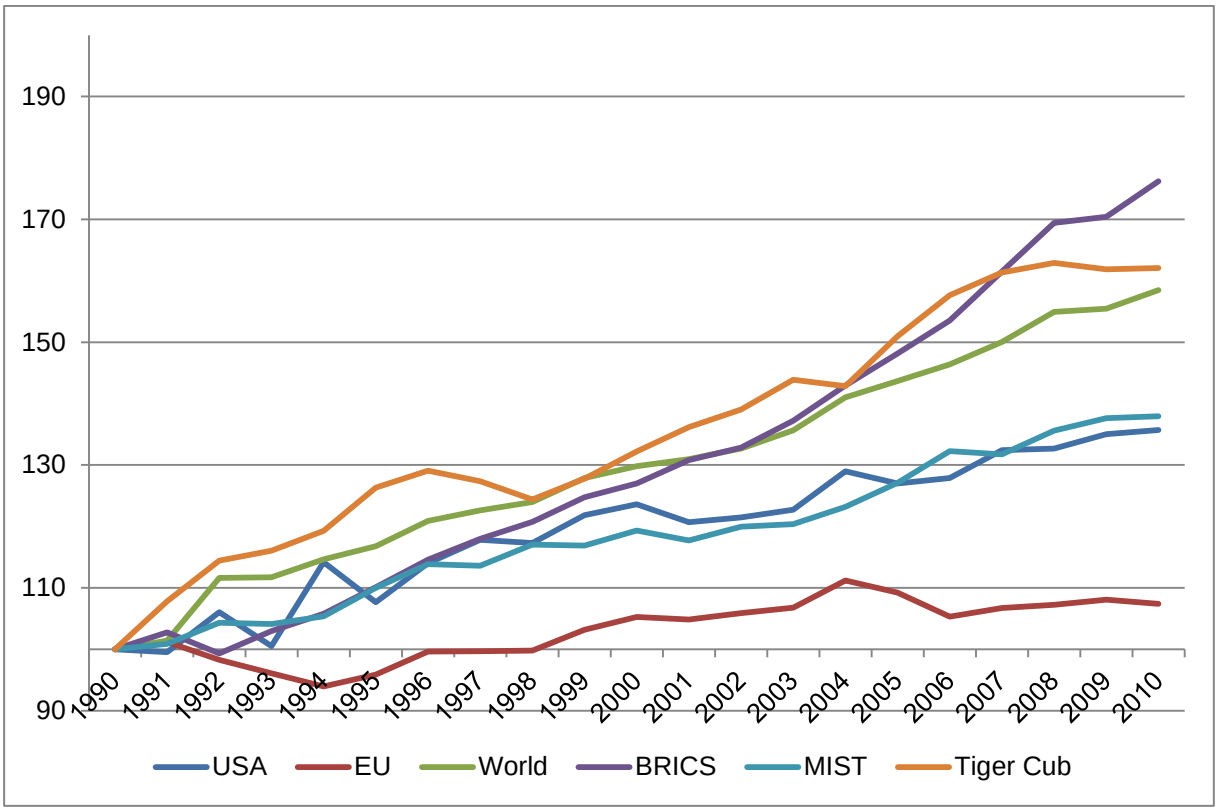


Source: Author's presentation based on data from FAO, 2013.

In developed countries like the USA and the EU, agricultural employment has declined sharply since the end of World War Two. This has resulted from consolidation at all stages of agri-food supply chains and growth in the rest of the economy which tends to offer higher incomes: “Declining agricultural population, labour power and employment are precursors developing mechanization” (Özogul, 2012, p. 458). Thus, the general increase in labour productivity was primarily achieved by reducing human labour input through the further mechanization of agricultural production (Özogul, 2012).

The digitalisation of agricultural machinery enables the collection and sharing of valuable information between different devices and global positioning systems. The result is a more precise and effective agriculture. New and optimized machinery further enhances productivity. The combination of two work steps into one, e.g. simultaneously sowing and fertilising, or even eliminating some, e.g. the ploughing of fields, is more and more common in the agricultural production process and reduces production costs (Özogul, 2012).

Figure 10: Land productivity indices for countries and country groups 1990-2010



Source: Author’s presentation based on data from FAO, 2013 (1990 = 100).

Land productivity has not grown as strongly as labour productivity. Greater productivity gains, primarily due to better yields from higher yielding and disease resistant varieties, were achieved in developing countries (Özogul, 2012).

The EU, the most land productive country of the selected country blocs, only achieved marginal land productivity gains (growth of 7.4% in 20 years). The other nations, i.e. USA (35.7%) and BRICS (76.2%), achieved comparably high growth in land productivity (see Figure 10), but still remain considerably below EU levels. The exceptions are the Tiger Cub nations, which are closing in on the EU level (see Table 6).

Overall, there was a shift from resource-driven growth to productivity-driven growth around 1990 due to an increase in labour, capital and material per hectare use. Between 2001 and 2009, the TFP (total factor productivity) accounted for 75% of the growth in agricultural production (Fuglie, and Nin-Pratt, 2013).

3.1.2 Demand for agricultural commodities

3.1.2.1 Population trends and their effect on demand

The population growth of selected countries and country groups can be seen in Table 7. The total world population grew from about 5.3 to 6.9 billion between 1990 and 2010 (30.2%). The average annual growth rate of the last two decades was about 1.3%. Developing and emerging countries like the BRICS or MIST states experienced similar growth rates. However, a gradual decline in annual growth rates for the world and almost all countries and country groups can be observed. The BRICS population growth rate declined from 1.7% in 1990 to 0.8% in 2010 and the rate for the Tiger Cub nations dropped from 1.8% to 1.1%. Population growth in the USA slowed marginally down, from 1.0% to 0.9%. In comparison, the EU achieved the lowest population growth in absolute numbers (around 45 million), but its population growth has stabilized at around 0.3% every year.

Table 7: Total population (in 1,000) and population growth rates of selected country groups

	Total population					Population growth rates	
	1990	1995	2000	2005	2010	1991	2010
USA	253,339	266,324	282,496	296,820	310,384	1.0%	0.9%
EU	445,741	478,020	481,686	490,931	500,679	0.3%	0.3%
World	5,296,249	5,726,237	6,122,769	6,506,646	6,895,888	1.6%	1.1%
BRICS	2,231,811	2,558,121	2,718,109	2,855,279	2,984,799	1.7%	0.9%
MIST	365,763	395,200	422,971	448,974	474,230	1.7%	1.1%
Tiger Cub	321,256	349,026	377,275	405,647	430,655	1.8%	1.1%

Source: Author's presentation based on data from FAO, 2013.

Nowadays, half of the world's population lives in cities, that's1.2 billion more than in 1990. Table 8 presents the absolute urban population figures and the share of urban population in total population in selected countries and country groups. Around three quarters of the population of developed countries lives in urban areas. The high percentage of people living in cities further increased in the USA (from around 75.3% to 82.3%) and the EU (from around 70.5% to 73.9%) over the last two decades. Also a significant proportion of the population of emerging and developing countries is located in cities. In the BRICS it's more than 1.3 billion people (44.2% of the total population). In the MIST countries more than 60% of their populations live in urban areas, closing in on the urbanisation level of developed countries.

Table 8: Urban population (in 1,000) and share of urban population in total population of selected countries and country groups

	1990		2010	
	Urban pop.	Urban pop./total pop.	Urban pop.	Urban pop./total pop.
USA	190,765	75.3%	255,403	82.3%
EU	314,387	70.5%	370,123	73.9%
World	2,251,425	42.5%	3,483,869	50.5%
BRICS	667,291	29.9%	1,320,043	44.2%
MIST	180,377	49.3%	285,134	60.1%
Tiger Cub	112,186	34.9%	195,796	45.5%

Source: Author's presentation based on data from FAO, 2013.

The age structure of the population differs markedly between developed and developing countries. The EU, in particular, is characterized by an ageing population (see Table 9). There are more people aged 65 and above living in the EU than young people aged between 0 and 14. Developing countries are characterized by a younger composition due to rapid population growth. For example, in the Philippines, one of the Tiger Cub nations, more than 35% of the population is 14 years old or younger and only 3.6% is older than 65. However, within the country groups there are very heterogeneous structures. India's population is

Table 9: Share of different age groups in total population for selected countries

	2010		
	Population ages 0-14 (% of total)	Population ages 15-64 (% of total)	Population ages 65 and above (% of total)
USA	20.1	66.9	13.1
EU	15.6	67.0	17.4
BRICS			
Brazil	25.5	67.5	7.0
Russian Federation	15.0	72.2	12.8
India	30.6	64.5	4.9
China	19.5	72.4	8.2
South Africa	30.1	65.2	4.6
MIST			
Mexico	29.1	64.6	6.3
Indonesia	27.0	67.4	5.6
South Korea	16.4	72.4	11.1
Turkey	26.4	67.7	6.0
Tiger Cub (without Indonesia)			
Malaysia	30.3	64.9	4.8
Philippines	35.4	60.9	3.6
Thailand	20.5	70.6	8.9

Source: Author's presentation based on data from FAO, 2013.

almost as young as the population of the Philippines, while the Russian population is in sharp decline. In the future, countries like China, South Korea and Thailand will probably develop EU-like age structures and experience similar consequences as their population growth declines.

3.1.2.2 Food scares and other trends affecting consumer's choices

Almost all EU member states, e.g. various illnesses derived from Salmonella in food, and many other developed and developing countries, like China with its milk powder scandal in 2009, experienced food scares. These have increased public concerns about food safety as well as public food safety regulations (Knowles et al., 2007).

A growing consumer distrust in the quality of food and conventional agricultural production results in a new consumer perception of food and its production (Renting, 2003). Studies have shown that many consumers regard organic food as a possible solution to food safety and quality issues (Hall 2008; Hill and Lynchehaun 2002, Hughner et al. 2007; Magnusson et al. 2001). It also thought to be beneficial to human health, since it is widely perceived by consumers to be containment-free and of higher nutritional value (Gottschalk and Leistner, 2013).

During the last years the European organic market has grown tremendously fast. The Swedish market grew by about 38% during 2008. Like other European countries France (25%) and Germany (15%) also accounted for double-digit growth rate of their respective organic markets in the same period. Even though the growth rates have slowed down since then, e.g. in Germany from 15% in 2008 to 10% in 2009, the demand for organic products is still outstripping supply in many European countries. Since there is a two year conversion period the supply side is constrained in its ability to react to changes in demand. All this is leading to an increase in imports of organic products (Schaack and Willer, 2010).

The under-supply of the European organic market creates export opportunities for non-European countries. To be able to export to the EU producers have to apply EU organic production standards. Consequently EU organic food regulations diffuse to developing countries. India has even gone so far as to establish a third country recognition program for its organic food exports with the EU (Wai, 2010).

Table 10: Sales of organic products in selected countries in 2008

	Amount of € spent per capita	Sales, total (in Mio. €)
United Kingdom	40.8	2,494
Germany	71.2	5,850
Italy	33.0	1,970
Spain	7.7	350
France	40.5	2,591
Denmark	132.3	724
Russian Federation	0.4	60

Source: Author's presentation based on data from Willer, 2010.

Even though, European markets for organic products have been growing rapidly in the last years, organics still account for no more than 7% of total food sales in any EU Member State, and in some countries, since the financial crisis, sales have stagnated or fallen (Soil Association 2013). Table 10 presents sales figures of organic products in selected countries. The annual amount spent on organic food products per person various widely across Europe and the world. In Denmark every person spent an average 132.3 € in 2008, while in Spain it was less than 8 € (Willer, 2010). Germany is the biggest European market for organic food products, accounting for about 5.85 billion € and a share of 3.4% of the total German food market in 2008. In comparison, about 6.7% of the food sold in Denmark was organically produced (Schaack, 2010). The greatest value of organic commodities was sold in the USA (worth about $24.6 billion) (Haumann, 2010). In developing countries, organic food consumption is very low compared to the European level. In the Russian Federation and other emerging countries less than 1 € per person was spent on organic food products in 2008 (Willer, 2010).

Because of the rapid growth in the demand for organic products, organic farming has expanded rapidly in some EU countries. For instance, between 2007 and 2008 the area under organic farming in Spain rose by 33.3% (in Belgium, Bulgaria, Greece, Hungary, Slovakia and the UK recorded growth of over 10%). However, organic production accounted for only 4.1% of the total EU-27 utilised agricultural area in 2007. In Austria 15.7 % and in Sweden 9.9 % of the total agricultural area was used for organic farming in 2008. In comparison, in France, Poland, Cyprus, Ireland, Romania, Bulgaria and Malta less than 2 % of the agricultural land was utilized for organic production. Most notably, around 50% of the EU-27's total organic area was accounted for by only four Member States (Germany, United Kingdom, Italy and Spain) (Rohner-Thielen, 2010).

The wealthier a population is the more its consumer behaviour is affected by factors like food safety, good taste, long shelf life, non-GMO and additional health benefits. Consumer attention in high income countries is not only concentrated on food conforming to certain minimum standards and thereby avoiding health issues, but increasingly directed toward food promising to promote health or adjusting to the needs of certain groups, e.g. people suffering from illnesses like diabetes or allergies (Zając and van der Lans, 2009). The demand for functional foods has risen rapidly in EU, USA and BRICS markets (Euromonitor 2012; Menrad 2003).

Furthermore, the continuous differentiation of lifestyles results in diverse expectations of the consumer concerning good food. "Instead of meeting basic, minimum quality standards, future food will be increasingly 'designed' and 'socially constructed' in response to specific demands" (Renting, 2003, p. 396). For example, the ageing of the European population creates and alters food product demand. Different food types are required to meet the needs of the elderly, e.g. packaging and nutritional composition have to be adapted to be convenient for senior citizens (Dennis et al., 2009).

In high-income countries a considerable number of diet changes were also sparked by policy implications. The policy actions of the last two decades have aimed at fighting certain lifestyle diseases, e.g. obesity and diabetes, by creating awareness through mandatory labelling, lowering unhealthy food ingredients or even banning them. For example, the Danish government banned trans fats in processed foods in 2004 or the mandatory labelling of fat

content in the EU since 2008 (Golan and Unnevehr, 2008). Policy actions regarding obesity are more important than ever. Over the past 20 years, the obesity rate has more than doubled in most EU member states. On average around 15.5% of the EU's adult population is classified as being obese (OECD, 2010).

The increasing demand for healthier and processed food commodities fosters the differentiation of food products. A vast array of new food products enters the markets or even creates new markets every year, as a consequence to the changes in consumer food preferences. In 1995 and 1998 approximately 13,000 to 16,000 new products were introduced on US markets (Menrad and Feigl, 2008). In comparison, between 1999 and 2001 1,600 new commodities appeared on German markets. Primarily food products promising to be healthier, dietary, more organic or allergy-free accounted for a great amount. Nevertheless, "most innovations in the food industry can be characterised as incremental innovations or even imitations" (Menrad and Feigl, 2008, p. 11). As a consequence, only around 3% of all newly introduced products can be regarded as truly innovative (Menrad and Feigl, 2008). The consequence is that processors and retailers are able to increase their value added, since they buy cheap undifferentiated commodities and turn them into highly differentiated products. All this is shifting the earnings downstream in the supply chains (Hawkes et al., 2012).

In addition to the consumer's growing distrust in conventional agricultural production methods, the continuous pressure on farmers' income, as a consequence of the decreasing share of the retail value of food products, nurtures the desire for different production systems. In 2008, farmers accounted for around 80% of the number of holdings/enterprises active in the food chain in the EU-27, but only contributed to about 25% of the value added. In comparison, the food and beverage manufacturing sector consisted of 1.6% of all European agri-food enterprises and added about 26% to the value (Martinez Palou and Rohner-Thielen, 2011). Evolving alternative concepts are concerned with certain aspects, e.g. ecological, animal-welfare, organic or marketing issues (Boye, 2012).

In Germany, the Netherlands and UK alternative production methods are orientated towards more modern quality definitions, e.g. environmental sustainability or animal welfare, while in Italy, France and Spain, representing 280 of 575 PDOs/PGIs, they are built on cultural and gastronomic traditions (Renting, 2003).

One idea concerning the marketing aspects of food commodities is direct-selling. This may allow farms to increase added value. It's quite successful and disseminated widely throughout the EU-15, accounting for about 20% of European farms (Renting, 2003). While beneficial for some farms, direct selling is not for all; many producers lack the infrastructure or marketing skills for making such a venture successful (Davidova et al. 2013).

New marketing approaches reveal themselves more and more profitable for EU farmers, since today organic certification is not the only label many consumers in high-income countries consider while making their buying decision. To a greater extent consumers are also concerned about the geographic origin of their food (Weatherell, Tregear and Allinson 2003). For some consumers, food purchased should have an ecological impact as small as possible and therefore not been transported over long distances. Two thirds of the Danish and British households asked in a study by Wier et al. (2008) stated that it was important for them to purchase locally

produced food. Exact information of the food commodity's geographic origin for the costumer further enhances the discussion on traceability (Gottschalk and Leistner, 2013).

The emergence of private food safety and quality standards is an increasingly important trend in agriculture across the globe. One reason that private standards have been introduced is the lack of public standards or to help ensure that public standards are achieved. Setting private standards allow enterprises to reduce risk and transaction costs in their supply chain, facilitate product differentiation to increase profits and regain consumer trust by labelling and branding (Henson and Reardon, 2005). The other cause is that trade liberalisations as well as globalisation in general have fostered the development of cross-national and even cross-continental supply chains. Global, elongated and fragmented supply chains make complete traceability and transparency difficult to achieve (Knowles et al., 2007).

"Food standards have evolved in response to this new landscape in the globalized and liberalised food production regime" (Gereffi and Lee, 2009, p. 7). In order to secure the supply agri-food products retailers and producers run global sourcing strategies. As a consequence they impose safety and quality standards, mainly pronounced in Western markets, on their suppliers by using their buying power. All this facilitates consolidation in developing and transition countries, since most small-scaled farmers are not able to meet the imposed requirements (Gereffi and Lee, 2009).

Not only what is consummated changed, but also how. Primarily in urban areas of developed and even developing countries a decreasing amount of time is spent on the preparation of meals and consumption at home. The fact that more and more women are entering the workforce is also further nurturing the trend. Consequently, more and more food is purchased as ready-to-eat commodities or meals, e.g. pre-sliced carrots or fast-food. About 80% of all global sales of food and beverages were accounted for by processed food and beverages. 40% of these were sold by the food services sector. Developed countries accounted for more than 60% of packaged food sales worldwide (Gehlhar and Regmi, 2005). However, retails sales for packaged food only grew slowly in high income countries between 1996 and 2002 (about 2 to 3% annually), while in developing countries they achieved growth rates of 7 to 28% per year. This is due to the high growth of population and income per capita as well as the greater urbanisation (Wilkinson and Rocha, 2009).

Even though food demand is increasingly focused on ethics, environment and quality and further segmenting, "consumers remain very price-sensitive and seek solutions that are affordable" (Dennis et al., 2009).

3.2 Food processors

The food manufacturing sector is far more concentrated than primary agricultural production, but still fails to match the level of concentration witnessed in the grocery retail sector. In 2007, the top 50 food processors accounted for a combined market share of around 27% in worldwide packaged food retail sales (see Table 11) (Gehlhar, 2008).

The food processing sector is gaining more and more importance in the supply chain. In 2002, only $531 billion of food retail sales corresponded to unprocessed products, while processed and semi-processed commodities accounted for $1.7 trillion. It was projected in 2002 that the retail sales for packaged food in high-income countries would only grow annually by

around 1.7% until 2008, while in low-income countries the growth rate was expected to average annually 6.1% (Gehlhar and Regmi, 2005).

Table 11: Shares of global packaged food retail sales by manufacturer in 2007

Company Name	Western Europe	Eastern Europe	North America	Latin America	Asia Pacific	World
Nestlé SA	2.9	2.6	3.9	6.0	1.8	3.3
Kraft Foods Inc	1.9	1.8	7.0	1.7	0.7	2.6
Unilever Group	3.1	1.4	2.2	2.4	0.6	2.1
PepsiCo Inc	0.9	0.7	4.6	3.1	0.3	1.8
Danone, Groupe	1.9	1.4	0.7	1.4	0.7	1.3
Cadbury Schweppes Plc	1.4	0.7	0.7	1.5	0.4	1.0
Top 50 companies	24.6	15.3	41.9	26.2	17.1	26.8

Source: Author's presentation based on data from Gehlhar, 2008.

Due to trade liberalisation, new transport and communication technologies, the perishable nature of agricultural products and low worker wages, large trans-national processors often seek proximity to producers and thereby elongate their supply chains to developing countries. However, TNCs invest in standalone process operations more frequently (Henson and Cranfield, 2009).

3.3 Retail

The concentration and consolidation process at the retail level is a relatively recent phenomenon. Prior to the 1990s the US and the European food retail sectors were quite fragmented. Since then, the concentration of the retail sector increased through natural growth or mergers and acquisitions. Nowadays three or four enterprises typically dominate the markets of developed countries accounting for about 60% of food retail sales (Wilkinson and Rocha, 2009). In the EU the top five retailers had a combined market share of around 50%, in Germany, the UK and Hungary even 70%, at the end of the 1990s (Swinnen and Vanderplas, 2010).

Starting in the mid-1990s the 'supermarket revolution' spread to emerging economies, among others due to diffusion of urban lifestyles, in South America, South Africa and East Asia. The supermarkets' share in food retail sales of these markets grew from 10% to 20% in 1990 to around 50% to 60% in the early 2000s. Other retail markets in developing regions like South East Asia and Central America would follow the development shortly afterwards (Reardon and Berdegué, 2002).

Swinnen and Vanderplas argue, in contrast to some other authors, like Hall et al. (1979), as well as Lamm (1981), that greater retail concentration benefits consumer prices, since it intensifies competition among the large retailing companies. "Increased competition in the retail sector is one of the main reasons why consumer food prices increased less than predicted with EU accession" (Swinnen and Vanderplas, 2010, p. 110).

The concentration process at the retail stage has effects on upstream suppliers. The introduction of private food standards and the growth of retail enterprises increases the demand for larger, consistent (to private food quality criteria) supply quantities and thus favouring larger supply enterprises. Especially affected is the food manufacturing sector, since 85% to

90% of food sales in supermarkets of developing countries are either processed or semi-processed products. The growth of retail enterprises and their distributions systems across the globe is shifting power and the management of the supply chain downstream, allowing retailers, until recent food price spikes, to simultaneously impose higher food standards as well as lower prices (Henson and Cranfield, 2009; Vorley et al., 2009).

3.4 Logistics

As a consequence of longer supply chains and the increasing worldwide trade of agricultural products and food, the transport of agricultural commodities accounts for a large share of world logistics. For instance, the transportation of grain makes up for around 13% of global sea-borne trade (Gebresenbet and Ljungberg, 2001). Bell (2010) argues that performance in the logistics sector is highly correlated with overall economic performance. He estimates that a 1% increase in infrastructure assets induces a growth of GDP by 1%-point. Consequently, it's no wonder that logistics costs in developed countries, like the EU, account for only around 8% of total costs, compared to 13% in India (Bell, 2010).

In addition to the everlasting problem of seasonality and thus capacity issues, three recent major trends affect logistics in the agricultural sector. First, the consolidation and concentration process at all stages of the agri-food supply chain reduces the number of agents, but also increases their size and thus the quantities that need to be transported. Second, the expansion of supply chains across the globe calls for optimized and faster logistic concepts that compensate for longer distances. Last but not least, new consumer patterns, demanding fresh food products with higher quality requirements throughout the year, increase the importance of logistics in agriculture. All this calls for the development of effective logistics. "Effective logistics requires delivering the right product, in the right quantity, in the right condition, to the right place, at the right time, for the right cost" (Gebresenbet and Bosona, 2012, p. 125).

The increasing interest of consumers in food quality and safety as well as the proliferation of public and private food standards are the essential challenges for logistics in agriculture. To meet these requirements effectively integrated logistics networks have to be established that enhance farm-to-fork traceability and optimize the logistic process to minimize harvest losses, contamination, spoilage and animal suffering. To guarantee 100%-traceability and high food quality, information has to flow continuously and permanently downstream as well as upstream the chain. Enhancing the animals' comfort while being transported is actually an important economic aspect for producers and processors, since the experience of a lot of stress might lower the quality of the meat and increase pathogen contamination risk (Gebresenbet and Bosona, 2012).

There have been many technological innovations in the logistics sector, improving the speed of communication and transport, securing food quality, e.g. refrigerated modular cargo boxes allowing an end-to-end cold chain, and cutting costs, e.g. ship cargo transport. However, the key aspect for optimizing the logistics chain is a good organisation that adapts to specific environments. For example, lunch meal distributors in Mumbai have developed their own sign system allowing illiterate employees to process information fast and correctly. Furthermore, by using a hub and spoke system based on the local train system the distributors are able to achieve a high logistic performance of only one error in 6,000 deliveries (Bell, 2010).

3.5 Market functioning

The organisation of agricultural markets differs widely across countries and has undergone dramatic changes since the early 1990s, especially in the formerly planned economies of Central and Eastern Europe. Developed countries have achieved the greatest integration into the global supply system of higher-valued food commodities, developed high-value domestic food markets due to changing demography and lifestyles and have been mostly affected by agricultural industrialisation. In many developing countries traditional supply chains still dominate, but some agricultural areas, producers and processors are already integrated into global supply chains (Henson and Cranfield, 2009).

The system of state intervention, ranging from being a monopoly buyer of agricultural products to regulating food markets, and governmental supply chain control, i.e. through marketing boards and state-owned co-operatives, has undergone tremendous changes since the 1980s. Change has been most dramatic in former socialist countries. State directed and owned supply chains were overall replaced by private companies. The new supply chains, organized by traders, retailers, processors and input suppliers, expand rapidly, since the new coordinators assist farmers in overcoming their constraints (e.g. lack of technical and managerial capacity, lack of capital) in realizing high-quality supplies (Swinnen and Vanderplas, 2010).

Modern processors and retailers (supermarket chains) further foster the expansion of these supply chains and consolidation process, or as an alternative, the horizontal collaboration at the producer level, because they need large and consistent quantities of food commodities, meeting their private standards, to satisfy consumer demand for quality and food safety. Contract farming is becoming a key element, instigated by processors and retailers, lowering the significance of spot markets (Henson and Cranfield, 2009). Up to 80 % of corporate farms in Czech Republic, Slovakia and Hungary sold crops on contract and 60-85 % sold animal products on contract (Swinnen and Vanderplas, 2010).

Contract farming has often been criticized as being a tool of TNCs to extract rents from the value chain by exploiting the unequal power distribution between them and small farmers. However, Swinnen and Vanderplas (2010), based on empirical evidence, argue that farmers benefit from contract farming. The reviewed studies suggest that private contract programs have more benefits for farmers, e.g. increase of profits, due to lower production and marketing costs, increased output, productivity and product quality, than state-controlled monopolized systems, e.g. cotton systems in Uzbekistan and Tajikistan. Further benefits of these programs to farmers are lower risks (often guaranteed sales at guaranteed prices) and the access to capital for farms (Swinnen and Vanderplas, 2010).

However, in the last couple of years, due to increasingly stringent food standards, the vertical coordinated contract systems have been changing from contract farming toward fully integrated production on agri-industrial holdings (Swinnen and Vanderplas, 2010). The financial crisis has further nurtured consolidation and concentration processes in the agricultural sector. Large agri-businesses were able to acquire weaker competitors and incorporate their assets (Kadlečíková, 2012).

“In the future, agrifood producers, processors and retailers will no longer compete as individual entities. Rather, they will collaborate as a strategic value chain and compete with other value chains in the market place” (Bouma, 2005).

3.6 Technological change

The further integration of information technology in agriculture will enhance certain aspects of the production process and the marketing of food products. By using satellite technology, for example, the application of fertilizers and pesticides can be improved and thereby the amount applied can be reduced. Today, producers and customers can already communicate with each other over long distances via the Internet and virtual markets to respectively offer and buy food products. This further enhances marketing strategies such as direct-selling and allows the consumer to choose from a greater variety of products more likely representing her / his individual choices (Cox, 2002; Carbonara, 2004).

Analysing biological data is more and more relevant to the agricultural production process. So-called bio-informatics will revolutionize certain aspects of agricultural production (Dooley, 2007). Traceability will be improved by the use of genetic markers in DNA and protein analysis for authenticity. Nutritional sciences will gain knowledge on how to enhance food quality, e.g. by identifying proteins, enzymes and other food ingredients with health and diet benefits and hazards. To extract and isolate specific food components as new ingredients, bioengineering methods can be applied (Dooley, 2007). Nanotechnology will allow the "precise application of farm inputs and site-specific data acquisition, monitoring, and transmission for real-time diagnosis and intervention" (Opara, 2002).

Bioengineering not only creates crop varieties that are better adjusted to extreme climates like droughts, salinity and extreme temperatures, but also modifies plants to be more beneficial to human diets and health. Thereby crops are engineered which can be cultivated on less arable land and in less favourable climate allowing to expand the overall agricultural area and adjust to consequences of climate change, thus securing the worldwide food supply. Furthermore, by maximizing or minimizing the amount of certain compounds of the plant, it is possible to form particular functional foods. Of course, the dissemination of bioengineered plants will be limited by concerns about the long-term risks and effects on human health or environmental aspects, e.g. disturbing ecological balance (Thomson, 2002). Better information about the effects of certain food components on human health, increasing knowledge of human genetics as well as nutrition and further advances in biotechnology and nanotechnology will allow the agricultural sector to produce food products that are safer, healthier and more individualised for certain lifestyle, age groups and tastes (Dennis et al., 2009).

In order to guarantee food security, not only the output has to be increased, but also the efficient use of food needs to be improved. In 2006, more than 77 million tons of animal and vegetal waste, which equals around 157 kg per inhabitant, was recorded in the EU-27 (EC, 2011). The EU has adopted a five-stage waste management hierarchy (waste reduction or prevention, reuse, recycling, other recovery options like energy recovery and safe and environmentally sound disposal) to reduce this large amount of waste of food products and therefore optimize the use of natural resources as well as increase overall food supply (EU, 2008/98).

One way to decrease food waste is to reduce the spoilage of food products. Therefore new postharvest preservation technologies are tested and introduced. The growing urbanisation and world trade expands the distance food and food products have to travel to reach the consumers. Further, there are storage issues in regions of the world with inadequate storage and distribution infrastructure as well as unfavourable climate for perishable food stocking

enhancing the risk of contamination of food by pathogens. Pathogens in food products are estimated to cause three million deaths of children under the age of three and 70% of around 1.5 billion diarrhoea cases every year. The reduction of risk of contaminated food can be achieved by exposing it to irradiation, electrolysed water or UV light. The technologies being used to enhance the preservation of food can be divided into non-thermal, e.g. irradiation and ultra-high-pressure processing, and thermal, e.g. freeze-drying (Dennis et al., 2009).

New packaging methods and materials help to reduce waste across the supply chain while ensuring hygiene. Intelligent packaging materials further reduce spoilage by noticing changes in the ambient environment and if necessary alter the internal atmosphere. Packaging waste itself is lowered by using biodegradable materials (Kerry et al., 2006).

An increasing amount of waste that can't be avoided or recycled is being used for energy production. For example, ethanol and synthetic oil can be obtained out of industrial organic waste originating from food processing. Today, there exist joint ventures between food processing companies and biofuel producers, which locate their plants on-site of the food processing location. In addition, biogas can be produced out of feeds, agricultural waste and manure enabling agricultural villages to become energy independent. This all might allow shifting biofuel production away from being at the expense of food crops to the utilisation of waste thereby increasing the food supply (Dennis et al., 2009).

The growing level of technology in agricultural production fosters the demand for skilled workers. Future R&D successes rely on qualified researchers and to adapt new technologies workers are needed who understand the technology and its appropriate application. To keep on increasing the productivity in agriculture and securing world food supply more and more trained and creative employees are necessary (Dennis et al., 2009).

4 Conclusions regarding trends and problems of EU agri-food supply chain

In the previous chapters, we identified a set of trends and developments during the past 20 years on global and local agri-food markets and discussed the main developments in the EU agri-food supply chain as well as the factors affecting the functioning of agri-food supply chains. In the following chapter we discuss the possible consequences of these developments for the competitiveness of the EU and the main players on international agri-food markets.

One of the major challenges for the food supply chain is the rapidly increasing demand for food due to an expanding world population, subsidized biofuel production and ***diet changes***. These diet changes e.g. greater consumption of animal products and high-value food products, e.g. ready-to-eat meals, were fostered by increasing incomes in a variety of emerging countries, especially the ***BRICS***, ***MIST*** and ***Tiger Cub*** nations and a growing urban population in developing countries. The EU and its large production of agricultural processed goods have been benefiting from the growing demand for high-value products by creating export opportunities on markets with an undersupply and will do so in the medium term. However, it seems likely that major importing countries will try to substitute these imports by building their own processing capacities, which will enable them to compete with European suppliers not only on their home markets, but with the European Single Market as well.

Growth in food demand outstripping change in agricultural supply led to a series of ***food price peaks*** in the 2000s, leading to weaker food security for the poor in developing countries. Furthermore, also the ***volatility of food prices*** has accelerated which increases the price risks and lowers the investments of small agricultural enterprises. It also distributes the income unequally along the supply chain towards downstream actors. Due to liquidity shortages and less differentiated supply chains in developing countries, this trend has been beneficial for well capitalized European enterprises and their competitiveness.

Global and regional trade liberalisation, e.g. the establishment and the enlargement of the WTO and the EU, globalisation and its economic, social and cultural effects as well as innovations in logistics and communication have boosted a ***higher openness*** of world and domestic markets, thus increasing worldwide trade tremendously. This has been beneficial for competitive EU agri-food enterprises by giving them better access to markets. Nevertheless, by simultaneously facilitating the access to the Single Market uncompetitive European food companies have lost market share due to ***intensified competition***, especially from emerging countries like the BRICS. An increasing value of goods is nowadays traded between and produced in emerging and developing countries.

Since trade growth rates surpassed these of output over the past 20 years, economic, and specifically agricultural, activities are more inter-linked over the globe than ever before. Certain countries, regions and enterprises are ***specializing*** on a small range of agricultural products and production steps and thereby gain large market shares. Intensified cultural exchange and increased trade disseminate local dishes to a global audience, thus creating ***global foods***. Large European enterprises and supply chains are able to profit from the trend and increase their competitiveness by establishing ***food brands*** that are recognized and highly valued by consumers around the world.

Trade liberalisation has fostered the development of TNCs, which established globally elongated supply chains, to pursue a ***global sourcing*** strategy to be independent of regional and seasonal supply limitations. The optimisation of supply chains demands ***effective logistics***. Elongated supply chains increase the risks of the spatial diffusion of food safety problems and make the accountability for food quality issues harder to pursue, thus enhancing the public desire for ***traceability*** and ***transparency*** along the chain. The better developed logistic infrastructure of developed countries, like the EU, has benefited their competitiveness, since they have been more able to implement effective logistics and to guarantee traceability and transparency across their supply chains.

In addition to food quality concerns, environmental, sustainable, animal-welfare and social issues regarding conventional agricultural production have fostered public interest in agricultural production. Public and private organisations have implemented ***food safety standards and regulations*** as well as promoting ***certified labels***, e.g. PDOs/PGIs and fair-trade, as a response to regain consumers trust. The high costs of building an infrastructure that guarantees traceability, food safety standards and quality across the supply chain for developing countries has limited their export opportunities on highly regulated markets of high-income countries by creating non-tariffs import restrictions. Consequently, EU enterprises have had competitive advantages, since their chains control food standards and assure traceability across the supply chain more effectively through tighter ***vertical integration and coordina-***

tion. Nevertheless, the increased trade, global sourcing strategies and vertical organisation tendencies disseminate Western private and public food standards to developing countries and alter their business environment. Eventually, they allow them to dissolve their current competitive disadvantage in the long-term.

Public and private standards and labels as well as changing demographics, an ageing population in many developed countries and an increasing urban population in developing countries, are boosting the ***diversification of food products***. Elders are demand food products that suit their habits and diets. More people living in cities reduce the time spent on the preparation and consumption of food, which increases the demand for processed food products. Apart from that, consumers can nowadays choose from a great variety of 'healthy' food products that consist of a greater amount of 'good' ingredients, e.g. vitamins, and excluding 'bad' ones, e.g. sugar and fat. Since demographic change and demand for healthy food products are well established in the EU, EU enterprises will increase their competitiveness compared to the ones in developing countries due to a huge advantage in knowledge concerning these products and a maturing world population. Furthermore, the diversification of food products enables downstream agents such as processors and retailers to increase their value-added, while upstream agents, e.g. farmers, face a reduction in their share of retail sales. The bargaining position of producers is further restricted by ***consolidation and concentration processes*** at the processor and retailer level. By demanding larger quantities of consistent quality, retailers and processors favour larger farms and foster vertical integration via ***contract*** farming even further.

Alternative production systems, e.g. ***organic farming***, and marketing methods, e.g. ***direct-selling*** to raise the producer's share in income and reconnect consumers more closely to production have been promoted by governments. As EU producers have been unable to keep up with the rapidly growing demand, new market opportunities for non-EU producers have evolved. In particular for producers from developing countries, since organic farming isn't bound to great investments, due to a low level of technological input. Thus imports from developing countries are likely to increase.

New technologies concerning the organisation of agricultural production have changed the industry dramatically. Information and communication innovations allow a more precise production of products and a better flow of information across the supply chain. Furthermore, advances in packaging and logistics increase the shelf life and minimize the spoilage of food products. All this can reduce food waste. Research successes in bio-informatics, bio-engineering and nanotechnologies offer a vast variety of possible applications to the food industry. Food products can be altered, composed with different ingredients and controlled in such a way that their nutritional features and quality as well as traceability are improved. In addition, research is looking for new uses for agricultural products and waste, e.g. for energy production. Innovations and their implementation boost the demand for ***highly skilled workers*** and R&D investments at all stages of the supply chain. The rapid growth of labour and land productivity in agriculture was achieved by the implementation of these innovations and a further ***mechanization*** of production. The competitiveness of the EU supply chain benefits from a high level of technology and mechanization in agriculture, since there are more financial resources and highly skilled workers available to implement new technologies and machines

compared to developing countries. However, the USA with its higher R&D investments in agricultural research and highly capitalized enterprises might surpass the EU in the long-term.

As it can be reasoned from the discussion, many recent developments have affected the competitiveness of the EU food supply chain in the past 20 years and will affect it even more in the future. In the course of the COMPETE Project the determinants of competitiveness will be analysed in greater detail.

International trade patterns and major competitors on domestic and international markets will be assessed to benchmark the competitiveness of the EU agri-food industry. Furthermore, the potential for fresh and processed agri-products on internal and international markets, especially of PDO/PGI and organic products, will be assessed.

After identifying the strengths and weaknesses of the competitiveness of major competitors, their national agricultural and trade policies will be described and their impact on agricultural trade and production explored. In addition, EU policies will be investigated and possible distortions to the functioning of the food chain will be identified. Having analysed the business environment of EU agricultural production, the food production and processing themselves will be examined by applying TFP factor analysis with relevant conclusions on competitiveness drawn.

Furthermore, the impact on competitiveness of market power at various stages of value chains will be discussed after the investigation of price formation across the value chain. By examining the organisation of transactions along agri-food supply chains the relationships between governance structures, market failures and competitive strategies in EU food chains including price transmission will be analysed.

To further boost innovation in the EU agri-food sector, the relationship between process and product innovation and company performance as well as the influence of supply chain governance structure on innovation capacities of the chain will be examined. Contemporary innovative and competitive corporate strategies enhancing R&D or limiting it will be presented.

After synthesizing the results, opportunities to enhance the competitiveness of the EU food supply chain will be presented and policy recommendations for actors at the national, EU and multilateral level will be provided.

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Project information

Title:	International comparisons of product supply chains in the agri-food sectors: determinants of their competitiveness and performance on EU and international markets (COMPETE)
Funding:	Collaborative research project (small or medium-scale focused research project), FP-7-KBBE.2012.1.4-09, total EU contribution is 2,422,725 €
Duration:	01/10/2013-30/09/2015 (36 months)
Objective:	The objective of the COMPETE project is to gain a more comprehensive view on the different elements which contribute to the competitiveness of the European agri-food supply chain in order to provide better targeted and evidence based policies on the EU as well as on the domestic level. The project investigates selected determinants of competitiveness like policy interventions and the business environment, productivity in agriculture and food processing, the functioning of domestic and international markets, the choice of governance structures, and innovative activities in food processing. The research results will enable a congruent, coherent and consistent set of policy recommendations aiming at improving competitiveness of European product supply chain.
Coordinator:	IAMO, Germany, Prof. Heinrich Hockmann
Consortium:	16 Partners from 10 European countries. COMPETE brings together academics, trade bodies, NGOs, agricultural co-operative, industry representative advisory services. In addition, the project is supported by the group of societal actors, incorporating farmer, food processing and consumer associations, providing in-depth knowledge on the agri-food sector and speeding up the achievement of the project goals.
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COMPETE
International comparison of product supply chains in the agro-food sector

SEVENTH FRAMEWORK PROGRAMME

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