Global implications of the European Food System

A food systems approach

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This study was carried out by Wageningen Economic Research and was commissioned and financed by SCAR Strategic Working Group ARCH

Wageningen Economic Research
Wageningen, May 2018

REPORT
2018-051

WAGENINGEN
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Berkhout, P., T. Achterbosch, S. van Berkum, H. Dagevos, J. Dengerink, A.P. van Duijn, I. Terluin, 2018. *Global implications of the European Food System; A food systems approach.* Wageningen, Wageningen Economic Research, Report 2018-051. 56 pp.; 4 fig.; 2 tab.; 73 ref.

De EU is een belangrijke speler op de wereldmarkt voor landbouwproducten. De EU is afhankelijk van de invoer van grondstoffen uit vele landen en exporteert hoogwaardige landbouwproducten. Er is behoefte aan een beter inzicht in de impact - op mensen, op de planeet en op de winst - van de EU-handel op voedselsystemen buiten de EU, met een focus op lage- en middeninkomenslanden (LMIC). Dit zal de EU helpen haar acties en beleid in andere richtingen te sturen, waar dit nodig wordt geacht om de Duurzame Ontwikkelingsdoelen te realiseren.

The EU is a major player in the world market for agricultural products, both dependent on commodity imports from many countries, and exporting high-value agricultural products. There is a need to better understand the impact - on people, planet and profit - of the EU trade on food systems outside the EU, with a focus on Low- and Middle-Income Countries (LMIC). This will help the EU to steer its actions and policies in other directions where this is deemed necessary to achieve the Sustainable Development Goals (SDGs).

Key words: EU, food systems, impact, trade, SDGs

This report can be downloaded for free at https://doi.org/10.18174/448884 or at www.wur.eu/economic-research (under Wageningen Economic Research publications).

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Wageningen Economic Research is ISO 9001:2008 certified.

Wageningen Economic Research Report 2018-051 | Project code 2282700275

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Contents

Preface

In Europe and elsewhere, there is a growing awareness about the effects of food production, use and consumption on a variety of issues, like the environment, (local) employment, food security, economic growth, etcetera. It is not the food itself that is questioned, but how it has been produced and delivered, under what circumstances and how this affects the place/region of production.

The EU is a major player in the world market for agricultural products, both dependent on commodity imports from many countries, and exporting high-value agriculture and products. Given this position, there is a need to better understand the impact - on people, planet and profit - of the EU trade on food systems outside the EU, with a focus on Low- and Middle-Income Countries (LMIC). This will help the EU to steer its actions and policies in other directions where this is deemed necessary to achieve the Sustainable Development Goals (SDGs).

This report focuses on the global dimension of the European food system, by zooming in on the trade relations between the EU and the rest of the world and the effects of this trade on local food systems.

The report was commissioned by the SCAR Strategic Working group ARCH. We thank the members of the SCAR Working group for their valuable comments and suggestions on a draft version of this report.

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Summary

S.1 Key findings

The objective of this study is to enhance the knowledge on the global implications of the EU food system. In particular, the study provides:

- an analysis of the trade relations between the EU and the rest of the world from several angles (total, by geographical blocs, by income blocs and by trade agreements), with a focus on Low- and Middle-Income Countries (LMIC);
- case studies of the effects of EU trade in three products – cocoa, soy and fish - on local food systems, based on social, environmental and economic indicators;
- an explorative analysis of possible changes in the EU food system and its impact on the food systems in third countries.

Trade analysis

The analysis shows that the majority of EU-trade is internal trade (73% for both imports and exports in 2016). The extra-EU trade shows an increase in imports from all geographical blocs except for Oceania in the period 2000-2016. Latin-America and the rest of Asia (including China) are the main exporters to the EU28; the rest of Asia (including China) and Northern and Central America are the main destination of EU exports.

The group of upper-middle-income countries is the main origin of extra-EU28 imports and ranks second – after the group of high-income countries – as export destination. EU28 imports from and exports to low- and lower-middle-income countries is modest and rather stable in the period 2000-2016 (8% and 4% respectively). The share of upper-middle-income countries in total EU28 imports and exports was 11 and 8% respectively in 2016. Compared to 2000 these shares are quite stable (13% and 6% respectively).

The share of low-income and lower-middle-income countries in total trade with the EU according to preferential trade agreements is small and fairly stable for the period 2000-2016. It was 8% for imports from the EU in 2016 and 4% for exports of the EU. The three major imported products from the EU by countries with a preferential trade agreement are fish, cocoa and fruits and nuts.

Case studies

The case studies focus on fish, cocoa and soy. Fish and cocoa are important traded items with lower middle income and low income countries. Soy is included as a representative product for the trade with high income countries.

The analysis of the effects of EU trade for cocoa, soy and fish focused on four performance metrics: competitiveness of agrifood business, environmental impacts, equitable outcomes and conditions, and a balanced and sufficient diet. The analysis shows that EU agricultural trade has negative impacts, particularly on land use, deforestation and loss of landscape value, water scarcity, farm worker welfare and curtailed agricultural development potential. There is also an understanding of the benefits that EU agricultural trade has and has had, particularly in terms of export revenues, rising wage income, increased human capital, and food availability. Not all impacts are quantifiable nor are they comparable across products due to a lack of data.

New policies to shape the direction of the EU food system and to deliver on the relevant Sustainable Development Goals (SDG 1,2, 8, 12, 13, 14 and 15) need to be informed by an understanding of the impact of trade and of available choices and the potential trade-offs they imply for all participants in the system, i.e. farmers and fishermen, traders, the food industry and final consumers.

S.2 Complementary results

The global impact of the EU28 food system should not be deduced only from its trade relations with third countries, yet should include all company-specific value chain activities taking place across the EU border. Such global value chain activities are not always easily traceable due to a lack of (detailed global) data on foreign direct investments in food and agriculture.

The food systems approach adopted in this paper shows the potential benefits of trade for e.g. income or food security, but also the potential negative impacts on for instance the environment or socio-economic goals. The ranking of the goals will define the overall outcome. Thus the analysis also shows possible trade-offs and entry-points for intervention by actors in the global food systems, including the EU. One example is the trade-off between income generating activities versus restraining further activities for environmental reasons (for example fishing rights).

Exploring future changes
Assessing how trade relations of the EU with LMIC in particular may evolve in future, requires an analysis of major trends in consumption and production in the EU and how their interaction may affect trade. Various scenarios are possible in which the pros and cons of consumer trends and their impacts on production and consumption issues differ as well as their routes to mainstreaming or marginalisation.

A scenario analysis would therefore be an appropriate tool to address this question, but is outside the scope of this study. Instead we have made a short-list of relevant trends.

... regarding consumption
Regarding trends in consumption, it is important to realise that the share of the EU in global consumption (in value) is declining, from around 40% at the beginning of this century to less than 30% in the next decade. Conversely, the share of the global middle-class consumption of Asian countries – particularly, China and India – is projected to rise to over 40%. It is therefore crucial to take into account the nutrition transition trends in these countries towards more animal-based products as well as more processed foods. Consumption patterns shift towards higher food energy supplies and higher intakes of saturated fat and cholesterol. The globalisation of similar dietary patterns is known as the nutrition transition.

Trends in the fringe of the EU food system relate to flexitarianism (part-time vegetarianism), to locavorism (consumer interest in 'authentic' local food) and conscious consumerism (slow food, organic food and the likes).

... production and the food chain
Production in the EU food sector is characterised by fewer but bigger farms and firms in agriculture and the food chain. Second, there is an increasing intensification of primary production; still, large areas of Europe have low-intensity agriculture, especially in more mountainous areas or other areas with less favourable circumstances for scale increase and/or intensification of production.

Third, ICT and the possibilities this may create for other business models within the agriculture and food sectors is of increasing importance. A fourth important trend is the increased role of standards and non-tariff restrictions (NTM) - in particular Sanitary and Phytosanitary Rules (SPS) and Technical Barriers to Trade (TBT) - in international trade. In addition to the public standards in the area of food safety, private standards regarding quality and sustainability are also gaining importance.

In this study, we assume a ‘business as usual scenario’ for the trends in consumption, production and the food chain and for the size and direction of EU trade with third countries. Our assumption of the absence of considerable changes could be justified as follows. First, we think that the three consumption trends of flexitarianism, locavorism and conscious consumerism will stay in the fringe of the EU food system. Second, we do not expect a sudden change in the current trends in production and the food chain, which implies a continued sustainable intensification of production and an increasing role of NTMs. The main implication of this business as usual scenario for the food systems

in third countries is that their exports to the EU will be faced with an increasing role of sustainability and non-tariff measures and that hence production systems need to be adapted accordingly.

Changing demands of the European processors and retail require an adaptive response by farmers and/or other parts of the food value chain. If farmers and the food value chain are able to do so, this may result in benefits for both farming and the wider economy (through processing and packaging). However, for low- and middle-income countries the necessary transformation of their food systems presents challenges for producers, especially smallholders. Domestic barriers, like lack of access to finance, markets and transport, as well as the barriers created by standards on quality, traceability and certification, often make their participation in integrated value chains very difficult. In many countries, the ongoing fragmentation of farmland may further hinder smallholder farmers' capacity to adopt new technologies.

Initiatives to increase the sustainability of chains often focus on certification. Agreements are made, for example, on the minimum remuneration for farmers ('Fair Trade') and farm workers ('Living Wage'), or instructions are given for improving the production method (Utz - 'Good Agicultural Practices') or sustainability of production ('Rainforest Alliance'). The case studies for soy and cocoa make clear that these are important aspects to focus on. Impact studies show that overall effects of certification are rather modest and tend to reduce over time. More promising routes are sector-wide agreements and covenants to use only sustainable products (such as sustainable timber in the construction business).

S.3 Recommendations

In our study we use the food systems approach. Food systems are the compounded and connected activities of primary agriculture and fisheries and the related use of input, the processing, transformation, distribution and consumption of food, and the impact of these activities on environment, social conditions and outcomes and public health.

The food systems approach describes the different elements of our food systems and the relationships between those elements. It focuses on all activities related to the production, distribution and processing of food and looks at the outcomes of these activities, both in terms of food security, socio-economic aspects (income, employment, equity) and the environment (biodiversity, climate).

There are many dependencies between geographically distant food systems, and trade flows are tangible connectors between food systems, yet there are many more examples. The concept of *telecoupling* is a particularly useful tool to tie distant places together in global systems analysis.

Telecoupling refers to socio-economic and environmental interactions over distances, in particular at international scales. Examples of distant interactions within the natural system are climate teleconnections (distant interactions between climate systems) and urban land teleconnections (land changes that are linked to underlying urbanisation dynamics); economic globalisation is an example of distant interactions between human systems. The telecoupling framework could be a useful tool to further enlarge the understanding of the EU's trade impact on global food systems and to give input for EU governance.

Data

The analysis of complex and dynamic food systems leads to rapidly expanding data requirements. The multiple interactions of food systems with the Sustainable Development Goals, with the Zero Hunger goal (SDG2) at the core of a web of interactions with other SDGs, form possible cascades in analyses that again call for expanding data needs. It is recommended from this perspective to invest in data linking and data access, and to allow multidisciplinary studies. Open data initiatives such as the Global Open Access Data Network present a remarkable opportunity for food systems research in LMIC. The brunt of open data in LMIC is geared to support research on agriculture, livelihoods and environmental impact; it covers much less of the perspectives on food processing & transformation, on distribution & provision, and on increasingly complex behavioural drivers of food choice, habitual diets and nutrition

outcomes. The brunt of data on the downstream food systems activities sits with the private sector, in LMIC as well as in the EU.

Partnership

Food systems challenges cross both boundaries and borders, and are intrinsically not different in EU than in African or Asian countries. They require partnership. Transformation commences with shared insight into challenges, as well as the analysis of the barriers and catalysts for behaviour change in the system. Experimental approaches are a core element of a systems approach to research and innovation. More attention is needed for changes in the food consumer culture through diffusing social norms and habits regarding eating preferences or practices. Such (subtle) changes can be (secretly) cultivated by food companies, advertising and marketing, food policies or changes in the food environment (e.g. new food outlets or developments in the affordability or accessibility of particular food products). Soft values such as knowledge, environmental management, consumer preferences, even impacts on SDGs are embedded in material trade flows and financial values. In this regard, the impact of foreign direct investment (FDIs) on food systems outside the EU and the potential for sustainable finance warrants specific attention. With recognition of the cultural context to problem definition and perspectives on solutions, the commonalities and shared interests between the EU and its global partners in addressing food security challenges provide a platform for mutually beneficial international collaboration in the area of food systems science and innovation.

1 Introduction

1.1 Background - why do we need this study?[1]

There is a growing debate in society, both in Europe and elsewhere, about the effects of food production, use and consumption, and the impacts of exports and imports – of both raw materials and processed products - on a variety of issues, like the environment, (local) employment, food security, economic growth prospects, etc. It is not the food itself that is questioned, but how it has been produced and delivered, under what circumstances and how this effects the place/region of production.

The EU is a major player on the world market for agricultural products, dependent on commodity imports from many countries, including Low- and Middle-Income Countries (LMIC), and exporting high-value agriculture and products. The way food in the EU is produced, processed, traded and consumed has profound implications for producers and consumers in the EU and around the globe.

New policies to shape the direction of the EU food system and to deliver on the relevant Sustainable Development Goals (SDGs) need to be informed by an understanding of available choices and the potential trade-offs they imply for all participants in the food system, i.e. farmers and fishermen, traders, the food industry and final consumers.

1.2 Purpose and scope of this study

The objective of this study is to enhance the knowledge on the global dimension of the EU food system. In particular, the study aims at:

- an analysis of the trade relations between the EU and the rest of the world from several angels (total, by geographical blocs, by income blocs and by trade agreements) with a specific focus on LMIC;
- case studies of the effects of EU trade in three products – cocoa, soy and fish - on local food systems;
- an explorative analysis of possible changes in the EU food system and its impact on the food systems in third countries

In our study we use the food systems approach. Food systems are the compounded and connected activities of primary agriculture and fisheries and the related use of input, the processing, transformation, distribution and consumption of food, and the impact of these activities on environment, social conditions and outcomes and public health (Zurek et al., 2016). They provide a framework to analyse the interactions between the different activities of the food systems, the dynamics within the systems as well as entry-points for change (Berkum and Dengerink, 2017).

The study will have a scoping nature. The goal is not to provide ‘science- and evidence-based’ results of linkages between (changes in) the European food system and emerging and developing countries, but to give a first broad overview of these linkages and explore what is needed to improve our knowledge of these linkages.

Due to the explorative character of the study, we aim to value if our approach is feasible, what hurdles we come across, what data may be lacking, etc. This study will thus help in assessing what is needed to apply the food systems approach at a wider scale and provide inputs to the SCAR priority areas in the FOOD2030 strategy. It may also provide elements to a possible new SCAR Foresight study on

[1] We are grateful for contributions from Monika Zurek, lead researcher of the conceptual framework in the SUSFANS project. This section is based on Zurek et al. (2016, 2017).

national and European strategies regarding the role of science and innovation for pursuing the SDGs for food, climate and resource use efficiency.

1.3 Outline of the study

Chapter 2 starts with a description of the food systems approach, the evolution of this concept and presents a framework to evaluate likely impacts of trade on food systems goals.

Chapter 3 analyses the structure of EU agricultural trade relationships with the rest of the world. Main linkages and trends will be described in terms of volumes and composition.

Chapter 4 applies the food systems framework to a number of products that are selected on the basis of the trade figures. These case studies serve to show the usefulness of the framework and will also elicit how the framework could be improved.

Chapter 5 outlines some major trends in consumption, production and the food chain in the EU, and gives some reflections on how these trends may impact the food systems in third countries.

Chapter 6 discusses the results and formulates recommendations with regard to the possible implications of our analysis for the policy and research agenda.

2 View on the issues at stake

2.1 The food systems approach

The food systems approach describes the different elements of our food systems and the relationships between those elements. This approach focuses on all activities related to the production, processing, distribution and processing of food and also looks at the outcomes of these activities, both in terms of food security and socio-economic aspects (income, employment) and the environment (biodiversity, climate) (see also Figure A1.1 in Appendix 1).

The food systems concept was first used by social scientists in the nineties (McMichael, 1994; Tovey, 1997). Around the turn of the century, the need arose to have a better tool to value the role of agriculture, processing and other activities in relation to environmental and climate change.

This approach addressed two parallel developments in the debate on food security at the beginning of this century. On the one hand, the conceptual model reflected the shift in the debate about food security from production and availability of food to access and use of food (Ericksen, 2007; a recent illustration is HLPE, 2017). On the other hand, it showed the rise of the livelihoods approach, which paid attention to the different functions of food, the role of institutions and the trade-offs at the household level between food security and other objectives, such as sustainable use of limited natural resources (e.g. Ericksen, 2008; FAO, 2008).

Assessing food systems performance outcomes
An increasing number of perspectives for assessing food systems outcomes are being developed, many aiming to provide tools to address effects of food insecurity or climate change. What is common in the majority of these novel approaches, is their emphasis on the need for a holistic and systematic interrogation of food systems. As such, a clear shift has been made from a focus on solely food production outcomes, to approaches that also incorporate food consumption, retail channels and policy incentives (CFS, 2012; Acharya et al., 2014; Prosperi et al., 2014; Maggio et al., 2015). A food systems approach is nowadays being seen as 'the most effective strategy to enhance nutrition security in a more sustainable manner' (Gustafson et al., 2016:2) for a number of reasons. Besides providing a useful framework to structure the debate on a highly complex and dynamic issue, it allows for an integrated assessment that can focus on simultaneous impacts and leverage points in different domains of the food systems (Ingram, 2011).

In the SUSFANS project,[2] the novel lens of *sustainable food and nutrition security* (SFNS) is put forward to describe the outcomes of food systems. Departing from the concept of food and nutrition security allows the combination of nutritional and (political) economic assessment and as such targeted policy action on multiple levels. Building on this notion, SUSFANS has chosen to highlight the sustainability component by making it a central element of the analysis, leading to the notion SFNS. By attempting to integrate the elements from the various approaches of the food systems, SUSFANS aims to develop a comprehensive framework for conceptualising sustainable FNS. This framework is discussed in the next section.

[2] Funded under the sustainable food security theme of Horizon 2020, SUSFANS is established as a research group to explore metrics, models and foresight for sustainable nutrition security in Europe. In the vision of the project, food systems are charged to deliver on public health, environmental protection, viable farming and agribusiness; and tradeoffs between these goals require an ongoing weighing of priorities which will be informed by different world-views (Rutten, 2018).

2.2 The SUSFANS framework

The EU food system consists of various components that work at different geographical and temporal levels (from global to local; short-term to long-term) and interact with each other in a number of ways (see Figure 2.1). This makes the system complex and difficult to analyse.

For the present purpose, we define and describe the basic components of the EU food system as:

- The various actors within and outside of the EU food system
- The direct factors (inside the EU food system) and indirect factors (outside the EU food system driving the behaviour of food systems actors and therefore influencing change within the food systems (drivers of change)
- The outcomes of the EU food system and its activities
- The policy goals at the EU level that are shaping the drivers of the food systems
- The interactions and feedback loops that exist between the various food systems components.

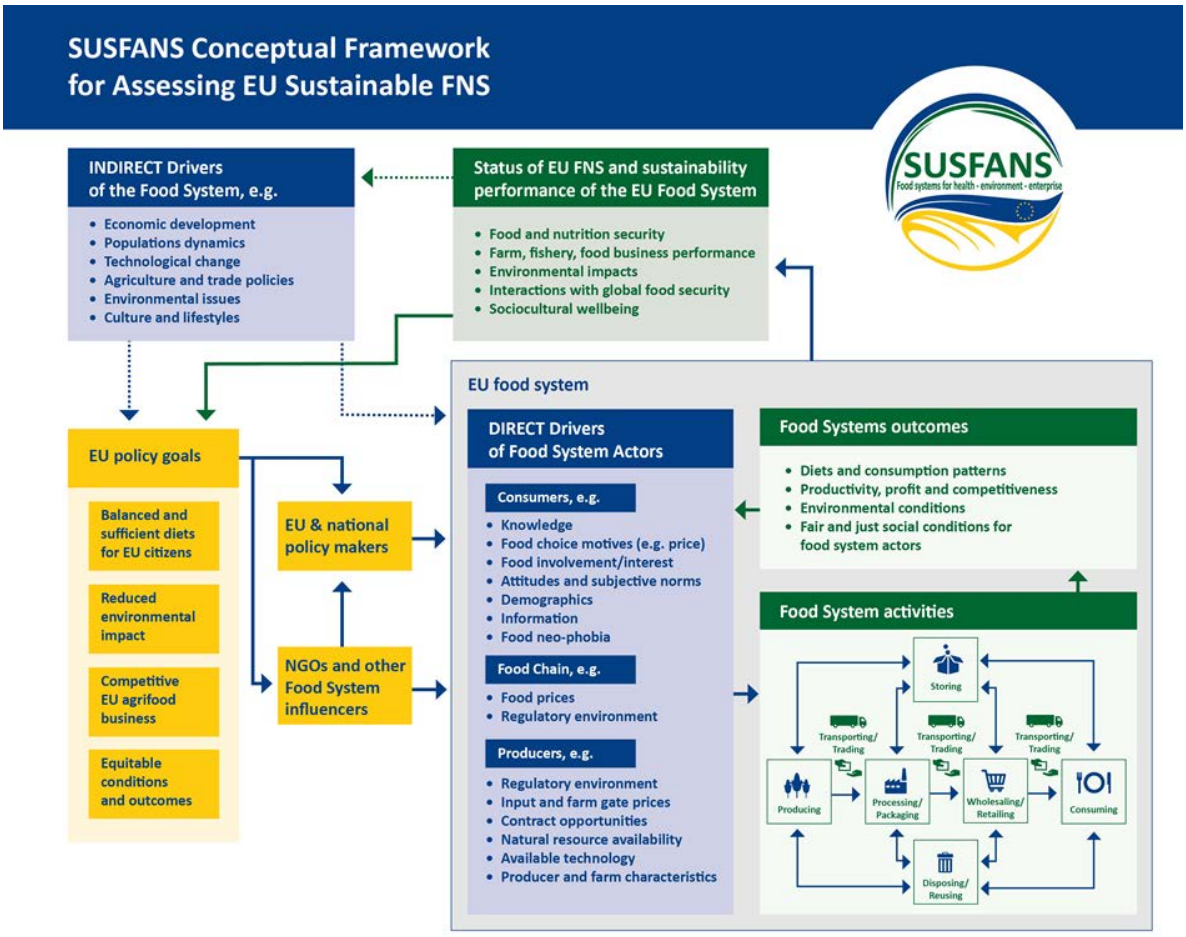

Figure 2.1 *The SUSFANS Conceptual framework for assessing EU sustainable FNS*

The EU food system provides various outcomes to EU citizens and also influences the food security status of people outside the EU. EU policy and decision makers formulated various goals with respect to these outcomes which the SUSFANS project distilled into a single vision for European sustainable FNS around four policy goals for the EU food system:

(1) Balanced and sufficient diets for EU citizens
(2) Reduced environmental impacts of the EU food system
(3) Competitiveness of EU agrifood businesses
(4) Equitable outcomes and conditions of the EU food system

Although EU oriented, these goals are our starting point to evaluate likely impacts of trade on food system goals for non-EU food systems.

2.3 Policy goals - SDGs

Through its interactions with its trade partners and global resource use, the European food system is linked to the performance of food systems of regions outside Europe. The United Nations Sustainable Development Goals (SDGs), established in 2015 as successors to the Millennium Development Goals, are designed as the platform for bringing such linkages to a political level. It is imperative to relate the policy goals for Europe to the global SDG framework.

The obvious SDG for assessing the performance of the food systems is SDG 2, which calls to end hunger, and to achieve food security and improved nutrition and promote sustainable agriculture. The elimination of chronic undernourishment by 2030 is the flagship target; it is supported by other targets related to various forms of malnutrition. A second set of sub-targets relates to household-level food access and food security. In the SUSFANS framework, these indicators of individual and household status are positioned under the policy goal of *balanced and sufficient diets*. In addition, the SUSFANS policy goals on *equitable outcomes* recognise that various forms of malnutrition and household-level determinants operate as key drivers and indicators of inequities in the food systems. SDG2 is also the home of targets related to making agriculture work for nutrition, which is the subject of intense research (Fan and Lorch, 2012) and policy advocacy (Haddad et al., 2017; Malabo Montpellier panel, 2017). A key target is to double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers. This target reflects a complexity of drivers and pathways, such as improving access to land and increasing the income of small-scale food producers. A further aim is to ensure the proper functioning of food commodity markets and to limit extreme food price volatility, for example by reducing trade restrictions and distortions in the world agricultural market. This is in turn related to competitiveness and to equitable outcomes and conditions.

Reduced environmental impact is related to several SDGs:

- SDG 12 Ensure sustainable consumption and production patterns
- SDG 13 Urgent action to combat climate change and its impacts
- SDG 14 Conserve and sustainably use the oceans, seas and marine
- resources for sustainable development and
- SDG 15 Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

This overview is not exhaustive and merely shows the need to take the broad perspective and to be aware of possible trade-offs between different goals.

3 EU trade relations

3.1 Introduction

This chapter highlights main trends in EU agricultural trade[3] with non-EU countries in the period 2000-2016. In Section 2.2 we discuss total agricultural imports of EU28 from third countries and EU28 exports to these countries. In Section 2.3 we split the group of third countries into 7 geographical blocs and analyse the EU trade patterns with these blocs. In Section 2.4 we divide the third countries according to their level of income. This results in 4 groups of income countries, whose trade patterns with the EU28 are reviewed. In the final section we focus on trade patterns between the EU28 and a number of third countries with low incomes, with whom the EU has agreed preferential trade relations.

In addition to conducting trade, EU-based food-related companies invest in foreign countries to either source their inputs or sell their products locally. Foreign direct investments (FDIs) are therefore also an indication of the international economic relationships among countries.

In most cases FDIs and trade are complementary to each other, with FDIs generating bilateral trade. Moreover, FDIs in the food (processing, marketing) and agricultural sector may encourage trade of the country the company invested in with other foreign markets. Next, FDIs bring in knowledge and capital, contributing to the agrifood sector development in the investment receiving country.

Hence, the global impact of the EU28 food systems should not be deduced only from its trade relations with third countries, yet should include all company-specific value chain activities taking place across the EU border. Such global value chain activities are not always easily traceable due to a lack of (detailed global) data on foreign direct investments in food and agriculture. Using trade data for illustrating the interconnectedness of the EU food systems with third countries is then a second best solution.

3.2 EU imports from and exports to third countries

The EU28 is a large market with over 500m consumers. Being a member of the World Trade Organisation (WTO) and having established numerous bilateral trade agreements, the EU is deeply integrated into global markets. Main agrifood trade characteristics of the EU are:

Imports

- The nominal value of EU28 imports from third countries increased from €79bn in 2000 to €146bn in 2016 (Table A2.1);
- Most of the EU28 imports originate from EU countries: 69% in 2000 and 73% in 2016, with the share of imports from third countries in total EU28 imports declining from 31% in 2000 to 27% in 2016;
- The top 5 of imported products by the EU28 from third countries includes fish (mainly fresh salmon and frozen shrimps & prawns), fruits and nuts (bananas and almonds), coffee and tea, residues from the food industry (oil cakes from soy bean meal), and oilseeds (soy bean and rapeseed) (Table A2.2). The structure of this top 5 was rather stable in the period 2000-2016, yet the category of fish and fruits has increased in terms of share in EU28 agrifood imports.

[3] In this trade analysis agricultural products include the chapters 01-24, 29, 33, 35, 38, 40-45 and 51-53 of the Harmonised System.

Exports

- The nominal value from EU28 exports to third countries increased from €61bn in 2000 to €148bn in 2016 (Table A2.1). This implies that the values of EU28 imports from and EU28 exports to third countries more or less balance in 2016;
- Like EU28 imports, most of the EU exports are directed at EU countries: 75% in 2000 and 73% in 2016; implying that the share of exports to third countries in total EU28 exports is 27% in 2016;
- The top 5 of exported products by the EU28 to third countries includes beverages (wine and spirits in particular), dairy produce and eggs (cheese), meat (pig meat), cereals (wheat), and cereal preparations (flour) (Table A2.3); Shares of this top 5 were rather stable in the period 2000-2016 apart from cereal preparations, which increased from 5% in 2000 till 8% in 2016.

3.3 EU trade with geographical blocs

We distinguish the next geographical blocs: EU28, Rest of Europe, Middle East and North Africa, Sub-Saharan Africa, Rest of Asia (including China), Northern and Central America (including the Caribbean), Latin America and Oceania.

Imports

- Except for Oceania, EU28 imports from all geographical blocs have increased in the period 2000-2016 (Table A2.4);
- EU28 imports mainly from Latin America (22%) and the Rest of Asia (25% of total extra-EU imports);
- EU28 imports from the Middle East and Oceania are modest (less than 4%);
- The most important products imported by the EU28 are fish (Rest of Europe), vegetables (Middle East and Northern Africa), cocoa (Sub-Saharan Africa), animal or vegetable fats and oils (Rest of Asia), fruit and nuts (Northern and Central America), residues from the food industry/oilcakes (Latin America) and meat (Oceania) (Table A2.6).

Exports

- The Rest of Asia has the largest share (40%) in EU28 exports; this share is rapidly rising since 2009 (Table A2.5);
- Northern and Central America (22%) and the Rest of Europe (18%) are the second and third destination of EU28 exports; these exports are also increasing;
- The Middle East and Northern Africa, Sub-Saharan Africa, Latin America and Oceania are minor destinations of EU28 exports;
- The most important products exported by the EU28 are cereals (Middle East and Northern Africa) and beverages to all the other geographical blocs (Table A2.6).

3.4 EU trade by income blocs

We distinguish four income blocs: high, upper-middle, lower-middle and low income countries (see World Bank for the definition of these categories).

Imports

- The group of upper middle income countries is the main origin of EU28 imports (Table A2.7);
- EU28 imports from the low income countries is modest and rather stable in the period 2000-2016;
- The most important products imported by the EU28 are fish (high income countries), fruits and nuts (upper middle income countries), animal and vegetable fats and oils (lower middle income countries), and coffee and tea (lower income countries) (Table A2.9).

Exports

- The group of high income countries is the largest destination of EU28 exports (Table A2.8), followed by the groups of upper and lower middle income countries;
- EU28 exports to the low income countries is rather low and stable in the period 2000-2016;

- The most important products exported by the EU28 are beverages (high income countries and upper middle income countries) and cereals (lower middle income countries and lower income countries) (Table A2.9).

3.5 EU trade according to trade agreements

The EU has agreed preferential trade agreements with a considerable number of lower middle income and low income countries. We distinguish the following blocs of lower middle income and low income countries according to their trade relations with the EU:

		Total number of countries
1	Lower middle income and low income countries with an Everything but Arms (EBA) arrangement for least developed countries	48
2	Lower middle income and low income countries with an GSP and GSP+ agreement (countries benefiting from the standard GSP arrangement and countries benefiting from the EU's Special Incentive Arrangement for Sustainable Development and Good Governance (GSP+))	25
3	Other lower middle income and low income countries (i.e. countries without an EBA, GSP or GSP+ agreement)	17

Sources: Websites: http://trade.ec.europa.eu/doclib/docs/2017/july/tradoc_155840.pdf; http://trade.ec.europa.eu/doclib/docs/2017/july/tradoc_155841.pdf; and http://trade.ec.europa.eu/doclib/docs/2017/july/tradoc_155842.pdf.

Imports

- EU28 imports from all three groups mentioned above are less than 10% of total EU28 extra imports in the period 2000-2016 (Table A2.10);
- EU28 imports from countries with a GSP and GSP+ agreement are considerably higher than those from the other two groups and increases in the period 2000-2016;
- The group of countries with no EBA or GSP trade agreement has a second ranking in imports to the EU28;
- EU28 imports from EBA-countries agreement are modest, with its value only slightly rising in the period 2000-2016;
- The three major imported products by the EU from countries with an EBA, GSP or GSP+ agreement are fish, cocoa, and fruits and nuts (Table A2.12).

Exports

- EU28 exports to all three groups of lower middle income and low income countries is about 5% of total EU28 extra exports in the period 2000-2016 (Table A2.11);
- The value of EU28 exports to all these three groups of countries are rising in the period 2000-2016, especially from 2009 onwards;
- The group of countries with a GSP and GSP+ agreement has the largest share in EU28 exports in the period 2000-2016, closely followed by lower middle income and low income countries with no trade agreement;
- EU28 exports from the lower middle income and low income countries with an EBA agreement is moderate and slightly rising in the period 2000-2016;
- The top-3 export products by the EU to these groups includes cereals, dairy and eggs, and beverages (Table A2.12).

4 Applying the framework

4.1 Introduction to the case studies

Based on the trade figures in Chapter 3, the following products are selected for a more in-depth case study: cocoa, soy and fish. Fish and cocoa are important traded items with lower middle income and low income countries. Soy is included as a representative product for the trade with high income countries.

For each product or product category we analyse the trade impact for a number of themes and corresponding indicators in the producing countries, using the SUSFANS-framework as introduced in Chapter 2.

It is important to note that outcomes may be both positive and negative, highlighting the added value of the food systems approach. The approach not only shows the potential benefits of trade for e.g. income or food security, but also the potential negative impacts on for instance the environment or socio-economic goals. Thus the analysis also shows possible trade-offs and entry-points for intervention by actors in the global food systems, including the EU.

For one product, cocoa, we have also attempted to crosslink the SUSFANS framework to the SDGs; this is done qualitatively, as quantification is not (yet) possible.

4.2 EU-Africa Cocoa Trade

4.2.1 Competitiveness of agrifood business

As shown in Table 4.1, the largest cocoa producing countries are Cote d'Ivoire and Ghana, followed by Indonesia, Ecuador and Brazil. More than 90% of cocoa consumed in Europe comes from West-Africa (Hütz-Adams & Fountain, 2012). Most of the cocoa is transported to Europe as dry beans to be processed into cocoa powder and cocoa butter. These ingredients are then used for the production of chocolate and as inputs to cosmetic products.

Table 4.1 Largest cocoa producing countries (x 1,000 tonnes)

1.	Cote d'Ivoire	1,796
2.	Ghana	740
3.	Indonesia	325
4.	Ecuador	261
5.	Brazil	230

Source: ICCO (2014/14).

The majority of cocoa is produced by 5.5m smallholders, with more than 20m family members directly dependent on cocoa for their livelihoods. A farmer household in Ivory Coast earns on average €3.5/day from the activities on its cocoa farm, which results in a yearly income of around 40% of the living income. This is the net income a household would need to earn to enable all members of the household to afford a decent standard of living. On an annual basis, the wage of workers on cocoa farms in Ivory Coast is €477,while the legal minimum wage is €659 and the annual living wage for an Ivorian worker, is €2,869 (True Price, 2016).

Productivity in cocoa is generally low with yields ranging between 250 and 350 kg/ha. With potential yields between 750 and 1,000 kg/ha, depending on local conditions, there is a significant yield gap. With low yields, limited investment and lack of external support, farmers often struggle to earn a living income and have to cope with poor living conditions for their families and workers. This creates the danger of a poverty trap: without capital investments farmer's yields cannot increase, but their current capital does not give them any room for investment (KPMG, 2012).

4.2.2 Environmental impacts

The production of cocoa has a serious impact on the environment. The deforestation of tropical forests and the impact of increasing use of agro-chemicals on soils and human health feature among the most researched outcomes (England, 1993; Rice and Greenberg, 2000). Smallholders in West-Africa increased their cultivated area by 3.3% annually during 1988-2007, causing 2.3m hectares of forest loss (Gockowski and Sonwa, 2010). The dominant model of full-sun cocoa farming significantly deteriorates soil quality (Tondoh et al., 2015).

Another environmental risk that has the potential to negatively affect the livelihoods of cocoa farmers is climate change. A report by the International Centre for Tropical Agriculture) shows that the cocoa-growing regions in Ghana and Ivory Coast will see a temperature increase of up to 2.0 °C by 2050, resulting in a major reduction in climate suitability for cocoa (CIAT, 2011).

4.2.3 Equitable outcomes and conditions

Cocoa farming is known for its poor working conditions. Cocoa farmers are exposed to hazardous labour, non-mechanised production systems and limited social or economic infrastructure in cocoa communities. They often make long hours doing hard manual labour, such as weeding, pruning, harvesting, fermenting and drying the cocoa beans. Many of them also use agro-chemicals without wearing sufficient protective gear, which can negatively affect their health (Hütz- Adams and Fountain, 2012).

An additional complicating factor is the old age of many farmers and the limited interest of younger generations to take over. The average age of farmers in Ghana is around 50 years. As Ghana's life expectancy is around 60 years, the current generation will soon start passing away. Many of the younger generation find the hard work and limited rewards of cocoa farming discouraging and decide to work outside the cocoa sector instead. As a result, a serious shortage of cocoa farmers is expected for the coming years. At the same time, demand for cocoa is expected to rise by 1m tonnes in the next decade (Hütz-Adams and Fountain, 2012).

Due to insufficient income to pay workers, coupled with a shortage of workers in rural areas, farmers are often forced to rely on unpaid workers, directly increasing the risk of (hazardous) child labour and forced adult labour. The share of household labour performed by children varies between 5-7% for Cote d'Ivoire and 31-34% for Ghana, with the share of hazardous labour by children ranging between 40-60% (ICI, 2016).

4.2.4 Balanced and sufficient diet

Under-nutrition is a major issue in the regions where cocoa production takes place. Under-nutrition is not only caused by a shortage of intake of energy (quantity of the food) but also by a shortage of micronutrients (quality of the food). Described as 'hidden hunger', this leads to underweight and stunting in children. Stunting - limited growth due to poor diets - is widespread in regions where cocoa production takes place. A recent study shows that in all production areas in Ivory Coast, Ghana and Indonesia more than 25% of the population is affected by stunting (GAIN/WUR, 2014).

Undernourished children are also more likely to die from preventable diseases, and therefore child mortality can also be used as an indicator for under-nutrition. In Ivory Coast, the largest cocoa producing country, 9% of infants die before they reach five years of age (UNICEF, 2017).

Malnutrition can have serious impacts on productivity, through different ways: (1) reduced labour output and physical productivity due to bad health: (2) reduced cognitive development due to malnutrition early in life and (3) losses in household resources from increased health care costs. Studies show that 1% reduction in iron status is correlated with a 1% reduction in productivity, while a 1% reduction in height leads to 1.4% reduction in productivity (Behrman and Rosenzweig, 2001).

Table 4.1 *Applying the SDGs and the SUSFANS framework to EU-Africa cocoa trade*

SDG	Performance metrics	Aggregate indicators	Developing country context
SDG 2: Zero Hunger SDG 3: Good Health	Equity among consumers: food systems outcomes	Availability of food	Malnutrition is a major issue in the cocoa sector. Stunting -limited growth due to poor diets - is a visible sign of chronic malnutrition and is widespread among cocoa farmers
		Accessibility of food	
		Utilisation of food	
		Stability of food supply	
		Health: Undernutrition	
		Health: Overweight/obesity	
SDG 2: Zero Hunger SDG 3: Good Health	Equity among consumers: food systems conditions	Wealth	Farmers often struggle to earn a living income and have to cope with poor living conditions for their families and workers
		Political stability	
		Consumer choices	
SDG 10: Reduced inequalities	Equity among producers and chain actors	Access to resources by primary producers	Cocoa farmers often struggle to get access to finance (loans, insurance) as they have limited collateral and are often not legally owner of their cocoa plots.
		Access to finance and technology	
		Producer sovereignty	
SDG 12: Responsible consumption and production	Equity in food footprint	Resources embedded in and emissions related to food consumption	yet to research
		Resources embedded in and emissions related to food production	
SDG 3: Good Health	Diverse diets (food based summary score)	Intake of various food products	Cocoa farmers lack a sufficiently diverse diet and depend mostly on staple foods (maize, rice, roots)
SDG 2: Zero Hunger	Intake of nutrients (nutrient based summary score	Intake of various nutrients	Cocoa farmers lack a sufficiently diverse diet and depend mostly on staple foods (maize, rice, roots)
SDG 3: Good Health	Energy balance	Share of population with normal weight	Stunting is widespread among cocoa farmers - 25% of cocoa farmers are affected
SDG 8: Decent Work and Economic Growth	Production and trade	Openness of countries	90% of cocoa consumed in Europe comes from West-Africa. Virtually all cocoa produced is for export.
		Self-sufficiency of countries	
	Trade - export flow orientation	Growth export share	yet to research
	Trade - trade orientation	Normalised trade balance	yet to research
	Trade - trade specialisation	Comparative Export Advantage	yet to research
		Comparative Import Advantage	
	Production - Economic performance of a sector	Net Trade Advantage	yet to research
	Production - Productivity cross-sector benchmarking	Real value added	Low yields (between 250-350 kg/ha) while potential yields are 750-1,000 kg/ha
		Total factor productivity	
		Real labour productivity	
SDG 6: Clean water and sanitation SDG 12: Responsible consumption and production;	Climate stabilisation	Reduction of GHG emissions	Land expansion due to cocoa farming is responsible for a large share of the deforestation in Ghana and Cote d'Ivoire. Cocoa-growing regions face a 2 degree temperature increase by 2050, causing major

SDG	Performance metrics	Aggregate indicators	Developing country context
SDG 13: Climate action;			reduction in climate suitability for cacao
SDG 15: Life on land	Clean air and water	Reduction of N surplus	Although fertiliser and pesticide use are limited in the cacao sector, use of non-legal toxic substances is widespread with large risks for water quality and human health.
		Reduction of N emissions to air	
		Reduction of N emissions to water	
		Reduction of P surplus	
		Reduction of toxic substances use	
	Biodiversity conservation	Reduction loss MSA	Deforestation and monoculture growing of cocoa reduces biodiversity in cocoa growing areas. Soil degradation is a serious problem due to lack of fertiliser use and shade protection.
		Land use	
		Reduction in no of threatened species	
		Sustainable water use	
		Sustainable exploitation of wild-caught seafood	
		Maintenance of soil fertility	

4.3 Soy

4.3.1 Competitiveness of agrifood business

Table 4.2 shows that Latin American countries such as Brazil and Argentina are the largest exporters of soy products to the European Union. North-American countries such as the United States and Canada also export a significant share of the soy imported to European countries. In terms of different soy products, soy bean meal (used for food and animal feeds) is the most imported product; unprocessed soy beans come second and soy oil only makes up a fraction of the total soy imports to the EU.

Table 4.2 *Top-five countries from which the EU28 are importing soy*

Country or origin	Import (1,000 tonnes)			
	Soy bean	Soy bean meal	Soy oil	Total
1. Brazil	5,800	8,784	24	14,608
2. Argentina	250	8,083	25	8,458
3. United States	2,300	1,545	7	4,852
4. Paraguay	2,000	209	25	2,234
5. Canada	1,150	62	0	1,212

Source: ISTA Mielke (2014).

The United States, Brazil and Argentina are the world's largest soy bean producers and represent more than 80% of global soy bean production. The average worldwide yield for soy bean crops is 2.6 tonnes per hectare, with highest yields per hectare measured in Thailand, Turkey and Italy.

4.3.2 Environmental impacts

One of the major environmental impacts of soy production is land-use change and associated deforestation. Yearly, 3.7m hectares of forests disappear in major soy producing countries Argentina, Brazil and Paraguay. Since 2000, the soy cultivation growth area has grown by more than 10% a year in these countries (DSC, 2012). Monoculture soy production and deforestation both contribute to problems of soil degradation. Moreover, pesticide use in soy production is known to produce adverse health effects in soy producing areas.

4.3.3 Equitable outcomes and conditions

Soy production is associated with different societal impacts. In the search for new agricultural land for soy cultivation, land conflicts often arise. Soy producers are known to encroach on nature reserves and reserves for indigenous people. Mechanisation of soy production has reduced the employment opportunities in soy production, but has increased the income opportunities for farmers producing soy. Other concerns are raised about the extent to which land converted for soy production can no longer support food crops that are needed to meet the local food demand.

4.3.4 Balanced and sufficient diet

On average, each European consumer eats 87 kg of meat[4] and 250 eggs per year. To produce this, 400 m^2 of land per person is needed. The EU imports of soy account for the use of 18m hectares of agricultural land outside the EU (Idel et al., 2013). Global meat consumption per capita is projected to rise from 41 kg per capita at present to 49 kg in 2050 (FAO, 2012).

Performance metrics	Aggregate indicators	Developing country context
Equity among consumers: food systems outcomes	Availability of food	Expansion of soy production is known to limit food production and affordability in some parts of Brazil
	Accessibility of food	
	Utilisation of food	
	Stability of food supply	
	Health: Undernutrition	
	Health: Overweight/obesity	
Equity among consumers: food systems conditions	Wealth	The movement of soy production from the USA to Latin American countries has greatly increased the accessibility and affordability of soy products.
	Political stability	
	Consumer choices	
Equity among producers and chain actors	Access to resources by primary producers	
	Access to finance and technology	
	Producer sovereignty	
Equity in food footprint	Resources embedded in and emissions related to food consumption	
	Resources embedded in and emissions related to food production	
Diverse diets (food based summary score)	Intake of various food products	On average, each European consumer eats 87 kg of meat and 250 eggs per year. To produce this, 400 m^2 of land per person is needed. The EU imports enough soy to account for the use of 18m hectares of agricultural land outside the EU
Intake of nutrients (nutrient based summary score	Intake of various nutrients	
Energy balance	Share of population with normal weight	
Production and trade	Openness of countries	EU is net importer of soy, mainly from South-America (Brazil, Argentina) and the United States
	Self-sufficiency of countries	
Trade - export flow orientation	Growth export share	
Trade - trade orientation	Normalised trade balance	
Trade - trade specialisation	Comparative Export Advantage	
	Comparative Import Advantage	

[4] These figures relate to consumption based on carcass weight, id est meat including bone. As a rule of thumb, actual meat and meat products consumption is about half this weight.

Performance metrics	Aggregate indicators	Developing country context
Production - Economic performance of a sector	Net Trade Advantage	
Production - Productivity cross-sector benchmarking	Real value added	USA, Brazil and Argentina produce together 80% of global soy. Average global yield is 2.6 tonnes per hectare.
	Total factor productivity	
	Real labour productivity	
Climate stabilisation	Reduction of GHG emissions	Land conversion for soy production is a major contributor to deforestation, resulting in high CO_2 emissions
Clean air and water	Reduction of N surplus	High pesticide use in intensive soy production has shown to have adverse health effects for local communities
	Reduction of N emissions to air	
	Reduction of N emissions to water	
	Reduction of P surplus	
	Reduction of toxic substances use	
Biodiversity conservation	Reduction loss MSA	Land conversion in tropical forests has major biodiversity consequences.
	Land use	
	Reduction in no of threatened species	
	Sustainable water use	
	Sustainable exploitation of wild-caught seafood	
	Maintenance of soil fertility	

Figure 4.1 *Food systems impacts in the soy sector, using SUSFANS indicators a)*
a) An empty cell indicates that no information is available.

4.4 Seafood products

4.4.1 Competitiveness of agrifood business

For the purpose of this analysis seafood products are defined as any form of aquatic life regarded as food by humans. Seafood is often viewed as one commodity. However, as a product category seafood is very diverse at different levels. This becomes clear from:

- Over 32,000 fish species and many more species of marine invertebrates have been described (Fishbase, 2017).
- The high global diversity in fishing gears, fishing methods, target species and management regimes.
- The high global diversity in aquaculture methods, aquaculture species (i.e. 600 different freshwater and marine animal species compared with only around 20 species in terrestrial animal production systems (Troell et al., 2014) and about 30 crop species that make up 95% of human energy needs (Henriksson et al., 2015)) and applicable policies and regulations.
- The high global diversity of sub-sector and value chain characteristics.
- The heterogeneity of fish market characteristics within and outside the EU28.

Seafood can either be caught (capture fisheries) or cultured (aquaculture). The EU as a whole derives its seafood products from two sources, namely EU production (catches within and outside waters under EU28 jurisdiction or aquaculture) and imports. In 2015 the EU's self-sufficiency ratio was 36.0% (EUMOFA, 2017). This implies that supply through imports from non-EU countries was more important than through EU28 catches or aquaculture production.

EU28 seafood imports

The EU28 imported €137bn worth of food products in 2016, of which fish represented 18% (EUMOFA, 2017). Extra-EU imports of fisheries and aquaculture products reached a value of €24.4bn in 2016. As shown in Figure 4.2, Norway is the main source of EU fish-product imports. Volumes of EU imports from Norway reached 1.5m tonnes in 2016, with a total value of €6.3bn. China, the second major supplier, sold 515,074 tonnes of capture fisheries and aquaculture products to the EU28 in 2016, with a value of €1.7bn.

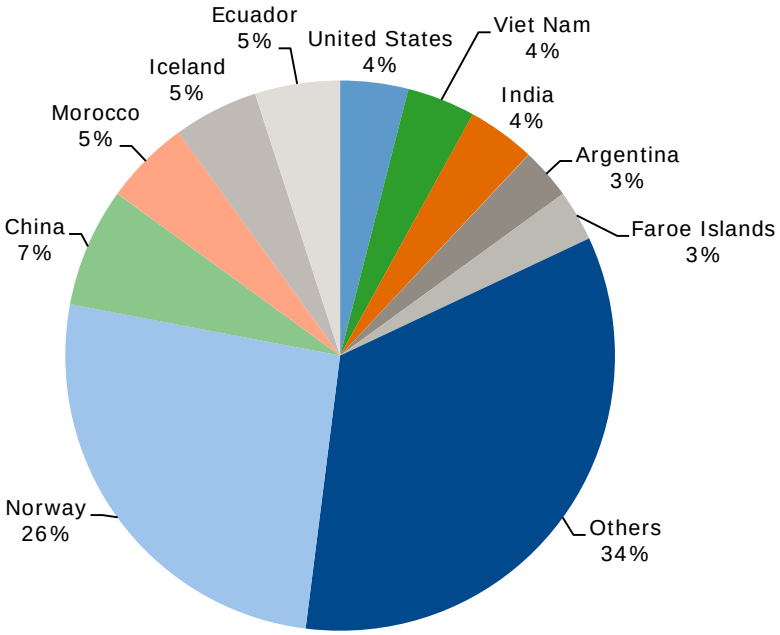

Figure 4.2 *Top extra-EU countries of origin by value (2016)*
Source: EUMOFA (2017)

EU28 seafood exports
In 2016, the value of EU exports reached €4.7bn (EUMOFA, 2017). Six MS covered 77% of total EU28 exports in 2016: Spain, Denmark, the Netherlands, the UK, France and Germany. EU28 exports are mainly destined for Norway and Nigeria. In 2016 the four most important commodity groups (by value) were salmonids (€754m), small pelagics (€690m), tuna (€628m) and non-food use (€552m). The category non-food use consists of fishmeal and fish oil that is mainly sold to Norway for the production of salmon feed. Small pelagics consist mainly of herring, mackerel and horse mackerel. The first two are exported mainly to Nigeria and Egypt, while the last one is exported mainly to Nigeria and Japan.

EU28 aquaculture production
The EU28 had a stable output of aquaculture products during the 2004–2014 period, with a production quantity fluctuating around 1.2–1.3m tonnes live weight (EUMOFA, 2017). At the same time the global output of aquaculture products (excluding aquatic plants) increased by approximately 75% from about 42 to 74m tonnes.[5] EU aquaculture production is mainly concentrated in five countries: Spain, the UK, France, Italy and Greece, making up 76% in weight and 75% in value of EU28 totals (STECF, 2016). The aquaculture sector in EU28 can be divided into three main sectors: Marine, Shellfish and Freshwater production. The main species produced in EU28 in terms of value are Atlantic salmon, oysters, seabream, seabass and trout, whereas the Mediterranean mussels dominate in weight (STECF, 2016).

EU28 capture fisheries in waters beyond the national jurisdiction of EU MS
Part of the EU28 vessels are also fishing in waters beyond the national jurisdiction of EU MS. According to EU data the external fishing fleet is believed to comprise about 700 fishing vessels (59% fly the flag of Spain, 14% the flag of France, and 10% the flag of Portugal),[6] 300 of which fish under EU fisheries agreements with countries outside the EU28. These vessels were estimated to account for approximately 21% of the EU's total catch for human consumption and 92% of all tuna and related

[5] http://www.fao.org/fishery/statistics/global-aquaculture-production/en
[6] https://ec.europa.eu/fisheries/sites/fisheries/files/docs/body/external_fleet_2008_summary_en.pdf

species caught.[7] However, different sources provide different figures, depending on the criteria used in the calculation and ultimately on how the term 'external fleet' is defined.[8] For example the results of a recent access to information request to the EU showed that between 2010 and 2014 15,264 fishing vessels have operated under EU flags in external waters. This makes an average of 3,052 vessels per year, which is 2,334 more compared to the original figure (i.e. 700).[9]

Effects on competitiveness of agrifood business[10]

EU trade in seafood products affects the local food systems in developing counties in various ways.[11] Its impacts on the competitiveness include the following issues.

- EU28 demand for seafood products and marine and terrestrial fish feed ingredients provides job and income in different steps of the capture fisheries' value chain from inputs & services, primary production, processing, retail and trade in producing countries.
- EU28 seafood exports compete with locally captured and cultured fish. The subsequent smuggling of small pelagics across borders in Africa creates unfair competition (no tax is paid).
- EU28 capture fineries in waters beyond the national jurisdiction of EU MS displaces foreign investors and local entrepreneurs in the coastal states (Kaczynski and Fluharty, 2002).

4.4.2 Environmental impacts

EU28 demand for fish from capture fisheries exerts pressure on marine resources and ecosystems and involves the killing of endangered species.[12] Moreover, it induces increased pressure on water resources, due to water pollution as a result of discharges from aquaculture operations. Such discharges refer amongst others to the use of water and sediment treatments compounds, fertilisers, pesticides, disinfectants, antibiotics and other feed additives, hormones, vaccines, anaesthetics and probiotics in Asian aquaculture. Considerable energy may be required in warehouses and dispatch centres for cooling and aeration. Seafood is also unique in terms of the prevalence of airfreighted fresh product, which may dominate supply chain energy use (Pelletier et al., 2011).

Due to the decreasing share of captured fishmeal and oil that are used to feed farmed fish, the aquaculture sector is shifting towards crop-based feed ingredients, such as soy; rapeseed/canola, maize, groundnuts and wheat, to replace captured fish as a feed source and allow for continued growth of the sector (Fry et al., 2016). As a consequence, an increasing share of cereal and soy production is being fed to fish as an ingredient in commercial aquafeed. This shift fundamentally links seafood production to land-based human food production including terrestrial agriculture. The use of aquafeed with a large proportion of terrestrial ingredients may reduce the pressure on capture fisheries and shift the direct biodiversity impacts away from the sea towards the land. The use of an increasing share of crop-based ingredients in the production of aquafeed results into :

- an increase in direct and indirect biodiversity impact on the terrestrial environment. Clearance of forests for agriculture is a major cause of deforestation worldwide; soy bean production is one of the three most significant commodities in this regard. Together, palm oil, soy and beef account for the majority of the deforestation associated with agriculture worldwide. The role of soy is particularly important as 70-75% of the world's soy ends up as feed for chickens, pigs, cows, and farmed fish.[13]
- An increase in indirect biodiversity impact on the fresh water and marine environment (e.g. increased ocean dead zones due to increase eutrophication of water resources as a consequence of mainly phosphorous).

Aquaculture uses both by-products (human-inedible coproducts from crops) and food-quality crop products. The growing demand for crop-based feed ingredients increases the pressure on land and the competition for natural resources. It contributes to land degradation and thus it may contribute to

[7] http://www.iuuwatch.eu/wp-content/uploads/2015/07/FAR-2pp-FINAL-Version.2016.LOW_.pdf
[8] http://www.europarl.europa.eu/RegData/etudes/BRIE/2017/608651/EPRS_BRI(2017)608651_EN.pdf
[9] http://www.iuuwatch.eu/wp-content/uploads/2015/07/FAR-2pp-FINAL-Version.2016.LOW_.pdf
[10] See also Appendix 3
[11] As less (quantitative) information for seafood products is available on the performance metrics of the SUSFANS framework relatively to cocoa and soy, no table on applying the SDGs and the SUSFANS framework for seafood trade is given.
[12] http://www.greenpeace.org/international/Global/seasia/2015/png1/Supply-chained_EN.pdf
[13] http://www.ucsusa.org/global-warming/stop-deforestation/drivers-of-deforestation-2016-soybeans

reducing the amount of productive land available. Lal (2005) reports that even a partial removal (30–40%) of crop residue from land can increase soil erosion, deplete soil organic carbon, heighten emission of CO_2 and other greenhouse gasses from the soil to the atmosphere, and aggravate the risks of climate change (Lal, 2005). Moreover, the use of crop-based feed ingredients results in an increasing pressure on freshwater resources, due to water consumption and pollution in crop production for aquafeed.

4.4.3 Equitable outcomes and conditions

The ILO identifies fishing as a highly hazardous sector.[14] Fishers on vessels routinely face hazards and conditions of work. Debt bondage, child labour and forced labour, but also human rights abuses (including human trafficking) and labour violations have been reported in tuna fisheries in Thailand[15] and the Philippines and capture fisheries in Indonesia.[16] Stringer reports that while the most recent and widely reported cases of slavery in the fishing industry have occurred in Thailand the use of slave labour in the industrial fishing sector is a complex and widespread issue.[17] Induced or inflated indebtedness, sexual violence, abuse and harassment and human rights abuses have been reported in aquaculture (fry collection, shrimp farming and processing) in Bangladesh[18] and forced labour, human trafficking, and child labour have been reported in the shrimp farming sector in Thailand.[19]

EU28 demand for fish from aquaculture influences not only the types and volumes of fish available locally, but also that of crops and livestock as local people (for direct human consumption), fed aquaculture and livestock production are all competing for the same limited marine and terrestrial resources (to be grown on limited arable land). This influences local prices and equitability of access. In addition, the use of terrestrial fish feed ingredients contributes to the essentially one-way flow of phosphorus from mines to oceans via agriculture is rapidly depleting a critical yet finite resource and simultaneously causing nutrient pollution of the world's rivers and oceans.

Overall, the EU's fourteen Fisheries Partnership Agreements with third countries sustain about 12,489 jobs in third countries. In addition, EU28 capture fisheries in waters beyond the national jurisdiction of EU Member States contribute licence revenues in the coastal states.

While EU28 capture fisheries in waters beyond the national jurisdiction of EU MS put an excessive pressure on marine resources, there is an increasing reliance of West Africa's coastal population on fisheries for their food and income despite decreasing total income and increasing fishing costs, which in turn aggravated poverty. Small-scale fishing in West-Africa is an activity of last resort. Despite the fact that small-scale fishing is not a source of sustainable livelihood, the number of people depending on fisheries is still increasing (Belhabib, 2015). Some sceptics link the loss of fisheries livelihoods to conflicts and dislocations on the African continent with migration and its accompanying environmental, economic, social and health & safety issues as a result (Garcia, 2005).

4.4.4 Balanced and sufficient diet

EU28 demand for fish from capture fisheries influences the types and volumes of fish available locally. A study in the British Medical Journal shows that studies from Bangladesh, India, Indonesia, and Thailand have reported antibiotic residues in aquaculture products and aquaculture water (Lundborg, 2017). As a result South East Asia is at high risk of the emergence and spread of antibiotic resistance in humans (Chereau, 2017). Besides antibiotics, other aqua-chemicals and hormones are routinely used in aquaculture. In particular, where knowledge regarding the use of chemicals is lacking, the use is associated with problems like appropriate dose, method of application and indiscriminate use. On the other hand, the EU28 seafood exports provide a source of cheap animal protein for in particular the lower market segments in countries like Egypt and Nigeria.

[14] http://www.ilo.org/global/industries-and-sectors/shipping-ports-fisheries-inland-waterways/lang--en/index.htm
[15] http://www.greenpeace.org/international/Global/seasia/2015/png1/Supply-chained_EN.pdf
[16] https://www.verite.org/project/our-work-in-seafood/
[17] http://sydney.edu.au/environment-institute/events/turbulent-waters-slavery-in-the-fishing-industry/
[18] https://www.verite.org/project/our-work-in-seafood/
[19] https://www.verite.org/project/our-work-in-seafood/

5 Trends analysis

5.1 Introduction

This chapter explores possible changes in the EU food system and its impact on the food systems in third countries. To fully comprehend how changes in consumption and production might affect various food systems outcomes, one would need a scenario analysis (see for instance Shutes et al., 2017a), which is not feasible within the scope of this study. We therefore take a simpler approach. Changes in the EU food systems are based on an analysis of trends in the direct drivers of the EU food systems, i.e. consumers, producers and the food chain. The impact of these changes on the food systems in third countries is assessed by focusing on the three products we analysed in the case studies in the previous chapter: cocoa, soy and seafood products.

5.2 Trends in the direct drivers of the EU food systems

5.2.1 Consumers

Discussing future trends in EU consumption against the backdrop of their possible consequences and ways of diffusion in third countries is not a simple matter. The question could be raised to what extent Europe is (still) a continent with worldwide influence. First, the idea of trickle-down as the royal road of diffusion or development should be nuanced in a world with various trendsetting centres and classes. Second, also more quantitatively we should acknowledge that, for instance, European consumers' global share is declining from around 40% at the beginning of this century to less than 30% in the next decade. Conversely, the share of the global middle-class consumption of Asian countries – particularly, China and India – is projected to rise to over 40%.

Globalisation of similar dietary patterns
The dominant consumption pattern in the EU can be denoted as a diet with a considerable intake of animal-based products, fats, added sugars, refined carbohydrates as well as more processed foods while simultaneously showing a lower dietary intake of vegetables, grains and legumes. However, this consumption pattern is not only perceived in the EU; on the contrary, it reflects a main tendency in worldwide food consumer behaviour. Spreading from the western world, the so-called nutrition transition set foot in an increasing number of countries all over the world, including many developing countries. As such, it implies a globalisation of similar dietary patterns in developed and developing countries. This transition indicates a shift in consumption patterns towards higher food energy supplies, and, as a result, higher intakes of saturated fat and cholesterol – with negative consequences regarding the prevalence of obesity and related non-communicable diseases ('from food poverty to health poverty').

Trends in the fringe of the food systems
In the fringe of the EU food systems we observe three trends in consumption: (1) consumer involvement in flexitarianism and (semi-)vegetarian diets in order to reduce their meat intake, (2) consumer interest into local agricultural produce in order to (re)connect with the food one eats, and (3) greening of food consumer behaviour in order to practise one's beliefs.

@1: *Flexitarianism, reducetarianism or part-time vegetarianism* is a trend in several European countries towards a diet pattern with less meat. Consumers reduce their meat consumption for both environmental and health concerns. Although this trend is still marginal in comparison to the meat market at large and the growing meat demand worldwide, flexitarianism really exists and consumer attention for animal-based food consumption has been raised. If flexitarianism is going to grow and becomes more mainstream ('the new norm') this would have important implications for the demand

for meat and vegetable protein. With respect to the demand side of the food market, it could serve as an example to people in other parts of the world and set a dietary pattern that is more or less the inverse of the nutrition transition ('nutrition transition 2.0*').*

@2: *Locavorism* attracts growing attention of consumers. It is motivated by considerations of food miles, food sovereignty, uncomfortable feelings of having lost control over where and how the food one eats has been produced, interest in place of origin and producer information, etc. It could also be a consumer reaction to globalisation and dependency of anonymous food supply chains. With respect to its future impacts it can be suggested to pay attention to food neophobia and food nationalism and its possible consequences for international trade as well as for the dynamics of short supply chains. Consumer interest in local foods could be advantageous to farmers' and consumers' empowerment, local economy and employment, social cohesion, as well as provide opportunities to act which have been lost or made impossible in the prevailing food systems as we know it.

@3: *Conscious consumerism or greening of food consumer behaviour* is a trend that has existed longer. Here, the interpretation is more in the sense of an 'immaterial' trend. That is, this trend is first and foremost about mentality and mind-set rather than solely about market figures and consumer demand. This trend refers to consumer criticism and concerns about principles and practices of the dominant consumer culture. This trend is about 'alternative' or 'avant-gardistic' consumption styles under such labels as slow food, organics, collaborative consumption, simply living, anti-consumption, cultural creatives, prosumerism, etc. This trend's future implications for the food market and trade could be forecasted in a growing impact of consumers who use their purchasing power as an asset and act as change agents. The concept of consumer-driven food chains that we know since the end of the 20th century, could be given new meaning – by the same token, this holds too for the newly concepts of inclusive and circular food chains. Moreover, part of this trend of conscious consumerism put emphasis on social justice or true pricing. Generally, it is closely related to Sustainable Development Goals – more particularly SDG 12 Responsible consumption and production (see Section 4.4).

5.2.2 Producers

The general pattern of development in the agricultural sector in the EU is a slowly decreasing number of farms (an average decline of 3.7% per annum), an increasing farm size and a reduction of farm labour, the result of the use of labour-saving technology. There was little change in the utilised agricultural area farmed in the EU during recent years (on average minus 0.1% per annum for the EU28 (excluding Croatia) between 2005 and 2013 (Eurostat, 2016).

Total agricultural production has increased over the years and the majority of production takes place on larger farms. In 2013 70% of the farms in the EU had a standard output of less than 8,000 euro, which is not enough to provide a living. By contrast, 6.3% of the farms had a standard output of at least 100,000 euros. In 2013, 49% of the farms at EU level had less than 2 ha, 3% of all holdings was larger than 100 hectares and farmed half of the utilised agricultural area in the EU28.

Despite the concentration of production, farming in the EU is by and large still a predominantly family activity. The very small and small farms (in economic terms) are often unable to provide a viable income for farmers and their families. As such, they are often run either as part-time operations, in conjunction with other gainful activities, or to supplement pensions; these small farms are typically characterised by a high share of family labour. On larger farms it is more common to find a higher share of the labour force engaged on a full-time basis, and these farms are also more likely to employ non-family labour (Eurostat, 2016).

Increasing intensification of primary production

The trend of the growing intensification of primary production is largely linked to the scale increase of farms. Bigger farms usually have better access to technologies that allow them to produce more efficiently. Whether intensification is good or bad is subject to much debate. Intensification is regarded by some as detrimental to the environment as intensification has led to monocultures, with 'considerable environmental impacts, reduced diversity and growing concerns among food consumers about food quality' (EEA, 2017:12). Others point to the need to take into account local conditions, as

some areas are more suited for high-productive farming systems than others, and the fact that intensive systems save land which, in for instance Africa, is becoming increasingly scarce (Nkamleu, 2011). The current key word is 'sustainable intensification', that is aiming for higher yields and reduction in inputs without increasing overall environmental impacts.

Despite the trend to intensification, large areas of Europe still have low-intensity agriculture, especially in more mountainous areas or other less favoured areas. As such, this type of agriculture delivers non-food services like biodiversity and local products and contributes to social cohesion and management of natural resources, especially land. In terms of employment the role of primary agriculture is very small, and keeping rural areas viable from an economic point of view requires a diversification of the economy.

5.2.3 Food chain

In general, the same trends as in the primary sector of increasing scale of production and increasing capital/labour ratio (reduction in labour input) hold for the up- and downstream sectors in the food chain. Fewer and larger food companies produce the food we need in the EU, fewer and larger companies supply the input necessary for farm/food production like fertilisers, seed, agrochemicals (plant protection agents) and machinery. The concentration is noticeable in the retail as well, in the EU the 10 biggest grocery chains account for almost 50% of food retail sales (Agrifood Atlas, 2017). According to the Agrifood Atlas, the concentration of power is a driving force of industrialisation of the agricultural sector along the entire global value chain, with detrimental effects for the environment, the climate and social welfare.

'Disruptive technologies'
ICT and the possibilities this may create for other business models within the agriculture and food sectors is a trend of increasing importance. For instance self-driving tractors, the use of drones for spotting plant diseases and on the spot spraying, the use of big data to improve production processes, etc. ICT-driven examples related to retail are the uptake of food delivery by Amazon, the creation of pick-up points for groceries by Walmart and on-line webshops of A-brands like Nespresso. Recently, Auchan, one of France's leading retail groups, announced it would open several hundred shops without checkout counters in China by the end of 2017 (CD, 2017). This 'mini-supermarket' has been developed together with Hisense, a global operating firm in electronics and home appliances. This type of developments may have 'disruptive' effects on the current role and position of the 'old' retailers in the food chain. As the big retail companies exert a lot of influence in the food chain, through their policies of product placing, preferred suppliers and the quality standards they apply, this changes in logistic may have more effects on the food systems than we currently may foresee.

Public and private standards
Another trend is the increased role of standards and non-tariff restrictions (NTM) - in particular Sanitary and Phytosanitary Rules (SPS) and Technical Barriers to Trade (TBT) - in international trade. In addition to the public standards in the area of food safety, private standards regarding quality and sustainability are also becoming increasingly important. Exports from developing countries are increasingly faced with such non-tariff trade restrictions. These may lead to an important loss of prosperity for producers in exporting countries, but also for consumers in the importing countries. Disruptions also occur in regular trade, partly due to cheap exports ('dumping') of for instance European chicken legs to West Africa, affecting local production in countries such as Senegal, Cameroon and Ghana.

Recent research by Bureau and Swinnen (2017) concludes:

> 'EU food standards have a major impact on trade and global value chains. At the same time they create obstacles and opportunities for developing countries to benefit from access to (rich) EU consumer markets. Empirical evidence documents a mixture of effects in terms of protectionist impacts and of how the institutional organisation of global value chains has adopted to address ever tightening public and private EU standards regarding safety, quality, sustainability and social conditions. Export value chains include both smallholder sourcing

systems and large scale production systems where poor households are employed. In general, studies show that households benefit from inclusion in these value chains, either directly through increased incomes from employment or from contract farming, or indirectly from spillover effects on household farm productivity through better access to inputs and technology'.

5.3 Impact of the trends on the food systems in third countries

In Chapter 3 we found that about three quarters (73%) of EU exports and imports in 2016 was directed at/originated from other EU countries. The other quarter of EU trade is related to third countries. This implies that changes in the EU food systems both affect EU countries and third countries. In this section, we explore the impact of the trends in consumption, production and the food chain in the EU on the food systems in third countries. In particular, we focus on the consequences for trade in cocoa, soy and seafood products.

'Business as usual scenario' in the EU food systems

In the exploration of the impact of possible changes in the EU food systems on the food systems in third countries it is important to have an idea on the extent of these changes. In the previous section we discussed trends in consumption, production and the food chain without indicating whether these trends will affect the volume of trade between the EU and third countries in the future. In this study, we assume a 'business as usual scenario' for the trends in consumption, production and the food chain and the size and direction of EU trade with third countries. Our assumption of the absence of considerable changes could be justified as follows. First, we think that the three consumption trends of flexitarianism, locavorism and conscious consumerism will stay in the fringe of the EU food systems. Maybe they could result in a somewhat smaller EU demand of soy for meat production on the world market. However, such a reduction in EU demand will be compensated for a bigger demand by other countries due to the nutrient transition. Second, we do not expect a sudden change in the current trends in production and the food chain, which implies a continued sustainable intensification of production and an increasing role of NTMs. The main implication of this business as usual scenario for the food systems in third countries is that their exports to the EU will be faced with an increasing role of sustainability and non-tariff measures and that hence production systems need to be adapted accordingly.

Impact on the food systems in third countries

As circumstances differ per country and or region, the impacts outlined here have a global nature. Changing demands of the European processors and retail require an adaptive response by farmers and/or other parts of the food value chain. If farmers and the food value chain are able to do so, this may result in benefits for both farming and the wider economy (through processing and packaging). Export crops such as soy, cocoa and seafood help increase the capacity of local producers to invest and may offer them an exit from the vicious circle of subsistence agriculture. However, for low- and middle-income countries the necessary transformation of their food systems presents challenges for producers, especially smallholders. Domestic barriers, like lack of access to finance, markets and transport, as well as the barriers created by standards on quality, traceability and certification, often make their participation in integrated value chains very difficult. In many countries, the ongoing fragmentation of farmland may further hinder smallholder farmers' capacity to adopt new technologies.

Initiatives to increase the sustainability of chains often focus on certification. Agreements are made, for example, on the minimum remuneration for farmers ('Fair Trade') and farm workers ('Living Wage'), or instructions are given for improving the production method (Utz - 'Good Agicultural Practices') or sustainability of production ('Rainforest Alliance'). The case studies for soy and cocoa show that these are important aspects to focus on, but also that more action is required from public and private parties to achieve the goals incorporated in the agreements.

Certification is increasingly being applied to tropical crops such as coffee, cocoa, tea, bananas, soy and palm oil. It is intended as a strategy to make trade more sustainable and inclusive, but impact studies show that overall effects are rather modest and tend to reduce over time (Ruben, 2017). More promising routes are sector-wide agreements and covenants to use only sustainable products (such as sustainable timber in the construction business).

Diverging impact of EU food retail on the global food systems

In general food retailers in the EU are increasingly emphasising products that are certified as being organic, natural or responsibly/sustainably produced (e.g. MSC, ASC)(Duijn et al., 2016). Some European retailers are now requiring their suppliers to comply with specific standards for specific products while others have developed their own sourcing standards and policies. However, although the EU is considered a single market the food retail sectors of the various MS remain segmented and therefore the retail landscape in different MS has very different characteristics. For example, while the UK's food retail sector is considered to be one of the most competitive food retail markets in the world, the more established retailers in Germany compete on quality instead of price. These and other differences in the EU retail landscape have consequences for the impact of individual MS on the global food systems.

6 Future perspectives

6.1 Governance

Europe is a leading global player in food and agriculture, and its food systems is deeply linked with other regions. This paper has illustrated for three products how food systems in countries outside the EU are coupled to the EU systems through trade, and has sketched the wider set of exchanges and impacts connected to this trade.

The EU has committed to a global development agenda embodied in the Sustainable Development Goals (SDGs). Food systems are directly, and most pertinent, related to the goals of SDG2, i.e. to end hunger, achieve food security and improved nutrition and promote sustainable agriculture. As has become clear from the analysis in this report, progress on food systems outcomes in the domain of food security and nutrition has to be linked to wider socio-economic outcomes (development, equity) and environmental outcomes. The implication is that food systems solutions will sit at the intersection of multiple SDGs and levels of decision-making.

Demand for a global systems approach

The issue of global food and nutrition security (FNS) is therefore complex: multiple types of malnutrition may exist within the same country, household or individual. There is a broad array of immediate causes of malnutrition, including inadequate availability of and access to safe, diverse, nutritious food; lack of access to clean water, sanitation and health care; and inappropriate child feeding and adult dietary choices. Its multidimensional root causes encompass the broader economic, social, political, cultural and physical environment which give way to feedbacks and trade-offs. The compounding challenges in the environment – be it urbanisation, land degradation or climate change – are well known.

In view of these multi-scale and multi-dimensional dependencies, global food and nutrition security is in search of new modes of governance (e.g. Lang, 2010; Lang and Barling, 2012; Clapp and Murphy 2013; Sonnino et al., 2016; von Braun and Birner, 2016). In the realms of decision-making, business, civil society and science there is a call for innovative, integrated governance approach for global FNS policies. Currently there is a shortage of clear vision by international organisations or policymakers how such an integrated approach should or could look like. There is an urgency to come up with coherent visions and actions that are in line with people needs and desires; as conventional supply-side paradigms are being replaced, debates on news paradigm are not conclusive and point at many uncertainties. Recent reviews (von Braun and Birner, 2016; Eklin et al., 2014) conclude that global and multi-country governance systems have been adapted in response to repeated crisis, but with a reform agenda that indicates unfinished business. One important area is in the governance of trade policies. There is ample attention to the manifold purposes of agricultural trade in the context of food security, and its unrealised potential in this respect (Torero, 2016).

How global systems analysis can inspire new forms of governance

Our food systems has become increasingly complex. Value chains are becoming longer, with more and more actors involved at different stages. Food is transported over longer distances and more resources are used to produce and process food than ever before. Systems thinking can help to understand this increasing complexity by employing a selection of perspectives:

- *Trade-offs*: One aspect of our increasingly complex food systems that has become more prominent over the past decades is the issue of trade-offs. To what extent do we use agricultural land for feed or fuel or fibre production if it can also be used for food? How do we ensure preservation of biodiversity while the need for new production areas keeps rising (i.e. competing claims on land resources)? Also, increasing agricultural production to feed a growing population may add to CO_2 emissions while emission reduction is necessary to combat climate change impacts. How to

accommodate the nutrition transition towards more animal based diets without compromising other food systems goals?

- *Tipping points*: Another aspect that has received increasing attention is the issue of tipping points. Scientific evidence shows that a lot of processes in our global ecosystem are non-linear, with small changes in one area having large implications for other areas when certain levels are exceeded. An example is climate change, where global warming beyond 2 degrees is expected to have large and irreversible effects.

- *Feedback mechanisms*: We have become increasingly aware of the interdependencies between different elements of our food systems. Especially the relation between agricultural production and our natural environment shows how our food systems can cause changes in the ecosystem that affect our food production capacity. An example is soil degradation due to agricultural practices, which in turn limits productive potential.

6.2 New research and policy perspectives

There are many dependencies between geographically distant food systems, and trade flows are tangible connectors between food systems, yet there are many more examples. For the purpose of this paper, the concept of *telecoupling* is particularly useful as a tool to tie distant places together in global systems analysis. We briefly explain and illustrate the concept.

Telecoupling refers to socio-economic and environmental interactions over distances, in particular at international scales (Liu et al., 2015). Telecoupling is an extension of what is referred to in geography as teleconnections, which is used to describe distant relations within disciplinary boundaries. Examples of distant interactions within the natural system are climate teleconnections (distant interactions between climate systems) and urban land teleconnections (land changes that are linked to underlying urbanisation dynamics); economic globalisation is an example of distant interactions between human systems (Liu et al. 2013). The telecoupling framework has been applied to trade of food and forest products, as well as other governance issues across spatial scales, such as global land-use and land change science, international land deals, species invasion, and payments for ecosystem services programs. We illustrate the potential value of the telecoupling framework for an understanding and the governance of EU's impact on global food systems with two examples.

Global trade and telecoupling in relation to SDG2 (End hunger, achieve food security and improved nutrition and promote sustainable agriculture) and SDG10 (Reduce inequality within and among countries)
Telecoupling concepts provide novel perspectives on the effectiveness of the trading system in contributing to global food and nutrition security. As food distributed through the global trading system contains nutrients that were harvested from soils and from open water, international trade can be represented as a means to deplete or replenish the domestic nutrient availability of the trading partners. Net food importers can, in this perspective, be net nutrient exporters and vice versa.

A recent analysis by ecologists has analysed the net effect of trade on the equality of nutrient distribution, in terms of net domestic nutrient availability for consumption (Wood et al. 2018). A starting point in the analysis is that there are sufficient nutrients available for nutrition, not only in terms of energy requirements but also in terms of key nutrients: the amount of food produced before accounting for waste and non-food uses is more than sufficient to meet the needs of the global population, ranging from between five times (protein) and two times (calcium) the current world population. A counterfactual world without trade is presented by removing exported and imported quantities in a straightforward accounting framework based on FAO food balance sheet data. The authors find that global food trade makes the global distribution of macronutrients and micronutrients across countries more equal and more in line with nutrient needs for most countries. For some low-income countries, trade is a source of depletion of particular nutrient stocks, including for iron, which is associated with major malnutrition challenges. At the same time trade introduces dependencies that can create sources of risk. It points to the need for global governance in the trading system to account

better for the interests of countries on both the sending and receiving end of nutrient trade. The overriding focus on staples in trade and agricultural policies can be challenged from this perspective. Wood et al. (2018) recognise that the simple computational counterfactual does little justice to the complex relations of the global trading system and food and nutrition security. A recent scenario analysis using a suite of advanced integrated assessment models identified significant trade-offs between equity considerations and environmental sustainability considerations in trade, in particular around agricultural contributions to climate change mitigation strategies (Shutes et al. 2017a).

Global trade and telecoupling in relation to SDG14 (Conserve and sustainably use the oceans, seas and marine resources)
Footprints of the use of land, energy or water in production are a common example of telecoupled environmental impacts. Deforestation and land degradation have also been studied with global trade as a driver, and EU trade in particular, for instance in relation to EU policies on palm oil (Bureau and Swinnen, 2017). We revert back to the case study on fisheries to illustrate the relation between trade and the environmental impact of telecoupled food systems.

At present, seafood consumption in the EU is based on a globally unequal sharing of a common resource, and strategies based on production and consumption are needed to bring balance (Hornborg, Bergman and Ziegler, 2016).[20] EU consumer preferences are telecoupled with the loss of ecosystem services in the high seas. The typical consumer in the EU holds a preference for seafood species at the top of the food web. The loss of top predators has been related to cascading effects on the planet's ecosystem functioning. During history of exploitation, fisheries have severely depleted predatory fish, caused collapse of major fish stocks, severely impacted seafloor structure and function and caused biodiversity loss of target and non-target species. In global capture fisheries, the EU, together with the US and Japan, dominate the value chains. The telecoupled impact on the interconnected human and environmental system is that countries with food insecurity and high prevalence of undernourishment often serve as net exporters of seafood today. Future EU seafood consumption from capture fisheries has to either be based on increased utilisation of available resources (by-products, fish used for feed today) or might have to decrease to achieve global food security; otherwise populations of developing countries may be severely affected. In SUSFANS, researchers explore an innovation towards 'fishing at equilibrium', i.e. to optimise long-term yield through fishing at maximum sustainable yield, as a strategy to find synergies between healthier diets in EU and putting an end to over-exploitation of fishing grounds.

6.3 Recommendations

Food systems approaches
This paper adopted a food systems approach in analysing the global dimensions of food production and consumption in the EU. The burgeoning field of food systems research provides new perspectives and concepts for analysis, both for work within scientific disciplines (addressing teleconnections) and in a multidisciplinary setting in studies that explore the interaction between human and environmental systems in distant locations (telecoupling). Insights from these emerging perspectives will be an inspiration for innovation in the governance of food systems.

Data
In the analysis of complex and dynamic food systems, data requirements expand rapidly for every scale that is brought within the scope of analysis. The multiple interactions of food systems with the Sustainable Development Goals, with the Zero Hunger goal (SDG2) at the core of a web of interactions with other SDGs, form possible cascades in analyses that again call for expanding data needs. It is recommended from this perspective to invest in data linking and data access particularly across the subsystems of food systems, and to allow multidisciplinary studies. Open data initiatives such as the Global Open Access Data Network present a remarkable opportunity for food systems

[20] This section is based on a case study in SUSFANS on the potential role of capture fish and aquaculture in a transformation towards a sustainable and healthy European diet, by Hornborg et al. (2016). For further detail and for references we refer the reader to this paper.

research in LMIC. The brunt of open data in LMIC is geared to support research on agriculture, livelihoods and environmental impact; it covers much less of the perspectives on food processing & transformation, on distribution & provision, and on increasingly complex behavioural drivers of food choice, habitual diets and nutrition outcomes. The brunt of data on the downstream food systems activities sits with the private sector, in LMIC as well as in the EU.

Partnership

Food systems challenges cross both boundaries and borders, and are intrinsically not different in EU than in African or Asian countries. They require partnership. Transformation commences with shared insight into challenges, as well as the analysis of the barriers and catalysts for behaviour change in the system. Experimental approaches are a core element of systems approach to research and innovation. More attention is needed for changes in the food consumer culture through diffusing social norms and habits regarding eating preferences or practices. Such (subtle) changes can be (secretly) cultivated by food companies, advertising and marketing, food policies or changes in the food environment (e.g. new food outlets or developments in the affordability or accessibility of particular food products). Soft values such as knowledge, environmental management, consumer preferences, even impacts on SDGs are embedded in material trade flows and financial values. In this regard, the impact of foreign direct investment (FDIs) on food systems outside the EU and the potential for sustainable finance warrants specific attention. With recognition of the cultural context to problem definition and perspectives on solutions, the commonalities and shared interests between EU and its global partners in addressing food security challenges provide a platform for mutually beneficial international collaboration in the area of food systems science and innovation.

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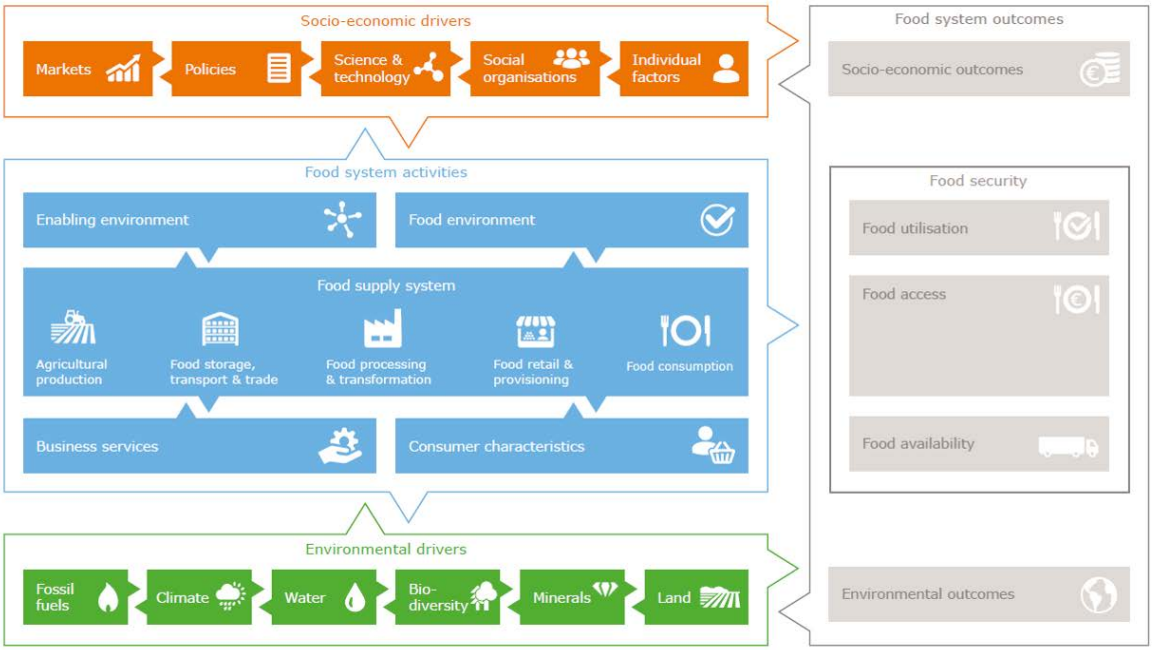
Appendix 1 The food systems approach



Appendix 2 Trade figures

Table A2.1 *Total EU agricultural imports and EU agricultural exports, 2000-2016*

	Value (bn €)		% total trade	
	2000	2016	2000	2016
Imports				
Total	256	533	100	100
intra trade	177	386	69	73
extra trade	79	146	31	27
Exports				
Total	246	541	100	100
intra trade	184	393	75	73
extra trade	61	148	25	27

Source: Eurostat (COMEXT); adaptation Wageningen Economic Research.

Table A2.2 *Share of product groups in total agricultural EU imports from third countries, 2000-2016 (%)*

	2000	2016
03 - Fish and crustaceans, molluscs and other aquatic invertebrates	12	14
08 - Edible fruit and nuts; peel of citrus fruits or melons	10	13
21 – Misc. edible (food) preparations	18	9
09 - Coffee, tea, mate and spices	7	7
12 - Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medical plants; straw and fodder	7	7
23 - Residues and waste from the food industries; prepared animal fodder	7	7
15 - Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes	3	6
18 - Cocoa and cocoa preparations	2	5
22 - Beverages, spirits and vinegar	4	4
20 - Preparations of vegetables, fruit, nuts or other parts of plants	4	4
16 - Preparations of meat, fish or crustaceans, molluscs or other aquatic invertebrates	3	4
07 - Edible vegetables and certain roots and tubers	3	3
10 - Cereals	2	3
02 - Meat and edible meat offal	3	3
24 - Tobacco and manufactured tobacco substitutes	4	2
21 - Miscellaneous edible preparations	6	2
17 - Sugars and sugar confectionery	2	2
06 - Live trees and other plants; bulbs, roots and the like; cut flowers and ornamental foliage	2	1
19 - Preparations of cereals, flour, starch or milk; pastrycooks' products	1	1
04 - Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included	1	1
05 - Products of animal origin not elsewhere specified or included	1	1
13 - Lacs; gums, resins and other vegetable saps and extracts	1	1
01 - Live animals	1	0
11 - Products of the milling industry; malt; starches; inulin; wheat gluten	0	0
14 - Vegetable plaiting materials; vegetable products not elsewhere specified or included	0	0
Total	100	100

Source: Eurostat (COMEXT); adaptation Wageningen Economic Research.

Table A2.3 *Share of product groups in total agricultural EU exports to third countries, 2000-2016 (%)*

	2000	2016
22 - Beverages, spirits and vinegar	19	19
Other	13	12
19 - Preparations of cereals, flour, starch or milk; pastrycooks' products	5	8
02 - Meat and edible meat offal	6	7
04 - Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included	9	7
10 – Cereals	5	5
21 - Miscellaneous edible preparations	5	5
24 - Tobacco and manufactured tobacco substitutes	4	4
15 - Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes	4	4
20 - Preparations of vegetables, fruit, nuts or other parts of plants	3	3
18 - Cocoa and cocoa preparations	2	3
23 - Residues and waste from the food industries; prepared animal fodder	2	3
03 - Fish and crustaceans, molluscs and other aquatic invertebrates	3	3
08 - Edible fruit and nuts; peel of citrus fruits or melons	2	2
07 - Edible vegetables and certain roots and tubers	2	2
12 - Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medical plants; straw and fodder	1	2
11 - Products of the milling industry; malt; starches; inulin; wheat gluten	3	2
01 - Live animals	2	2
17 - Sugars and sugar confectionery	4	2
06 - Live trees and other plants; bulbs, roots and the like; cut flowers and ornamental foliage	2	1
09 - Coffee, tea, mate and spices	1	1
16 - Preparations of meat, fish or crustaceans, molluscs or other aquatic invertebrates	2	1
13 - Lacs; gums, resins and other vegetable saps and extracts	1	1
05 - Products of animal origin not elsewhere specified or included	1	1
14 - Vegetable plaiting materials; vegetable products not elsewhere specified or included	0	0
Total	100	100

Source: Eurostat (COMEXT); adaptation Wageningen Economic Research.

Table A2.4 *Share of each geographical bloc in EU imports, 2000-2016*

value	Value (bn €)		% total trade		% extra trade	
Row Labels	2000	2016	2000	2016	2000	2016
EU28	177	386	69	73		
Rest of Europe	10	25	4	5	12	17
Middle East and Northern Africa	2	5	1	1	3	3
Subsahara Africa	10	17	4	3	13	12
Rest of Asia	18	37	7	7	23	25
Northern and Central America (Northern America. Central America and Caribbean)	17	24	7	5	21	16
Latin America	17	32	7	6	21	22
Oceania	5	5	2	1	6	4
Unknown	1	1	0	0	1	1
Total	256	533	100	100		
Intra trade	177	386	69	73		
Extra trade	79	146	31	27	100	100

Source: Eurostat (COMEXT); adaptation Wageningen Economic Research.

Table A2.5 *Share of each geographical bloc in EU exports, 2000-2016*

	Value (bn €)		% total trade		% extra trade	
Row Labels	2000	2016	2000	2016	2000	2016
EU28	184	393	75	73		
Rest of Europe	12	27	5	5	19	18
Middle East and Northern Africa	4	10	2	2	7	7
Subsahara Africa	4	9	1	2	6	6
Rest of Asia	21	59	9	11	34	40
Northern and Central America (Northern America. Central America and Caribbean)	15	31	6	6	24	21
Latin America	2	4	1	1	3	3
Oceania	1	4	1	1	2	3
Unknown	2	4	1	1	4	3
Total	246	541	100	100		
Intra trade	184	393	75	73		
Extra trade	61	148	25	27	100	100

Source: Eurostat (COMEXT); adaptation Wageningen Economic Research.

Table A2.6 *Top-three of most important product groups in imports to the EU28 and exports from the EU28 per geographical bloc, 2000-2016*

		Imports from geographical bloc to the EU28		EU28 exports to geographical bloc	
	Rank	Group no.	product	Group no.	product
Rest of Europe	1	3	03 - Fish and crustaceans, molluscs and other aquatic invertebrates	22	22 - Beverages, spirits and vinegar
	2	10	10 - Cereals	2	02 - Meat and edible meat offal
	3	15	15 - Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes	8	08 - Edible fruit and nuts; peel of citrus fruits or melons
Middle East and Northern Africa	1	7	07 - Edible vegetables and certain roots and tubers	10	10 - Cereals
	2	8	08 - Edible fruit and nuts; peel of citrus fruits or melons	4	04 - Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included
	3	3	03 - Fish and crustaceans, molluscs and other aquatic invertebrates	5	05 - Products of animal origin not elsewhere specified or included
Sub-Saharan Africa	1	18	18 - Cocoa and cocoa preparations	22	22 - Beverages, spirits and vinegar
	2	8	08 - Edible fruit and nuts; peel of citrus fruits or melons	4	04 - Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included
	3	9	09 - Coffee, tea, mate and spices	10	10 - Cereals

		Imports from geographical bloc to the EU28		EU28 exports to geographical bloc	
	Rank	Group no.	product	Group no.	product
Rest of Asia	1	15	15 - Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes	22	22 - Beverages, spirits and vinegar
	2	3	03 - Fish and crustaceans, molluscs and other aquatic invertebrates	2	02 - Meat and edible meat offal
	3	8	08 - Edible fruit and nuts; peel of citrus fruits or melons	19	19 - Preparations of cereals, flour, starch or milk; pastrycooks' products
Northern and Central America (Northern America. Central America and Caribbean)	1	8	08 - Edible fruit and nuts; peel of citrus fruits or melons	22	22 - Beverages, spirits and vinegar
	2	12	12 - Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medical plants; straw and fodder	4	04 - Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included
	3	22	22 - Beverages, spirits and vinegar	19	19 - Preparations of cereals, flour, starch or milk; pastrycooks' products
Latin America	1	23	23 - Residues and waste from the food industries; prepared animal fodder	22	22 - Beverages, spirits and vinegar
	2	8	08 - Edible fruit and nuts; peel of citrus fruits or melons	15	15 - Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes
	3	12	12 - Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medical plants; straw and fodder	21	21 - Miscellaneous edible preparations
Oceania	1	2	02 - Meat and edible meat offal	22	22 - Beverages, spirits and vinegar
	2	22	22 - Beverages, spirits and vinegar	21	21 - Miscellaneous edible preparations
	3	12	12 - Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medical plants; straw and fodder	19	19 - Preparations of cereals, flour, starch or milk; pastrycooks' products

Source: Eurostat (COMEXT); adaptation Wageningen Economic Research.

Table A2.7 *Share of each income bloc in EU imports, 2000-2016*

	Value (bn €)		% total trade		% extra trade	
	2000	2016	2000	2016	2000	2016
High income	27	43	11	8	34	29
Upper middle income	33	60	13	11	42	41
Lower middle income	16	38	6	7	20	26
Low income	3	4	1	1	4	2
Unknown	1	1	0	0	1	1
EU28	177	386	69	73		
Total	256	533	100	100		
intra trade	177	386	69	73		
extra trade	79	146	31	27	100	100

Source: Eurostat (COMEXT); adaptation Wageningen Economic Research.

Table A2.8 *Share of each income bloc in EU exports, 2000-2016*

	Value (bn €)		% total trade		% extra trade	
Row Labels	2000	2016	2000	2016	2000	2016
High income	35	77	14	14	57	52
Upper middle income	15	44	6	8	25	30
Lower middle income	8	20	3	4	12	14
Low income	1	3	1	0	2	2
Unknown	2	4	1	1	4	2
EU28	184	393	75	73		
Total	246	541	100	100		
intra trade	184	393	75	73		
extra trade	61	148	25	27	100	100

Source: Eurostat (COMEXT); adaptation Wageningen Economic Research.

Table A2.9 *Top-three of most important product groups in imports to the EU28 and exports from the EU28 per income bloc, 2000-2016*

	Imports from income bloc to the EU28			EU28 exports to income bloc	
	Rank	Group no.	product	Group no.	product
High income countries	1	3	03 - Fish and crustaceans, molluscs and other aquatic invertebrates	22	22 - Beverages, spirits and vinegar
	2	8	08 - Edible fruit and nuts; peel of citrus fruits or melons	19	19 - Preparations of cereals, flour, starch or milk; pastry cooks' products
	3	12	12 - Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medical plants; straw and fodder	4	04 - Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included
Upper middle income countries	1	8	08 - Edible fruit and nuts; peel of citrus fruits or melons	22	22 - Beverages, spirits and vinegar
	2	23	23 - Residues and waste from the food industries; prepared animal fodder	4	04 - Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included
	3	3	03 - Fish and crustaceans, molluscs and other aquatic invertebrates	2	02 - Meat and edible meat offal
Lower middle income countries	1	15	15 - Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes	10	10 - Cereals
	2	18	18 - Cocoa and cocoa preparations	4	04 - Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included
	3	9	09 - Coffee, tea, mate and spices	22	22 - Beverages, spirits and vinegar
Low income countries	1	9	09 - Coffee, tea, mate and spices	10	10 - Cereals
	2	24	24 - Tobacco and manufactured tobacco substitutes	19	19 - Preparations of cereals, flour, starch or milk; pastry cooks' products
	3	3	03 - Fish and crustaceans, molluscs and other aquatic invertebrates	2	02 - Meat and edible meat offal

Source: Eurostat (COMEXT); adaptation Wageningen Economic Research.

Table A2.10 *Share of each bloc of lower middle income and low income countries according to their trade relations in EU imports, 2000-2016*

	Value (bn €)		% total trade		% total trade lmi and li countries	
Row Labels	2000	2016	2000	2016	2000	2016
Countries with EBA agreement	3	5	1	1	17	11
Countries with GSP and GSP+	11	27	4	5	57	66
Other LMI and LI countries	5	10	2	2	26	23
ROW (including EU)	237	491	93	92		
Total	256	533	100	100		
ROW (including EU)	237	491	93	92		
Total LMI and LI countries	19	42	7	8	100	100

Source: Eurostat (COMEXT); adaptation Wageningen Economic Research.

Table A2.11 *Share of each bloc of lower middle income and low income countries according to their trade relations in EU exports, 2000-2016*

	Value (bn €)		% total trade		% total trade LMI and LI countries	
Row Labels	2000	2016	2000	2016	2000	2016
Countries with EBA agreement	2	4	1	1	22	19
Countries with GSP and GSP+	3	10	1	2	38	44
Other LMI and LI countries	4	8	1	2	39	36
ROW (including EU)	237	518	96	96		
Total	246	541	100	100		
ROW (including EU)	237	518	96	96		
Total LMI and LI countries	9	23	4	4	100	100

Source: Eurostat (COMEXT); adaptation Wageningen Economic Research.

Table A2.12 *Top-three of most important product groups in imports to the EU28 and exports from the EU28 per bloc of lower middle income and low income countries according to their trade relations with the EU, 2000-2016*

		Imports to the EU28		Exports by the EU28	
	Rank	Group no.	product	Group no.	product
Lower middle income and low income countries with an Everything but Arms (EBA) arrangement for least developed countries	1	3	03 - Fish and crustaceans, molluscs and other aquatic invertebrates	10	10 - Cereals
	2	9	09 - Coffee, tea, mate and spices	22	22 - Beverages, spirits and vinegar
	3	24	24 - Tobacco and manufactured tobacco substitutes	19	19 - Preparations of cereals, flour, starch or milk; pastry cooks' products
Lower middle income and low income countries with a GSP and GSP+ agreement	1	18	18 - Cocoa and cocoa preparations	4	04 - Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included
	2	15	15 - Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes	22	22 - Beverages, spirits and vinegar
	3	9	09 - Coffee, tea, mate and spices	10	10 - Cereals
Other lower middle income and low income countries (i.e. countries without an EBA, GSP or GSP+ agreement)	1	8	08 - Edible fruit and nuts; peel of citrus fruits or melons	10	10 - Cereals
	2	7	07 - Edible vegetables and certain roots and tubers	4	04 - Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included
	3	15	15 - Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes	19	19 - Preparations of cereals, flour, starch or milk; pastrycooks' products

Source: Eurostat (COMEXT); adaptation Wageningen Economic Research.

Appendix 3 Overview EU28 food system impacts on global food systems

Table A3.1 *Seafood imports from capture fisheries*

	Competitiveness of agrifood business (economic)		Reduction of environmental impacts (environmental)		Equitable outcomes and conditions (social)		Health and safety	
	Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative
Inputs and services	Jobs							
Primary production	Jobs			Pressure on marine resources and ecosystems Killing of endangered species		Hazards and conditions of work Human rights abuses		
Food processing & transformation	Jobs			High energy use		Hazards and conditions of work Human rights abuses		
Food storage, transport and trade	Jobs			High energy use particularly in airfreight		Hazards and conditions of work Human rights abuses		
Food retail & provisioning	Jobs							
Food consumption							Types and volumes of fish available locally	Types and volumes of fish available locally
Food waste	Jobs			Pressure on marine resources and ecosystems				

* Empty cells do not necessarily indicate that there is no impact, but merely that no impact was either found and/or investigated during this study

Table A3.2 *Seafood imports from aquaculture*[*]

	Competitiveness of agrifood business (economic)		Reduction of environmental impacts (environmental)		Equitable outcomes and conditions (social)		Health and safety	
	Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative
Inputs and services	Jobs			Pressure on terrestrial, fresh water and marine resources and ecosystems Biodiversity impact Land degradation		Human rights abuses		Antibiotic resistance in humans Inappropriate use of chemicals and hormones
Primary production	Jobs			Pressure on terrestrial, fresh water and marine resources and ecosystems		Hazards and conditions of work Human rights abuses		Antibiotic resistance in humans Inappropriate use of chemicals and hormones
Food processing & transformation	Jobs			High energy use		Hazards and conditions of work Human rights abuses		
Food storage, transport and trade	Jobs			High energy use particularly in airfreight		Hazards and conditions of work Human rights abuses		
Food retail & provisioning	Jobs							
Food consumption							Types and volumes of fish available locally	Types and volumes of fish available locally
Food waste	Jobs			Pressure on marine resources and ecosystems				

[*] Empty cells do not necessarily indicate that there is no impact, but merely that no impact was either found and/or investigated during this study

Table A3.3 *Seafood exports*[*]

	Competitiveness of agrifood business (economic)		Reduction of environmental impacts (environmental)		Equitable outcomes and conditions (social)		Health and safety	
	Positive	**Negative**	**Positive**	**Negative**	**Positive**	**Negative**	**Positive**	**Negative**
Inputs and services	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Primary production	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Food processing & transformation	Jobs							
Food storage, transport and trade	Jobs							
Food retail & provisioning	Jobs							
Food consumption							Types and volumes of fish available locally	Types and volumes of fish available locally
Food waste	Jobs			Pressure on marine resources and ecosystems				

[*] Empty cells do not necessarily indicate that there is no impact, but merely that no impact was either found and/or investigated during this study

Table A3.4 *EU28 Aquaculture production*[*]

	Competitiveness of agrifood business (economic)	Reduction of environmental impacts (environmental)	Equitable outcomes and conditions (social)	Health and safety
Inputs and services	*Positive*: jobs *Negative*: Less jobs compared to using consumption grade fish directly for human consumption.	*Positive*: Shift to terrestrial ingredients reduces pressure on capture fisheries and shifts direct biodiversity impacts away from the sea *Negative:* Shift to terrestrial ingredients shifts direct biodiversity impacts towards the land Increase in direct and indirect biodiversity impact in the terrestrial environment Pressure on terrestrial, fresh water and marine resources and ecosystems Increase in indirect biodiversity impact in the fresh water and marine environment increase the pressure on freshwater resources increase soil erosion, deplete soil organic carbon, heighten emission of CO_2 and other greenhouse gasses from the soil to the atmosphere, and aggravate the risks of climate change		*Negative:* The use of marine and terrestrial fish feed ingredients has an effect on the types and volumes of crops, fish and livestock available; prices; equitability of access
Primary production	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Food processing & transformation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Food storage, transport and trade	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Food retail & provisioning	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Food consumption	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Food waste	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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Table A3.5 *Capture fisheries in waters beyond the national jurisdiction of EU MS*[*]

	Competitiveness of agrifood business (economic)		Reduction of environmental impacts (environmental)		Equitable outcomes and conditions (social)		Health and safety	
	Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative
Inputs and services						Displaces foreign investors and local entrepreneurs		
Primary production		Aggravate poverty		Pressure on terrestrial, fresh water and marine resources and ecosystems		Displaces foreign investors and local entrepreneurs		Contributes to conflicts and dislocations
Food processing & transformation	Jobs					Displaces foreign investors and local entrepreneurs Hazards and conditions of work Human rights abuses		
Food storage, transport and trade	Jobs					Displaces foreign investors and local entrepreneurs Hazards and conditions of work Human rights abuses		
Food retail & provisioning	Jobs					Displaces foreign investors and local entrepreneurs		
Food consumption							Types and volumes of fish available locally	Types and volumes of fish available locally
Food waste	Jobs			Pressure on marine resources and ecosystems				

[*] Empty cells do not necessarily indicate that there is no impact, but merely that no impact was either found and/or investigated during this study.

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REPORT
2018-051

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The mission of Wageningen University and Research is "To explore the potential of nature to improve the quality of life". Under the banner Wageningen University & Research, Wageningen University and the specialised research institutes of the Wageningen Research Foundation have joined forces in contributing to finding solutions to important questions in the domain of healthy food and living environment. With its roughly 30 branches, 5,000 employees and 10,000 students, Wageningen University & Research is one of the leading organisations in its domain. The unique Wageningen approach lies in its integrated approach to issues and the collaboration between different disciplines.