Transition Pathways - Analyzing Transitions in Food Systems

A Synthesis of seven case studies

Just Dengerink, Nina de Roo, Marijke Dijkshoorn - Dekker, Bram Bos, Bas Hetterscheid, Marloes Kraan, Johann Bonnand, Wim de Haas, Vincent Linderhof1

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1 Introduction

Food systems around the world face challenges in providing sufficient, healthy and nutritious food for all. Food system transformations are needed for these food systems to achieve the necessary food & nutrition security within environmental boundaries. The "Transition Pathways and Integral Findings" project (motif) from the KB programme Food and Water Security (KB-35) of Wageningen University and Research, hereafter called the 'TransPath' project, aims to develop an analytical framework to study these food system transformations to guide future policy food policy making. The 'TransPath' project runs from 2019-2022.

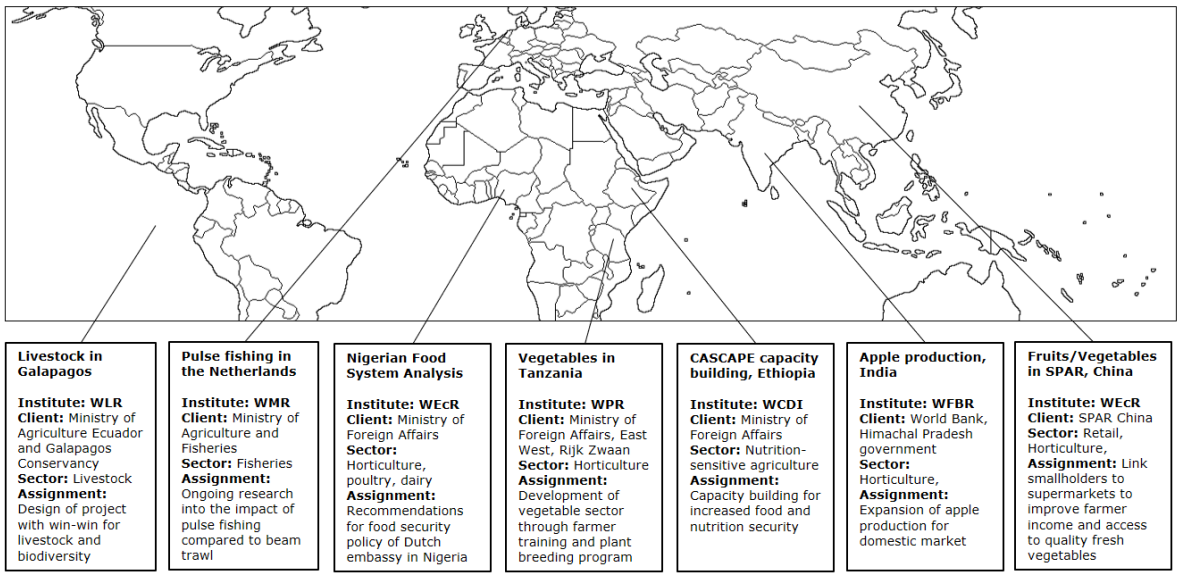
In the first year of this project, a first version of this analytical framework has been completed (Elzen et al, 2020). To test the usefulness of this analytical framework for understanding food system transitions, researchers in the project have applied the framework to case studies of food system transitions from their own work. This paper provides a synthesis of seven case studies from different institutes across Wageningen University & Research, to which the analytical framework has been applied.

Section 2 of this paper presents a descriptive analysis of the case studies. It provides information on the focus and the scope of the case studies, the relevant sustainability challenges, the stakeholders involved in the study, a map of the key food system elements and the food system transition that is envisaged. Section 3 discusses a more in-depth application of the analytical framework. It shows to what extent food systems and transition theories have played a role in the case study, identifies different visions on and contributions to food systems change, describes relevant niches, landscapes and regimes, interesting transitions dynamics and important drivers and barriers to food system change. Finally, section 4 presents some reflections on the usefulness of the analytical framework for understanding food system transitions and outlines some possible ways forward.

2 Case study descriptions

2.1 Focus & scope of case

As Figure 1 shows, the seven case studies covered a wide range of themes, clients, sectors and locations. Research in these case studies covered themes from plant breeding to food production, trading and consumption. These research projects included agricultural sectors as broad as horticulture, livestock, fisheries and cereals. They were related to assignments for government actors, private companies, banks and non-governmental organizations. Geographically, they were spread over four continents: Latin-America, Europe, Asia and Africa. They covered the full range of developing, emerging and developed countries and included smaller as well as larger economies.



Figuur 1 *Location, focus and schope of case studies.*

2.2 Stakeholders involved

The types of stakeholders involved in the different case studies ranged from farmers, fishers, companies and consumers to government actors, development organizations, NGO's and knowledge institutions, see Figure 2. Farmers and fishers involved in the case studies included smallholders as well as more commercial farmers, while consumers ranged from subsistence farmers to middle-class urban consumers. Government actors ranged from Dutch ministries to EU institutions and local governments while knowledge institutions included both Dutch research institutes as well as research institutes abroad.

Farmers / Fishers	Government
• Vegetable producing smallholders in China • Vegetable farmers in Tanzania • Livestock farmers in Galapagos • Apple farmers in Himachal Pradesh, India • Flatfish fishermen from the Netherlands • Ethiopian smallholder farmers	• Dutch Ministry of Foreign Affairs • Dutch Ministry of Agriculture • Dutch Embassy in Nigeria, Tanzania and Ethiopia • Ministry of Agriculture in Ethiopia, Nigeria, Tanzania and Ecuador • Local governments in Ethiopia and Tanzania
Companies	**Development organizations / NGO's**
• Supermarkets China • Fish processors and traders, chefs • Indian retail companies • Extension service companies in Tanzania • Dutch companies (Rijk Zwaan, East West Seeds)	• The World Bank • Galapagos Conservancy • Bloom Association
Consumers	**Knowledge institutions**
• Consumers in urbanised areas in China • Middle-class consumers in India • Rural consumers of Ethiopia • Nigerian rural and urban consumers • Tanzanian vegetable consumers • Flatfish consumers in the EU	• Wageningen Institutes (WLR, WMR, WPR, WFBR, WCDI, WEcR) • KIT Royal Tropical Institute • Research institutes in China • University researchers in Ethiopia

Figure 2 *Stakeholders involved in the case studies.*

2.3 Sustainability Challenges

The case studies in this paper were facing a range of different sustainability challenges, each of which contributed to the need for a food system transformation. Figure 3 shows an overview of the major sustainability challenges in the case studies, covering a range of economic, environmental and social sustainability challenges. Key economic sustainability challenges in the case studies were low production and poverty among farmers, post-harvest losses along the value chain, dealing with high input prices vs low output prices, wider pressures on rural development and increasing reliance on imports.

Environmental sustainability issues ranged from issues around water pollution and water scarcity to the impacts of climate change and decreasing soil fertility, from the impact of fishing on the seafloor and fish stocks to the negative impacts of using too much pesticides and antibiotics. In terms of social sustainability, food insecurity and malnutrition among smallholder farmers featured as important issues in many case studies. On top of that, social exclusion, competition and conflict over land and resources were identified as key sustainability challenges. Finally, economic inequality between groups and gender disparities between men and women were recognized as important issues of social sustainability.

Economic	Environmental	Social
Low production, post-harvest losses (Ethiopia, China, Tanzania, India)	Water pollution (Galapagos), water scarcity (Ethiopia, Nigeria)	Food insecurity, malnutrition (Ethiopia, Nigeria, Tanzania)
Increasing reliance on imports (Nigeria, Galapagos), high input prices (oil) vs low output prices (fish) (Netherlands)	Climate change (Netherlands, Nigeria), soil fertility (Ethiopia), impact on the seafloor and fish stocks (Netherlands)	Social exclusion (Ethiopia), conflicts over land and resources (Nigeria), competition over fish resources (Netherlands)
Pressure on rural development (China), rural poverty (Nigeria, Tanzania, Ethiopia)	Pesticide use (Ethiopia), Antibiotics use; Biodiversity & invasive species (Galapagos),	Gender disparities (Ethiopia), economic inequality (China),

Figure 3 *Sustainability challenges in case studies.*

2.4 Mapping the Food System

The conceptual model of the food system as developed by van Berkum et al (2018) played a central role in the analytical framework that has been developed in the KB "Transition Pathways and Integral Findings" project. This conceptual model was based on the core elements of food systems conceptualizations from recent key food systems publications (Ericksen, 2008; Ingram, 2011; Global Panel, 2016; UNEP, 2016; HLPE, 2017).

In line with these key reports, it identified three key elements of the food system: (1) the *drivers* of the food system (socio-economic and environmental); (2) the food system *activities* (the value chain and its surroundings) and (3) the *outcomes* of the food system (including food security, socio-economic and environmental outcomes).

Analysing the key focus areas of the research in each of the seven case studies, it seems that most of the case studies were focused on the food system activities, and in particular on the activities of actors in the value chain, such as producers and consumers. Food system outcomes had a less central role in most case studies, and focussed mostly on improving food availability, and less on social-economic and environmental outcomes. Moreover, the socio-economic and environmental drivers were not as central to most case studies, as shown by Figure 4.

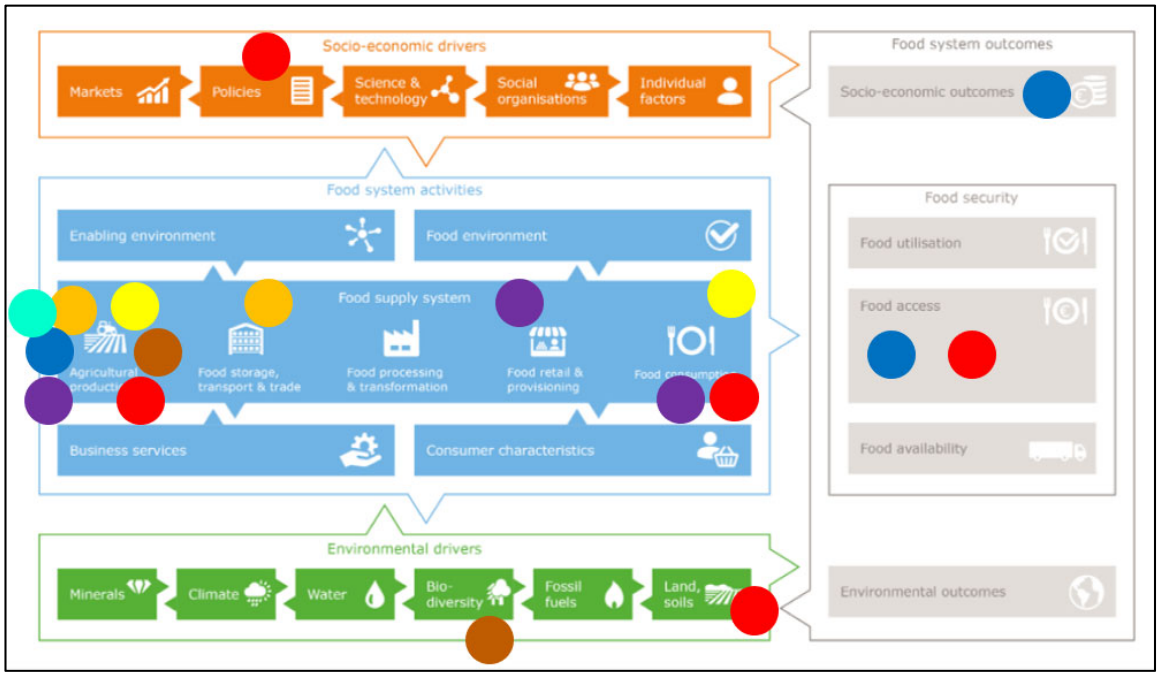


Figure 4 *Focus areas in the food system (van Berkum et al, 20).*

Red = Ethiopia, Orange = India, Yellow = Nigeria, Turquoise = Netherlands, Blue = Tanzania, Purple = China, Brown = Galapagos

2.5 The Food System Transistion

Another key element of the analytical framework used to analyze the case studies was the concept of transitions. Figure 5 shows an overview of the different transitions of the food system that were the focus of each of the case studies. From this overview, it becomes clear that there were large differences in the scale, scope and depth of the transitions in the case studies. These differences will be discussed in more detail in section 3 of this paper.

China	Link vegetable farmers and supermarkets to increase fresh vegetable supply and increase farmer incomes
Ethiopia	Support agricultural transformation towards modern agriculture and improved food security
Galapagos	Use livestock production to reclaim abandoned land, fight invasive species and create ecological corridors
India	Introduce more storage facilities to improve the position and income of Indian apple farmers
Netherlands	Introduce a new practice that can reduce CO2 emissions, lower by-catch and decrease input costs.
Nigeria	Work towards a more sustainable food system with improved food security and nutrition outcomes
Tanzania	Improve plant breeding and farmer training to increase productivity and income of vegetable farmers

Figure 5 *Food system transitions.*

3 Food System Transitions

3.1 Food Systems & Transition Theory

As indicated in the previous section, both conceptual thinking around food systems as well as transition theory were central to the analytical framework (Elzen et al, 2020) that was applied to the seven case studies in this paper (Haasnoot et al 2016). Figure 6 shows to what extent theories around food systems and transition thinking were used to analyse the dynamics in the case studies, and to what extent the use of these theories were helpful to induce any changes in practice in these cases. The same figure also shows to what extent other theoretical concepts were used to analyse (parts) of these cases.

From the Figure 6, it becomes clear that only two out of seven case studies actively used the food systems concept (two cases) and that only one out of seven has made actively use of transition theory. However, in all three cases the use of food systems concepts or transition theory has resulted in changes in practice. Moreover, two other cases used other theoretical concepts to support the research for that case study.

	Nigeria	India	Ethiopia	Tanzania	China	Galapagos	Netherlands
Does the case make use of the food systems concept?	**Yes**	No	No	No	**Yes**	No	No
Does the case make use of any type of transition theory?	No	No	No	No	No	No	**Yes**
Did the use of the food systems concept already lead to changes in practice?	**Yes**	No	No	No	**Yes**	No	No
Did the use of transition theory already lead to actual transitions in practice?	No	No	No	No	No	No	**Yes**
To what extent are other theoretical concepts used?	No	No	**Yes**	No	No	**Yes**	No

Figure 6 *Use of food systems & transition theory.*

3.2 Analysing Food Systems Change

As indicated in the previous section, both conceptual thinking around food systems as well as transition theory were central to the analytical framework (Elzen et al, 2020) that was applied to the seven case studies in this paper (Haasnoot et al 2016). Figure 6 shows to what extent theories around food systems and transition thinking were used to analyse the dynamics in the case studies, and to what extent the use of these theories were helpful to induce any changes in practice in these cases. The same figure also shows to what extent other theoretical concepts were used to analyse (parts) of these cases.

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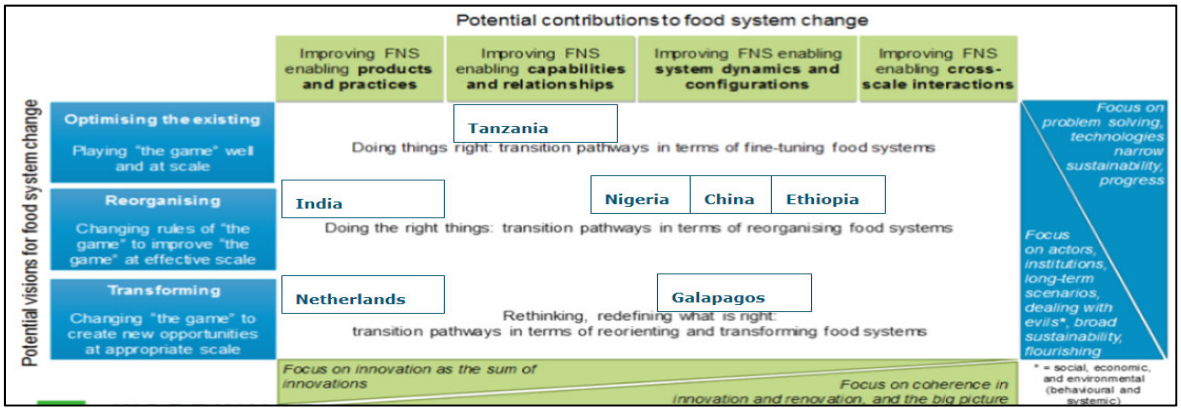

Figure 7 *Visions for and contributions to food systems change (Wigboldus et al, 2019).*

3.3 Niches, Landscape, Regime

Three concepts from transition theory were key to the analytical framework that was used to analyze the seven case studies in this paper: niches, landscape and regime. Under regime we understand the main features of the current system, that needs to be transformed. The landscape is the wider context of a system that can put pressure on the system to change. Niche are alternatives to the present system that are still under development, but have the potential to help transform the food system in the future.

Figure 8 shows an overview of the niches, landscapes and regimes relevant to the seven case studies. It shows how some regimes were covering a whole food system and some only certain parts of a food system. For each case other aspects were important to the landscape driving the system: for some cases these are market forces and developments, for other cases these were policy revisions and for yet others these were discourses about agriculture. Finally, the type of niches also varied significantly: some are farm-level innovations, others *were* financing models, training approaches or simply new ways of working together.

	Nigeria	India	Ethiopia	Tanzania	China	Galapagos	Netherlands
Niches	Agri-business incubators, finance models for small-scale producers	Resilient high-productive trees; advanced storing techniques	Holistic home-garden approach; joint testing of new varieties	Training of trainers, Demonstration plots	Smallholders producing fruits and vegetables for supermarkets	Tourism & local produce	Pulse fishing as socio-technical innovation
Landscape	European regulation of fishing practices	Agricultural policy focused on raising productivity and modernization	Top-down government approach to modernisation & commercialisation	Support from the Tanzanian government remains limited	Changing consumption patterns due to income growth	Tourism skews local economy; high prices, high labour cost	Revision of European regulation of fishing practices
Regime	Lack of investment in agriculture, limited policy implementation	Low-productive apple farms with limited room for investments	Smallholder subsistence farming using local varieties	Low consumption and negative perception of vegetables	Supermarkets with limited connection to vegetable growers	Two regimes: biodiversity conservation versus food sovereignty	Current fishing practices and legislation

Figure 8 *Niches, Landscapes and regimes in the case studies.*

3.4 Drivers and barriers

Finally, another central element to the analytical framework applied to the cases was the assessment of possible drivers and barriers to food systems change. Figure 9 shows a SWOT analysis with internal drivers (strengths), external drivers (opportunities), internal barriers (weaknesses) and external barriers (threats). Interestingly, many case studies experienced similar drivers and barriers to realizing food system transitions.

Strengths	Weaknesses
Stakeholder involvement (Ethiopia, Tanzania)	Lack of implementing capacity (India, Ethiopia, Galapagos)
Technical innovation, strong collaboration in the niche-groups (Netherlands)	Limited education level of farmers (Nigeria, Tanzania)
Holistic approach (Nigeria, Galapagos)	Long experience and old age of farmers (Tanzania, Ethiopia)
Knowledge transfer (Ethiopia, Nigeria, China)	Conflicting perceptions of the way forward (Tanzania)
Sustainable production methods (Tanzania, India)	High turnover of staff in partner organization (India)
Creating win-win situations (Galapagos, Tanzania)	Lack of involving EU actors on time and misreading political room to manouvre (Netherlands)

Opportunities	Threats
Growing middle class (China, Nigeria, Tanzania)	Conflicts (Nigeria, Ethiopia, Netherlands)
Changing consumption patterns (Nigeria, China)	Politics (India, Netherlands)
Policy attention for food security (Nigeria, Ethiopia)	Large informal market (Nigeria, India)
Growing environmental awareness (Galapagos, India)	Import dependency (Nigeria, Galapagos)
Strong case for less impact and CO2 reduction (Netherlands)	Limited entrepreneurial capacity (Tanzania, Galapagos)
	Limited infrastructure (India, Galapagos)
	Traditional habits (China)

Figure 9 *Analysis of strengths, weaknesses, opportunities and threats (SWOT).*

4 Reflections

In this section, we briefly reflect on our experience within the KB "Transition Pathways and Integral Findings" project of applying the first version of our analytical framework to seven case studies from our WUR research.

Overall, the combined use of food systems thinking and transition theory in the analytical framework seems to provide interesting insights in the dynamics of food system transitions of the selected case studies.

The process of selecting relevant cases for this first assessment brought forward the importance of better defining when we can speak of food system transitions, and distinguishing between research projects that have the potential to contribute to wider food system change and projects that are already far underway in realizing this. These different stages (in time) of when projects and their impact are assessed brings different lessons learned. We have seen however that the concepts and methods we used are applicable for these different settings. They can be used to evaluate what happened and can be used to assess preliminary assumptions and make relevant adjustments early in the project.

In addition it is important to realise that projects with a research focus might aim at contributing to a transformation, but that whether or not food systems really change is dependent on not only the uptake of project results, but of many more factors. Transitions are never linear nor rational processes (Haasnoot et al 2016). Practices of actors need to change, which requires willingness and capability; policies or market forces that impact food systems need to change but these are also impacted by other developments or forces which cannot always be predicted or other contextual factors may have an impact.

Not everything can be foreseen and predicted, yet the use of these concepts and methods in projects attempting to contribute to transitions in food systems do highlight a couple of things that often tend to be forgotten: food systems are complex but can be structurally assessed; technical innovations are always *socio*-technical innovations thus always require attention for understanding the wider context in which they take place; analysing whom are relevant stakeholders in a case requires constant attention as this might change during the process.

There in fact is a dynamic interface between the technological development and adoption at the one hand and the influence of social values related to the technological innovation and changing power relations at the other hand (Haasnoot et al 2016). Lastly the aspect of scale is important. Food systems can be assessed at different scale levels. Niche developments can change a regime at a certain scale, yet for wider uptake of the innovation change is also needed at a higher scale level. A successful transformation at a certain level can then be halted or reverted due to different contextual aspects at a higher scale level. A continuous reflection on the transition pathway is therefore required.

As a result of these discussions, we came to the following definition of food system transitions: *"Changes and innovations in the food system, including production, trade, processing, retail and consumption, in which technical, social, as well as governance aspects play a role in changing the food system".*

This definition of food system transitions could help next iterations in research and designing policy when selecting the case studies for which the application of the analytical framework within this project could be relevant and insightful.

In summary, this scan of cases shows the many aspects of the complexity of food systems and the challenges of a transition to a more sustainable food system. In next steps in this project, these and

other cases will be used to gain a better view of transition processes, to identify principles for responsible transition and to contribute to the development of methods, techniques and tools that can be used in food system transitions.

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Annex 1 Case study Nigeria

CASE STUDY 1: FOOD SYSTEMS IN NIGERIA
Title of the case: Application of the Food Systems Decision-Support Tool in Nigeria
Author, affiliation: Just Dengerink, Wageningen Economic Research

Main case characteristics of the case and history

Characteristics of the case
Wageningen University & Research and the KIT Royal Tropical Institute have developed the Food Systems Decision-Support Tool. This tool uses systems thinking to help policy makers map the dynamics of complex food systems in low- and middle-income countries, enabling them to give direction to policies that shape the transition to a more sustainable food system.

The tool was recently applied to Nigeria for the Ministries of Foreign Affairs and Agriculture, Nature and Food Safety, resulting in a number of concrete recommendations being made for Dutch involvement in food security in the country. To increase access to healthy food, for example, the study recommended to invest in value chains of nutritious products such as vegetables, fish, milk and poultry.

Drivers of the present system
Public investments in the agricultural sector are low, resulting in underdeveloped (rural) infrastructure and agricultural services. Underlying institutional drivers include weak institutions, weak links between science and practice, low quality of education, corruption, and non-transparent markets with high transaction costs and high investment risks despite the high (urban) demand for food.

Nigeria is a food-deficit country, the urban demand for cheap food is met through food imports, but there is a mutually reinforcing mismatch between supply and demand at many levels and in many dimensions. Negative feedback loops – between a weak enabling environment, lack of incentives and finance for investment and low agricultural productivity – keep the agri-food sector locked into underperformance.

Scope of the food system transition
The boundaries of the food system that is analysed in the application of the Food System Decision-Support Tool are not clearly defined. The study is focused mainly on food produced in Nigeria for Nigerians, although it does shortly refer to Nigeria's food import dependency. Spatially, four regions are given more attention in the report: Kano, Kaduna, Edo and Lagos. In its recommendations, the horticulture, dairy and aquaculture are given most attention.

Although the assignment for this study did not clearly outline the transition to which the analysis should contribute, the recommendations of the report give a clear indication to which food system transition the Ministry could contribute in Nigeria. The report advises the Netherlands to focus its trade and investment strategy on helping to transform the Nigerian food system from an import-dependent, staple-focused food system to a diverse, less import-dependent food system that improves access to the right nutrients for all Nigerians.

Characterisation of the case in MLP terms

The regime

The regime that is studied in this case is the Nigerian food system as a whole, including its value chains, its food security outcomes and socio-economic and environmental drivers. However, most of the attention of the analysis is focused on the role of the horticultural sector and the potential of four states: Kaduna and Kano in the North, Edo and Lagos in the South.

Technologies: lack of investment in critical infrastructure and services

Public investments in the agricultural sector are low, resulting in underdeveloped (rural) infrastructure (e.g. roads, storage facilities and processing facilities) as well as a lack of agricultural services (advisory services, access to inputs and finance). As a result, production costs, and thus domestic food prices, are high while domestic food supply remains low

Institutions: limited implementation of existing transformation policies

Underlying institutional drivers include weak institutions, weak links between science and practice, low quality of education, and non-transparent markets with high transaction costs and high investment risks despite the high (urban) demand for food

Although policies for agricultural sector transformation have been created (e.g. political agenda for import substitution), weak formal institutions, corruption, and conflicting political and economic interests often prevent their implementation. These phenomena of weak formal market institutions and concentrated power among a small group of traders reinforce each other, making it difficult to bring about change through policy interventions.

Actors in the system: informal markets dominate food system dynamics

The Nigerian economy is largely driven by the informal economic sector, which is estimated to account for 65 per cent of the GDP (IMF, 2017). The supply chains within the informal sector are shaped by power imbalances between trader and farmer associations. Traditional market authorities such as so-called 'market queens' are important in organising trade, acting as trade brokers while accumulating both wealth and power within the commodity markets.

Some parts of this informal agricultural economy are characterised by high turnovers and profits, and private accumulation of wealth and power, with little influence of regulation and taxation. Large-scale traders and importers have vested trade interests in food imports. They also have private capital to strengthen their position, and are thought to use corruption to guarantee their power and interests. Many value chains for staple crops are characterised by concentrated power in cartels and vested interests.

Niches

The food systems analysis of the Nigerian food system presented existing niches that could help make the transition to a more sustainable food system:

- Oxfam has an inspiring programme in Nigeria to increase public finance for female small-scale producers, under the name 'Female Food Heroes'
- Babban Gona is a social enterprise that provides cost-effective end-to-end services to a network of franchise farmer groups. Services include training in sustainable farming, soil analysis, crop insurance, access to storage facilities, marketing and distribution of products and access to credit, fertilizer and seeds
- Food Connection Challenge (Crosswise Works) is an incubator for existing agribusiness SMEs in Benin & Nigeria. The goal of the FCC is to reduce post-harvest food losses by incubating innovative business ideas by these SMEs.
- CGIAR, IAR&T, NIHORT and the like contribute significantly to development and distribution of seed varieties to farmers & they have developed strong bonds particularly with subsistence farmers, leading to higher productivity of staple crops (cassava, maize, yam etc.)

Landscape

In the food system analysis, elements of the landscape or wider context were identified that could influence the regime change that is needed to realize a more sustainable food system:

- Climate change and global warming, if left unchecked, will cause adverse effects on livelihoods in Nigeria. Temperatures will continue to increase with more warming in the North. Rainfall variability will also continue to increase whereby the North is expected to face lower and more erratic rainfall and the South more intense rainfall, resulting in flooding.
- The Nigerian food system has a challenging enabling environment, with bottlenecks around infrastructure, corruption and government bureaucracy. Nigeria scores 125 out of 140 countries on road quality, a relatively low score compared to other economic powerhouses in Africa, Nigeria ranks 144th out of 180 on the TNI Corruption Index, which is even worse than in 2010, when it ranked 134th out of 178.
- Cultural beliefs and taboos as well as religious beliefs are also found to influence the food choices of consumers. The vegetable availability is region- and season-dependent, and products are mostly eaten fresh, since storage possibilities are few and substantial losses occur due to inadequate preservation and transport.
- Access to agricultural finance and other services, such as inputs, is limited in much of Nigeria. A share of 74 per cent of adults (64m) have never had a bank account, and only 15 per cent of women currently have bank accounts. While 71 per cent of salaried workers have a bank account, 86 per cent of rural adults do not. Only 5 per cent of SMEs have access to a loan, and 59 per cent report difficulties accessing financial services.
- Population prospects now stand at a staggering 410 million in 2050. This fast-growing population will increase pressures regarding food access, access to water and land.
- In Nigeria, there is an increasing pressure on land, due to increasing population growth and the expansion of agricultural land.
- Land tenure insecurity in Nigeria influences the potential of farmer investment in agronomic practices and climate change mitigation interventions.
- Building the capacity of farmer unions can help strengthening civil society and empower farmers.

Sustainability challenges

The food systems analysis of Nigeria identifies a range of social, economic and environmental sustainability challenges. The most important ones are described here.

Pressures on rural development

Nigeria is facing major challenges with high population growth, a high number of people living in extreme poverty, rapid urbanisation, and stagnating agricultural productivity. Tensions between pastoralists and sedentary farmers affect much of Nigeria's northern region. Gender inequalities are a major barrier to rural development. The central place that oil exports hold in the Nigerian economy limits diversification towards agricultural exports, which have the potential to contribute to more inclusive and sustainable economic development.

Low productivity and food security

Moreover, low productivity levels affect the livelihoods of rural households, who are struggling to earn a decent wage. Among households in rural areas, 71 per cent of the population is food insecure (Matemilola & Elegbede 2017). NFCNS data on nutritional status showed that at national level, 36 per cent of the children under five were stunted and 25 per cent underweight (SUN 2011). Meanwhile, obesity among adults (18+) has more than doubled from 3.4 per cent in 2000 to 7.8 per cent in 2016..

Overexploitation of natural resources

Rapid economic and population growth have led to an over-commitment of available surface water resources, over-exploitation of groundwater resources in many areas and unreliable access to water – all combining to affect the livelihood of many, particularly rural and poor people, especially in 'Sahelian' northern Nigeria. Moreover, the availability of water in both quantity and quality is being severely affected by the extreme weather events brought on by climate change. Forest cover in Nigeria has also been severely affected. CIA World Factbook records show that 70 to 80 per cent of

Nigeria's original forest has disappeared. Between 1990 and 2005, Nigeria lost 35.7 per cent of its forest cover, or around 6,145,000 hectares

Changing the system

The food system analysis of Nigeria has focused on the role of the Dutch Embassy (EKN) in Nigeria and its network of partners to improve food and nutrition security among Nigerian smallholder farmers. It described the key roles the Dutch Embassy and its partners could play in helping to transform Nigeria's food system.

Joined efforts in specific sectors and regions

For example, the report concluded that the Netherlands government does not have the mandate nor the resources to address all the root causes that restrain the transformation of the agri-food sector in Nigeria, yet it can collaborate with Nigerian stakeholders to transform a sub-sector or value chain within a target region. But efforts need to be joined, and choices need to be made, given the limited resources.

Embassy can play broker and matchmaking role

Nigeria offers a lot of potential, with necessary resources being available, but not in all places at all times; the challenge is to bring different parties together on the right opportunity and in the right way. The EKN in Lagos can play a brokering role and provide matchmaking services for companies, organisations and individuals interested in such an opportunity.

Working in alliance with intermediary organizations

Alliances must be created to improve market linkages, provide skills training of youth, enhance access to quality inputs (in particular seed) and finance, support processing SMEs, and invest in storage, packaging and transport facilities. Furthermore, to achieve the desired impact, it is recommended to work with intermediary organisations who serve the target group directly.

Assessing barriers for change

The food system analysis identified a couple of types of system behaviour that pose barriers to improving food system outcomes, such as food and nutrition security, environmental health and poverty alleviation.

Underinvestment in the agri-food sector

Increasing (urban) demand for food puts pressure on the agri-food sector while structural investments (from private and public sector) are insufficient to increase productivity at the required level and speed. The lack of investments affects all parts of the agri-food sector: institutions, science and technology, rural infrastructure (roads, processing facilities, storage), availability of data and information, agricultural services (including extension, inputs, agri-finance).

Vested interest and corruption

Large-scale traders and importers have vested trade interests in food imports. They also have private capital to strengthen their position, and are thought to use corruption to guarantee their power and interests. This opposes policies and attempts (also due to limited capacity in terms of financial and human resources) to strengthen the institutions and enabling environment for sustainable and inclusive growth of the agri-food sector.

Concentration of market power

As private capital accumulates, successful private entrepreneurs gain more power, but smaller entrepreneurs and young adults struggle to set up business because of a lack of (access to) capital. Those with capital can easily set up a business in the agri-food sector, giving rise to the group of so-called 'telephone farmers'. However, those without a starting capital or collateral (e.g. youth, women), struggle to start up a business due to a lack of resources.

Dependence on food imports

There is a huge urban demand for (cheap) food. Agricultural productivity is low (see 'growth and underinvestment'), resulting in a national food deficit. Importing food from neighbouring countries and

international markets is cheaper than investing in domestic agricultural production.. As the gap in domestic food supply becomes larger, Nigeria becomes more dependent on cheap food imports. In addition, the foreign exchange obtained through crude oil exports is declining. This lowers the GDP and thus public investments in the agri-food sector, which are required to increase the domestic food supply in the long term.

Lack of policy enforcement
Although the Nigerian government develops agri-food policies, the implementation and enforcement is weak, and reality is far from the goals. Small successes are being booked and celebrated, but the agri-food sector as a whole does not show transformative change. Each government wants to achieve its own 'success' but overall policy on transformation is disjointed. This can lead to failure when shortcuts are made to meet unrealistic goals without strengthening the entire agri-food sector.

Tragedy of the commons
Population growth results in increasing pressure and overexploitation of land and water resources for individual benefit (food production), resulting in land degradation and conflict between users. As arable farmers and pastoralists compete between and among themselves for the same natural resources, the ecological resilience and productivity are declining, making the Nigerian agriculture more vulnerable to climate change.

SWOT Analysis
Based on the conclusions of the food system analysis of Nigeria, the following strengths, weaknesses, opportunities and threats can be identified for the Nigerian food system:

Strengths	Weaknesses
• Strong policy framework on food & nutrition security • Export crops such as cocoa and palm oil can help create more employment • Growing young, better educated and entrepreneurial workforce	• The current food system is very dependent on food imports • Agricultural policy and investments is focused mostly on staple crops • There is a mismatch between supply and demand in many value chains
Opportunities	**Threats**
• Improving access to rural finance can improve farmer investment in the food system • Building the capacity of farmer unions can help strengthening civil society and empower farmers. • Investment in horticulture can help to improve nutrient intake of Nigerians • Promising horticulture crops are tomatoes, onions and yam	• Climate change is likely to increase temperatures and disturb rain patterns • High corruption and government bureaucracy limit implementation of good agricultural policies • High population growth is likely to increase the pressure on land • Increasing water scarcity and over-exploitation of water resources is likely to affect agricultural production

Normative perspectives
Normative perspectives play an important role in defining the transition towards a thriving Nigerian food system. Different actors in the food system are likely to be driven by different value sets and different interests. From the analysis of the Nigerian food system, it becomes clear different stakeholders have different visions of what the transition of the Nigerian food system should look like. In the following sections, an attempt is done to describe what these different normative views mean for the way in which the transition process takes shape, and what niches or innovations could be its building blocks.

Technology and scale-driven transformation
Based on one view of how the food system transformation could look like, the current system of smallholder farming with low investment, low use of inputs and low use technology should be

transformed into a system with high investment, high input use and more technology use. The norms behind this view relate to the discourse of modernization, with its central focus on economies of scale and the importance of technology in driving progress.

Employment and inclusion transformation
Another view of how the transformation of the Nigerian food system could look like is focused on transforming a food system with limited employment opportunities for young people and women into a sector that is more inclusive and beneficial to all Nigerians. The norms behind this view relate to the discourse of inequity and exclusion, with its focus on small businesses and targeted interventions to improve opportunities for different groups.

Nutrition and health-focused transformation
A third view of the transformation of the Nigerian food system that should take place is a transformation of a food system where the majority of the rural population is food insecure and nutrition-related diseases are common to a food system that provides a minimum of nutrients to all Nigerians. The norms behind this view relate to the discourse of basic human rights to food and health, focused on targeted support to those most deprived of these rights.

Environmental resilience-led transformation
Finally, another view of the transformation of the Nigerian food system is one that would argue for a transformation from an environmentally degrading food system to a food system that supports key ecosystem services and stays well within planetary boundaries. The norms behind this view relate to the discourse of environmental stewardship, with the human responsibility to preserve the (functions of) the environment for future generations.

Annex 2 Case study on Galapagos

CASE STUDY 2: LIVESTOCK ON GALAPAGOS

Title of the case: Redesign of animal production on the Galapagos Islands
Author, affiliation: Bram Bos & Daniel Puente Rodriguez (WLR)

Main case characteristics and history (0,5 page)

Galapagos Islands are well known for their rich and unique biodiversity. Almost all (96.7%, approx. 7,970 km^2) of the land surface is protected within the Galápagos National Park (GNP) boundaries (CEPROEC and SNPyD,2014a), the Galápagos Marine Reserve (133,000 km^2) is one of the largest of the world. In the remaining 3% of the territory people are allowed to live and to conduct productive activities such as agrarian and livestock farming. The UNESCO granted the World Heritage Site status, and defines Galápagos as 'the unique living museum and showcase of evolution.'[1] The relative isolation of these ecosystems facilitated the development of Charles Darwin's evolution theory.

The local economy is fueled primarily by tourism which is fueled mainly by the rich local ecosystems and biodiversity. Approx. 225.000 tourist visited the islands in 2015 and the current local population is estimated to be 25.000 inhabitants. Agriculture has been very small scale, and still is for the most part. Only coffee is exported to some extent. The rest is produced for the local market. Our case is especially dedicated to poultry and pig farming on Santa Cruz, which is the main island of the Galapagos. This because these two sectors have grown hard in the last decades to feed in increasing local population and visitors. Moreover, concerns exist whether the development of these sectors currently is compatible with the local ecosystems. Poultry production is divided into traditional backyard farming, and more modern poultry production with modern breeds, although on a small scale compared to the mainland and Western Europe. Pig production is small scale, and partly based on the accessibility of food remains (swill) from restaurants.

The islands are not self-sustaining for food, and the numerous tourists and local population rely on food that is imported from the mainland. Imports of feed and food are expensive, and strictly regulated for biosafety reasons (to prevent the import of invasive species and diseases that may harm biodiversity).

As far as we can see, the current food system on the Galapagos has not been guided by a clear policy to define a clear place of food production on the island. In policy development, nature conservation is the central issue. Other activities (like agriculture) are constrained by the space left.

Characterisation of the case in MLP terms (2 pages)

The regime

There are two regimes, that coexist and somehow compete here. First, the regime of pristine biodiversity conservation, with a strong emphasis on the prevention of the introduction of invasive species and diseases on the islands that may threaten the original species, and limits on human activities (particularly agriculture) in and around the natural areas. Governmental bodies on biosecurity and externally funded institutes like the Charles Darwin Foundation play a key role.

Secondly there is the regime of the main land (Ecuador) that stresses food sovereignty, the importance of being self-sufficient in food production and the important role of small-holders. The Ministry of Agriculture (MAG) represents this line, but is less powerful than the biodiversity side.

[1] http://whc.unesco.org/en/list/1 (accessed, December 2018).

There is general awareness (also among the local population – 'the birdies are more important than people') that biodiversity is a key feature of the Galapagos, that is very important for the local economy. Yet, actual environmental awareness is quite low, and the local government is not powerful enough to enforce strict environmental measures (in terms of waste management, prevention of ground water pollution etc.).

Agriculture itself is composed of a few hundred farmers, most of them small to very small in scale. Technology used is partly very basic (dating back to the 60's), but also dependent on imports of modern feed and genetics, especially in poultry production. At the same time, traditions like swill feeding that are banned in the EU, are still important elements of pig production. Some of the farmers would like to use modern feed (imported concentrates) but find it too expensive.

Water is also an important issue, not only for human and livestock consumption, but also for local agriculture and ecosystems. The combination of the geographical position at the Equator, marine influences, wet and dry seasons, volcanic character and the influence of climate change which in the archipelago is especially material in the 'El Niño' phenomenon that puts many stressors on the islands at different levels.

Furthermore, land ownership and use are strictly regulated. Due to the relative low income that can be made by working the land, compared with tourist activities, rural land is being abandoned.

Expensive transport is a constraining feature of the system. Cars are scarce, and cannot be imported easily because of strict regulations. Transport of swill, products etc is therefore expensive, since smallholders have to rent taxis for that.

Niches
There are some innovative livestock producers. As far as we know these have economic or land resources to experiment of diversify production, belong to the local political elite, or/and have links to external initiatives in the form of knowledge or funding. We have met some of these guys but have not yet analysed in detail their niches.

We need this type of actors to develop further seemingly obvious strategies such as the connection of the tourism-industry with more sustainable forms of (local) production. Design strategies developed in a RIO-process, are waiting for further funding. Due to the island character, the relative economic prosperity of Galápagos, a local population which is mainly formed by immigrants and the strong international funding on ecosystems services, among others, provide for ample opportunity for niche experiments.

Landscape
Tourism skews the local economy. Prices are high compared to the mainland, as do the salaries in non-agrarian work. Labour in agriculture is becoming irrelevant or a secondary activity. Farmers are dependent on temporary migration from the mainland. This leads to a tendency to stop farming altogether, and abandon the land, which is subsequently populated by fast-growing invasive species.

Growth in tourism and number of tourists leads to an increase in imports of people and stuff, thereby increasing the risks of the introduction of invasive species.

Political ideology of the mainland (at least under the former government of Correa) stresses the importance of principles such as 'food sovereignty' and agroecology. Moreover, as it is the case in other Latin American countries beyond specific presidents, there is a chronic and structural malfunction of institutions, organized around individual persons (clientelism) and bureaucracy, that is prone to corruption.

Money for biodiversity conservation is far more powerful to structure the local and easy to get than for agricultural renewal on the islands.

Sustainability challenges (0,5 page)

- Climate change & El Niño
- Water scarcity (brackish water) and drought
- Ground water pollution and run off to marine systems (poor manure management)
- Invasive species that grow on abandoned rural land and grow into nature reserves
- Antibiotics use, especially in local breeds of poultry
- Increasing reliance on imports (requiring lots of transport)
- Ecuadorian and Latin American political international weakness and subsequent instability

Changing the system (0,5 page)

In the first phase of the RIO-process we conducted in Santa Cruz, it became clear to us that the two somehow competing regimes could be connected by the introduction of new practices. The redesign-strategies we formulated and validated based on stakeholder interviews and dialogues are meant to do this. Most clear example is to use animals in livestock production to reclaim abandoned land, fight invasive species and create ecological corridors between agriculture and nature reserves. Important institutional change is relaxing the regulations on renting land. Other structural features that need to change are the transport system, swill processing, and manure management. At the same time, certain more traditional characteristics that seem to be retrograde at first sight, can be strengthened to make a more circular agriculture (swill feeding; multicropping; mixed farming), that is less dependent on imports from the mainland and reduces the risks of the introduction of invasive species. New market opportunities can be seen in developing sustainable local livestock production (e.g. antibiotics free, local breeds, local tastes, fair trade, etc) to connect with nature loving tourists, in order to increase margins and sustainability.

Assessing barriers for change (0,5 page)

The most important barrier is the unimportance, for the dominant discourse, of food production viz. biodiversity protection on the islands. Connected to this: a skewed distribution in expertise available on biodiversity conservation on the one hand, and agricultural expertise on the other.

Secondly it is the small scale of production, that does not warrant investments in innovation specific for this market (f.i. in special poultry breeds for the islands) by manufacturing and genetics companies.

Thirdly: the highly regulated market for transport, and strict regulations on ownership, use and rent of land.

Formally, a strong system of biosecurity is organized around livestock production, that is however ‘cheerfully’ neglected/disrespected by local producers. Any initiative will have to seriously assess these constraints.

Annex 3 Case study in India

CASE STUDY 3: APPLE PRODUCTION IN INDIA

Title of the case: Establishing postharvest facilities in Himachal Pradesh (India)
Author, affiliation: Bas Hetterscheid (WFBR)

Case study selection

Originally this project started 30 years ago, when Himachal Pradesh Marketing Corporation (HPMC) set up 6 facilities for sorting, grading and storage of apples in de Himachal Pradesh (HP) region in India. These facilities gave a boost to the local economy. Building on that idea, the HP Government has requested funds at the World Bank for further economic development since 2012. It was granted around 2016, when the search for implementation partners started. Since then feasibility studies are conducted, site construction has been tendered. Construction is expected to start in 2020. The goal of the project is explained in the next paragraph.

Main case characteristics and history (0,5 page)

The Himachal Pradesh Horticulture Development Project is a $ 135 million project, to support small farmers and agro-entrepreneurs in HP to increase the productivity, quality and market access of horticulture commodities. Economic development of the HP region and especially the small holder farmers is the main driver behind the project.

The reason horticulture products are selected is because (a) it is the main commodity of the HP region, (b) India is currently not self-sufficient in the demand, while (c) the demand for horticulture products is rising as well. The project consists of 3 components:

1. *Horticulture production and diversification* = increase yields by introducing disease free planting materials, high yield trees, technologies (water management), knowledge and finance;
2. *Value addition and agro-enterprise development* = capacity building, establishing postharvest facilitates and training on the use of facilities
3. *Market Development*: obtain more accurate market information, introduce e-marketing platforms and upgrading wholesale markets.

Wageningen Food & Biobased Research is involved in component 2 of the project, as the postharvest department has great experience in means of postharvest management and techniques suitable for HP.

Places in the food system:

- Interventions focus on: Agricultural production, food storage, transport & trade, food retail and business services.
- Means of intervention is: Science and technology.
- Goal of the project is to enhance social economic outcomes (improve farmer income / enhance economic development in the region).

Characterisation of the case in MLP terms (2 pages)

The regime

Technology

HP is located in the Northern part of India. As it is located at the foot of the Himalaya, places are often remote and underdeveloped. The region has a significant number of smallholder farmers, who live from the produce of their farm and sell their overproduction. Most farmers hardly have access to funds for further technological development. This means they currently have trees with a low production. Storage facilities are available, but do not match with the required capacity in the harvest season. Especially in regions where the density of population is less, the infrastructure lacks.

Institutions
The market is organised in a traditional way. Farmers bring their produce to local markets, where traders / middlemen will buy the products. Contrary to legislative requirements, the apples are sold per box, rather than per kilogram. This provides a negative incentive among farmers, to stack the boxes overfull to have competitive advantage selling the apples. Smallholder farmers need to sell their produce in the harvest season, as they need the money and do not have the volumes or access to storage facilities, such as middlemen do. Middlemen benefit from this position and determine the price at the moment of harvest to a great extent, causing the prices to drop to even 20% of normal value in high season. When prices are stable and high again, the middleman brings the apples onto the consumer market and gains the profit. This is the entry point for the HPHDP project, to have governmental owned storage facilities, which can be used by farmers, including financial support to bring the produce to the market at a later stage.

Main institutions are the governmental policy to stimulate economic development of the Himachal Pradesh region and HP horticulture development project, which serves as basis for the $ 135 million loan taken by HP government from the World Bank.

Actors
- Apple farmers = 25.000+ small holder farmers are located in the HP region, mainly producing apples.
- HPMC = HP Horticulture Produce Marketing and Processing Cooperation – owns 6 storage facilities and processing units. Has extension workers supporting farmers in the field.
- Commercial facilities and middleman – Mainly involved in the storage and trade of fresh produce. Buy produce from farmers and sell to retail.
- Retail – Sell
- Consumers – Target group of component 3 ('Market development'). Only involved through surveys and interviews.
- Individual project members. Politics might have impact on the decisions made under this project, as performance might be connected to personal status and political opportunities. Therefore, decisions are seen in a broader perspective than technical and economic feasibility.

Niches
The niches in the MLP-framework are elaborated from a perspective of technical, institutions and actors.

Technical
The most significant technical interventions are:
- Increase yield of farmer by introducing new high productive tress species, improved irrigation and fertilisation. The intervention aims to improve the livelihood of smallholder farmers and facilitate the domestic demand for apples in India.
- Setting up postharvest facilities; mechanisation of the packing & grading process and advanced storing techniques such as controlled atmosphere storage facilities. Aiming to add value to the produce and enlarge the moment produce can be brought to market from 2 months to year round. This could enable farmers to sell their produce when prices have recovered after the harvest season.

Other observed technological niches, which are not part of the project, but are niches entering the regime:
- Ethylene – Farmers from regions with medium altitude start to use ripening gasses (Ethylene) to get the apples to the market before the peak of the harvest season. This to prevent the price drop.
- Commercial Controlled Atmosphere (CA) stores - With increasing yield, the market becomes more interesting for commercial parties with postharvest storage facilities, starting to compete with HPMC on the produce.

Institutions
The project envisions to change the market dynamics, by strengthening the position of smallholder farmers. This should lead to the farmers being less dependent on the middlemen and thereby increase the income of the apple farmers in the region. This not only through technical interventions, but also

by developing market channels through which the horticulture products can be distributed. Other focus is on the marketing of local produce.

To the livelihood of the smallholder farmers, the access to funding is improved. HPMC will manage these funds and can support farmers with investments in new trees and bridging loans, to compensate for the time until sell of the produce by farmers.
The farmers are involved in the project through focus group discussions per region and are thereby able to steer the outcome of the research, but final decisions are at HPMC / HPHDP and World Bank.

Actors
Actors in the niche are:
- The World Bank – provided the loan and monitors the progress in the project;
- HP government – Took loan of The World Bank, established project office HDHDP
- HDHDP – Project controller of all projects. Final decision maker as monies of the loan are controlled by them.
- HPMC = HP Horticulture Produce Marketing and Processing Cooperation – Project implementation partner of the HPHDP. Client for Consultants. Semi-governmental body, currently having apple packing & grading lines, including cold chain storage facilities. Facilities built under component 2, will be managed by HPMC.
- Consultants (such as Global Agrisystems and WUR) – Providing technical knowledge on contractual basis to HPMC.
- Apple farmers - main target group of project and (future) users of technologies described in technology and institutions.
- Commercial facilities and middleman – will be impacted as their role is expected to reduce.
- Retail – Impacted by development of new market channels
- Consumers in India – They are the target group for sales of the produce, but are only involved through surveys and interviews for determining new market channels.

Individual project members. Politics might have impact on the decisions made under this project, as performance might be connected to personal status and political

New roles of actors in the system:
- The farmers, which are enabled to produce more food and have storage facilities at their disposal through HPMC and funds for bridging income gaps between harvest and bringing produce to the market,
- Farmers cooperation – Condition to run CA-stores with smallholder farmers is to cooperate more closely than now. Part of the capacity development of farmers is focussed on the aspect of horizontal cooperation.
- HPMC's storage capacity will extend exponentially, extending their business model from strong focus on marketing, to include running storage facilities together with farmers and provide financial services.
- Capacity development of HPMC staff on running facilities and financial services is required and included in the scope of the project, this by means of developing protocols, handholding and providing training.
- The middlemen will be affected by the envisioned change, although it is not explicitly described in the project documents.

Landscape
- Indian Agriculture policy:
- Raising productivity
- Protecting the interest of underprivileged agriculturalists (smallholder farmers)
- Modernizing agricultural sector
- Enhancing yield of major commodities
- Checking environmental degradation (connected to climate change)
- Promote agricultural research and training.

HP has a lot of smallholder farmers and the productivity can increase significantly. This was the primary reason the HPHDP project was initiated. This puts significant political interest on the project.

Sustainability challenges (0,5 page)
Currently, the region of HP has a significant amount of smallholder farmers, ranging from families with six apple trees as part of a diverse farm and dedicated apple farmers with hundreds of trees. The harvest season starts in August and ends in October, this means all apples from the region will come into the market at the same time, depressing the price per unit significantly. This means the apple growers receive lower prices than they could have had if the apples were brought to market outside of the harvest season and therefore are unable to invest in intensification or other technical solutions.

To break this vicious circle, the government will invest in yield increases, storage facilities and new distribution channels. The technology will provide more produce and improved storage capabilities (up to 1 year), thereby increasing the income of the small holder famers (SDG 1) and contribute to the economic development of the region (SDG 8). Sub-goals of the project focus on reducing inequality between sexes (SDG 5) and reducing postharvest losses (SDG 12(.3)). See niches for more information.

Changing the system (0,5 page)
The Himachal Pradesh Horticulture Development Project is a $ 135 million project, to support small farmers and agro-entrepreneurs in HP to increase the productivity, quality and market access of horticulture commodities. Economic development of the HP region and especially the small holder farmers is the main driver behind the project.

The objectives of different actor are stipulated below:
- HP Government: Economic development of the region and sustainable business model to earn back the provided loan.
- HDHDP – Execution of project, within constraints and conditions of World Bank. Defined KPI's: (a) Productivity (in ton/ha) (i) of rejuvenated apple orchards and (ii) of new plantations of selected horticulture crops. (b) Percentage of apple grades A, B and C. (c) Share of selected horticulture commodities sold through new marketing channels for apples and tomatoes. (d) direct project beneficiaries (number), of which female (%).

HPMC: (a) having the postharvest facilities delivered turn-key, (b) with trained staff and (c) can operate them commercially (with profit);
Consultants: Execute work packages defined by HPHDP and HPMC. Create a positive impact in the world, cover costs made for the project and seek for exposure on achieved goals.

HPMC and consultants collaborate on a contractual basis, as HPMC has requested the technical consultancy services for execution of the different components. Wageningen works together on establishing postharvest facilities and providing capacity development.

Assessing barriers for change (0,5 page)
- Project alignment – As the project is large and distributed amongst different parties, misalignment has arisen in the project. Example 1, postharvest facilities are designed for regions where there is no catchment area at present and uncertainty exists about future yields due to delays in other components. Leading to renegotiations of contracts (cost increase) and delay of delivery. Example 2: Parts of the project are new to the client and therefore no formal process is in place at the moment of executing the project. Authority for decision making is distributed between multiple parties or even unclear which party is responsible. Therefore recommendation of consultants are not answered in timely manner.
- Governmental policy – There is a complete ban on cutting trees in the forest areas of Himachal Pradesh, meaning that land availability is a major constraint in the project. Although this was known, parties are unable to provide suitable land for execution of a substantial part of the project until this date.

- Uncertainty and traditions – To increase yield with high density trees, it might be required to chop down low productive trees. A significant parts of the farmers is not willing to do that, due to the uncertainty of the new or traditional values (farm trees planted by previous generations);
- Political agendas. Politics might have impact on the decisions made under this project, as performance might be connected to personal status and political opportunities. Therefore, decisions are seen in a broader perspective than technical and economic feasibility.
- Infrastructure – product quality decay starts from the moment of harvest. Investments are focussed on the construction of facilities, ignoring the poor road conditions and lack of chilled transport modalities. These, amongst others, are not mentioned in governmental plans.
- Ethylene – Farmers from regions with medium altitude start to use ripening gasses (Ethylene) to get the apples to the market before the peak of the harvest season. This to prevent having to sell their produce while the price drop. This lowers the demand for postharvest facilities;

Annex 4 Case study in Tanzania

CASE STUDY 4: VEGETABLES IN TANZANIA

Author: Johann Bonnnand, Wageningen Plant Research

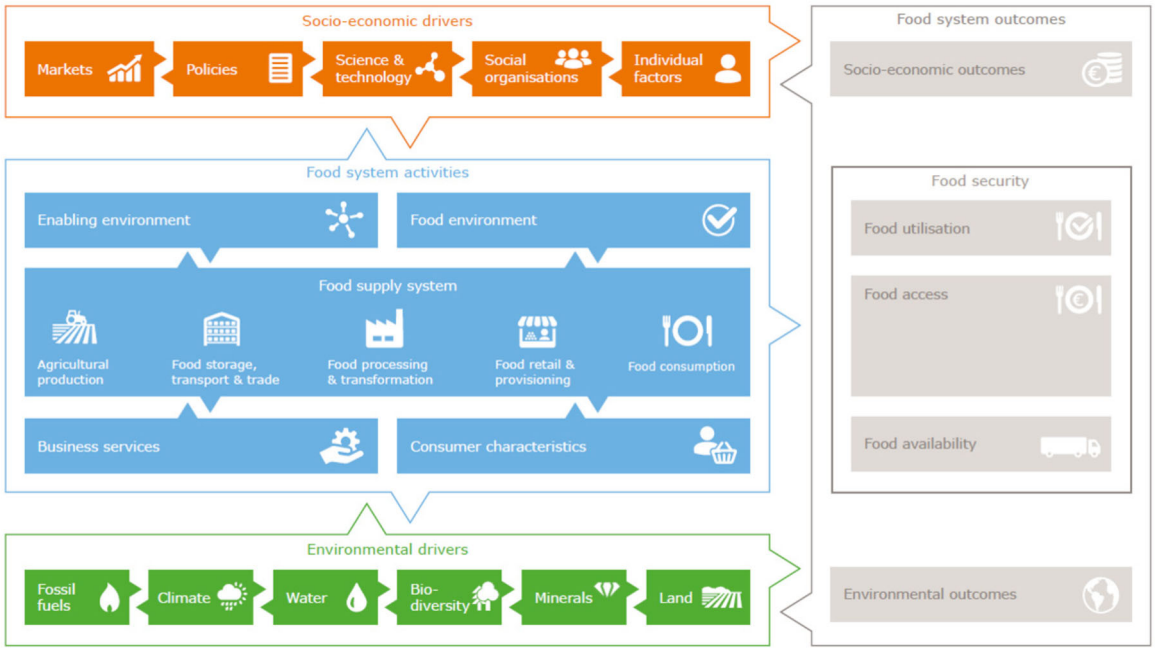
Main case characteristics and history

Vegetable consumption in Tanzania remains low: a study made in 2012 has shown that more than 95% of Tanzanian households do not consume enough vegetables compared to the recommended value (400g/day). Vegetables containing nutrients, vitamins, fiber, antioxidants, etc., they represent one of the major sources of such elements to prevent Non-Communicable Diseases, cardiovascular diseases or other health issues. Low-income households have shown signs of undernutrition or malnutrition as their diet is mainly composed of carbohydrates but is low in vitamins and minerals. Although the Tanzanian Ministry of Health and Social Welfare is promoting the consumption of fruits and vegetables, few studies are today published to assess accurately the consumption of fruits and vegetables. It is, therefore, difficult for the Ministry to imagine new policies and give adequate answers promoting the consumption of horticultural products. Awareness being an important factor to change food habits, more assiduous efforts are necessary to encourage Tanzanian households to consume healthier food (Msambichaka et al., 2018). Past and present aims to reach food security have put an emphasis on staple crops production and consumption rich in calories such as cereals, tubers and roots although medical properties and taste are still associated to traditional vegetables (Afari-Sefa et al., 2016).

The horticultural sector is one of the fastest growing sub-sector in the Tanzanian agriculture, with a growth from 9 to 12% per year, as well as the major employer sub-sector in agriculture. The vegetable production is today dominated by small-scale commercial farmers (around 70%) who have a limited access to good quality inputs, lack of information and knowledge as well as access to national and international output markets (Match Maker associates, 2017). The production of traditional vegetables is supposedly possible, requiring low investments while seeds and other inputs are already available on the market. In addition, farmers are somewhat able to invest and to take limited risks to improve their production quality and productivity of non-traditional vegetables, usually offering more interesting returns compared to traditional ones (Afari-Sefa et al., 2016). The production of vegetables has a comparative advantage over staple crops, knowing that their crop cycle is usually shorter than staple crops, making them less prone to pest and disease infestations. Diversifying their cropping strategies has also environmental benefits, limiting the nutrient soil depletion and the creation of soil-borne diseases. Eventually, vegetable crops prices on the market is higher than staple crops prices: the production of vegetable crops could have a double benefit through an increase in their income and the availability of nutritious food (Afari-Sefa et al., 2016). Therefore, the Dutch vegetable (seed) sector could play a role in increased vegetable production in Tanzania and thereby contribute to address issues such as poverty, food insecurity and malnutrition.

SEVIA is a public-private partnership between the Dutch Ministry of Foreign Affairs, Wageningen University and Research and two vegetable breeding companies East-West Seed and Rijk Zwaan. The main objective of SEVIA is to contribute to the development of the vegetable sector in Tanzania and thereby strengthen food security and alleviate poverty. The project tries to address these objectives through two main components:

1. The development of a breeding program in a public-private partnership with the two Dutch breeding companies to improve the African vegetable varieties and develop adapted-external vegetables (non-traditional African vegetables) to the Tanzanian agro-climatic conditions;
2. The dissemination of Good Agricultural Practices among farming communities in order to increase the productivity and farmers' income in various districts of Tanzania through the deployment of a vegetable "brigade" of extension officers.



Indirectly the project is also "working" on *food storage, transport and trade* as the use of improved varieties possessing longer shelf-life characteristics and support better the transportation to markets.

Transition

Through the introduction of better agricultural inputs alongside knowledge (to use these inputs in an optimal way), the SEVIA project aims at demonstrating new agricultural practices under real-life conditions to farmers. The end goal is to support the development of the horticultural sector towards a better performance and productivity of smallholder farmers through the adoption of Good Agricultural Practices and more modern techniques and technologies. The adoption of better practices in vegetable production at a larger scale, supported by the government, should lead to a modernization of the agricultural sector and an increase in production and productivity giving access to more nutritious food to the Tanzanian population. In addition, the income and labour creation should also contribute to poverty alleviation and economic development.

Characterisation of the case in MLP terms

Regime

In Tanzania, negative perceptions of consumption of traditional African vegetables have reduced their proportion (from 20% to 11%) in the total value of food in household diets. Vegetables occupy only 9% of the arable land, are generally produced only half of the year (although quite variable according to the regions). They are consumed at 95% within the Tanzanian territory. The potential for the vegetable sector growth can be considered as substantial as the country counts 55 million inhabitants, bearing in mind issues of malnutrition and poverty especially among farmer communities; Tanzania (mainland) even imports vegetables from the Island of Zanzibar. To solve issues of malnutrition, especially in rural communities, vegetable productivity or production need to be improved.

According to the national horticulture association (TAHA), the horticultural sector value, including flower production, has grown from 64 million US dollars to 700 million US dollars in the last 10 years and is growing faster compared to the entire agricultural sector or other agricultural sub-sectors. Nonetheless, the Tanzanian horticultural sector suffers from a poor access to high-quality inputs such as hybrid seeds or good crop protection products and remains archaic, as traditional techniques are still widespread, keeping the farmers' productivity and the profitability low. In addition, farmers remain often clueless as to improve their business and practices as they lack of appropriate services such as market information. Eventually, existing public extension services are generally considered as inappropriate (having knowledge on staple crops) or of a poor quality (wrong advice, very limited time on the field), leading to a poor trust between public extension workers and farmers. Empowering farmers with knowledge on vegetable farming offers them the opportunity to change their farming

practices but, above all, their capacity to reflect upon their own strategy to make wise and appropriate choices and decisions for their activity.

The implementation of better farming practices should lead to a more efficient use of inputs, a better resilience of their farming activity against shocks (weather, markets, etc.), increasing their return on investments, which should contribute to poverty alleviation and to the development of small holder farmer communities. For example, training farmers on crop protection by identifying pest and disease problems as well as appropriate crop protection products against specific issues and available in input dealer shops have potentially several benefits. Firstly, thanks to an early identification of pests, controlling them at a less advanced stage will limit the damages to the crop. Second, in connection with the first point, identifying the right crop protection products will help farmers improve their return on investment as well as limit their impact on the environment. Mixing chemicals or spraying multiple chemicals together are common actions among those farmers who do not know which products are effective against specific pests.

Farmers have different options for their output market. They can sell on local markets but many of them are working with traders. Nevertheless, farmers, due to poor knowledge and bargaining power, are often condemned to accept traders' offers. Few institutions, like the national horticulture association TAHA, are working towards the strengthening of the link between producers and buyers. Working with producers and traders seems useful but this issue is not addressed in the SEVIA project.

Tanzania possess favourable conditions for the growth of vegetables, therefore, has a high potential to increase their production offering more nutritious food to the population and contributing to the development of rural communities. Few projects with a limited outreach, on the development of the vegetable sector, have been carried out during the last few years, partly by the private sector. The focus of the Tanzanian government was to ensure food security; although now that it is almost ensured, there has been only a slight shift in public discussions to produce more nutritious food. The support and the capacity of the government and its institutions are, today, too weak to bring change in the vegetable sector, but, concomitantly, brings only a limited support to development projects in the vegetable sector, diminishing again potential changes from external projects (from the private sector for example). There is considerable potential for improvement in the vegetable production sector in order to become a viable business for a larger number of smallholders and, to a greater extent, benefit the national economy. The sector development is led today by the private sector.

SEVIA project will end in 2020 but knowledge transfer activities will be pursued, particularly by East-West Seed who has hired part of SEVIA team of field officers and will continue to widely disseminate knowledge among farmer communities. Rijk Zwaan is, now, taking a closer look at this issue. Both companies will continue also their work on varietal research. Through the development of SEVIA activities, the two companies are already enjoying a strong position in the seed sector first but also more broadly in the vegetable sector and will certainly play an important role in the future.

Niche

Tanzania is a major developing market for large input producers and retailers such as seed companies. However, the SEVIA project does not target the "poorest of the poor" but smallholders able and willing to invest because adopting better inputs, such as hybrid seeds, would not be affordable, so the adoption rate would also be low. Innovators (participant in this project), among these farming communities, play the role of a model for their fellow peers introducing new technologies and practices. Interested, neighbouring farmers learn from these innovators, knowing that peer-to-peer learning is more efficient than external actors trying to teach farmers new practices. Therefore, the identification of "key" farmers (in the sense of innovators), receiving personal support and advice from SEVIA extension officers, is important for the future of the project. Based on demonstration plots at the key farmer's farm, new practices are introduced on a small surface comparing their results with traditional practices. This demonstration plot is then used to train the rest of the farmer community invited several times during each crop cycle to receive training on Good Agricultural Practices in vegetable farming and to assess practically and visually on the field their advantages over traditional practices.

In addition, SEVIA's approach is based on the idea that the introduction of better inputs, technologies and practices must go hand in hand with knowledge to optimize their use. SEVIA is therefore a breakthrough in the sector, both in terms of introduction of innovations (technologies and practices) and extensive and costly knowledge transfer, although similar to few other programs in the horticultural sector in Tanzania, in the absence of a support and appropriate extension services from the government.

New technologies
Training of Trainers is, firstly, given by experts from Wageningen Plant Research to the extension team on Good Agricultural Practices (seedling and nursery, crop fertilization and protection, spraying techniques, irrigation and water management) and on other topics such as adult learning, practical knowledge transfer methodologies and demonstration organization and management: frequency of visit to a farmer by the extension officer, importance of selecting a good site and key farmer by staff, appropriate demo topic/objective, record keeping.

SEVIA, on its training center, is testing East-West Seed and Rijk Zwaan varieties, developing demonstration plots and organizing farmer field days to demonstrate modern and good agricultural practices in the vegetable production. African foreign workers (Uganda, Nigeria) in the vegetable sector were also invited on SEVIA site to receive training on vegetable production, SEVIA center being an interesting example of WUR work in Africa. SEVIA field staff, spread around the country, is organizing demonstration on farmers' plots as well as Training of Farmers (private extension services) on the following topics:

- Crop and variety selection, use of good quality seeds;
- Land selection, land preparation, advice on proper field layout and field hygiene, use of organic mulches;
- Seedling and nursery: improved nurseries, use of shade net;
- Crop management: good timing for trellising crops such as tomato and cucumber;
- Fertilization: split application of fertilizers for sandy soil, plant nutrition at different stages of plant growth;
- Crop protection: timing for crop protection, proper identification of pests and diseases and safe use of pesticides;
- Irrigation and water management;
- Farm economics: record keeping for both extension staff and farmers.

An important factor while promoting these practices is to keep them simple to be adoptable, and affordable by small holder farmers but also to be easily disseminated by pioneer farmers or other sector professionals both private and public. Data collection has demonstrated that adoption is already happening (see table below) and that it has been beneficial to the farmers knowing the number of good farmer stories coming from the field.

Area: Meru (Tanzania)	Adoption rate before intervention (%)	Adoption rate after intervention (%)
Use of improved seeds	18	48
Crop selection according to market demand	38	61
Mulching	0	2
Drip irrigation	0	13
Trellising	35	83
Adoption of greenhouse production	0	9

Landscape
An important number of factors is also influencing (either catalysing or limiting) the evolution of the vegetable sector in Tanzania.

Firstly, the low educational level of the farmers is limiting their interest and their understanding in the new knowledge introduced. Even though, the introduced practices are adapted to the farmers' educational level, some of them still have difficulties with basic calculations or are illiterate. Agriculture being a business where a lot of calculations are required (eg. fertilization needs, gross margins calculations), the lack of skills shorten the vision of the farmers of their farming activity (investments are made on a short vision) and farming practices are not optimal (under- or overfertilization for example). In addition, the low literacy rate limits the possibility of the farmers to improve their practices as they cannot read pesticides label or informative documents.

Secondly, it exists a variety of chemical inputs that are either fake (sometimes smuggled) with a limited efficiency or wrong products in the containers or packaging. In addition, some products are still sold but not registered by the government (eg. highly toxic products banned by the government or hazardous products for the environment). This limits the efficiency of the farming practices. On the other side of the vegetable value chain, traders often take advantage of the poor awareness and knowledge of the farmers to impose their prices. Working with such actors, eventually, to foster the growth of quality vegetables could be a solution to also obtain fairer prices to the farmers.

Food storage, transportation, processing and transformation is either weak or non-existing hindering the value addition to farmers' productions. Generally, transportation costs are known to be too high to facilitate the distribution of the production: they are estimated at 46% of the total value of export consignments. Exports are often done through airplanes, particularly to Kenya. Exporters have identified the irregularity and the low quality of the production as well as the low investment in airfreighting cargos as the main barriers to expand exports internationally. Despite improvements in the past years, the business environment is still considered as not fully favourable and there is still a high demand for quality products both nationally and internationally which cannot fulfilled (Match Maker Associates, 2017).

Few public or private organizations participate in the development of the sub-sector, TAHA is one of them. It plays a role in advocacy, facilitation and problem solving to strengthen and support changes in the horticultural sector. For example, in recent years TAHA has lobbied the government to drop 18% VAT on exported horticultural products, limiting the competitiveness of Tanzanian vegetable companies at the time. Since 2012, 14 programmes have taken place in Tanzania for the development of the sector, SEVIA among them.

The fact that the government is still massively importing vegetables from various regions should be an eye-opener for them to concentrate their effort on the vegetable sector and largely to the production and access to nutritious food. As mentioned earlier, Tanzania enjoys favourable conditions for the growth of vegetables and the area allocated to these crops is still limited. There is, therefore, room for improvement. Various organizations and projects (such as SEVIA) are already involved in the development of the sector. But without the support of the government to disseminate widely better agricultural practices across the countries, there will be limited observable changes. The combination of actions of the private and the public sector is seen as key for the future, maybe in a public-private partnership.

Sustainability challenges

Smallholders are the main actors in the current vegetable farming production system. They have limited access to high-quality means of production and related services such as loans or insurances. This inhibits the further development of the sector. Although they have access to fertilizers and pesticides, these are of poor quality) and knowledge to handle them efficiently is limited. In addition, farmers have no soil conservation techniques and the limited rotation of crops have an impact on the fertility of the soils and the creation of soil-borne diseases and resistances against pests and diseases. Thus current farming practices inhibit an increase in productivity and profitability, withholding smallholders in poverty and difficult working conditions. This has an impact on the future of farming as the youth is not attracted to become in turn farmers.

Public extension services have poor quality and do not give a high level of support to farmers. Therefore, knowledge transfer on better farming practices seems to be limited to international projects, yet they have a limited outreach. The government effort is not sufficient to develop a vibrant, inclusive and profitable vegetable sector.

Women's work and capacities are often underestimated. They remain isolated and can seldom join training, as due to cultural norms it is their husband whom usually attends any kind of event.

Changing the system

In order to reach the larger goals of access to nutritious food, diet improvement and poverty alleviation in Tanzania, improving the vegetable sector, firstly, by introducing Good Agricultural Practices and, secondly, high-quality inputs in farmer communities seem the way forward.

SEVIA is also an actor of change as their extensive field team was able to demonstrate these new practices and create a learning process among farming communities who were in turn able to adopt these modern and Good Agricultural Practices. The adoption of such practices were beneficial for these communities who were able to increase their productivity and income. Relying on a "key farmer" who accepted to adopt promoted practices, supported by the field officers, are a showcase to the rest of the community. Without these key farmers, it would have been difficult to convince other farmers due to a limited trust in extension officers and seed companies as well as the doubtfulness of famers' own capacities to adopt such practices on their own. Therefore, key farmers were an important node in the change process. Peer-to-peer learning approach is considered as crucial for change.

From Training of Trainers (extension services with sector professionals), Wageningen University and Research hopes that better agricultural practices in the vegetable production will stem from the training with sector professionals. The training, focusing both on technical and soft skills capacity building, aim at increasing knowledge and skills on technical points but also on the method of messages delivering to farmers which is as important as the technical knowledge.

Eventually, the two companies are also main actors of change, introducing better inputs for better results in terms of productivity but also regarding their effort to demonstrate adapted practices to the use of higher and more costly inputs to farmers.

Nonetheless, without the support and investments of the government, particularly, to catalyse the spread of these new practices as well as the related knowledge, the adoption process will be long. If in the past years, some work has been done to strengthen the vegetable sector, also thanks to lobbying actions from actors such as TAHA, there is still a lot of room for improvements to reach its full potential. Traders could also play a role as they require a more regular supply of higher quality vegetables that it is currently available. Rewarding farmers who have adopted Good Agricultural Practices with better prices and taking them as examples for other farmers, could facilitate the development of the sector particularly at the farm level.

Assessing barriers for change

Knowledge on Good Agricultural Farming has been introduced through the SEVIA project in different farming communities across Tanzania. Nonetheless, considering the size of the country and the number of citizens working in the agricultural sector, the spread of innovative messages by SEVIA extension agents is very limited. Few barriers for the sustainability of the knowledge has been observed:

1. As mentioned above, without the involvement of the public sector and other actors to spread massively the introduced knowledge, the outreach will remain limited. Knowing the poor quality and commitment of public extension, the low support so far of the Tanzanian government, as well as the low trust in public extension agents among farming communities, important steps needs to be undertaken by the government to perform extension in an efficient way.
2. Smallholder farmers often have a rather limited capital, if existing, to invest in their farming activity. Although the introduced improved practices promote the use of more and more costly inputs and technologies, the application of Good Agricultural Practices with appropriate knowledge should lead to a reduction of the costs of production of the farmers. Nonetheless, farmers usually

have a rather short vision on their activity and their future. Even if they understand and are sometimes convinced by the speech of SEVIA extension agents, they still consider these technologies as costly. Farmers' mind is more oriented towards cost reduction and low-investment methods rather than more important investments. Therefore, if farmers are not interested or cannot invest in the technologies and inputs promoted, the knowledge might be lost and adoption limited.

3. Farmers are ageing and studies have shown that age is influencing the uptake of new knowledge and practices. In Tanzania, it has also been observed that older farmers are more reluctant to adopt the promoted practices, limiting their interest in knowledge.
4. Farmers distrust companies in the agricultural sector due to former bad experiences. Therefore, they defy the work of these 2 companies and/or adopt sometimes unsustainable practices (eg. Harvesting seeds of hybrids thinking that companies tell them to buy hybrids every year to earn more money "on the back" of poor farmers).

The input market is still poorly developed in some areas, although SEVIA project and the 2 companies are supporting market development by introducing new products (better seeds) and by spreading better farming practices which require, sometimes, the use of better inputs and technologies. Until farmers do not have access to high-quality inputs, the production and productivity will remain low. In addition, as the value creation will remain low (also impacted by other issues such as post-harvest losses, low attraction for consumption of vegetables), it will attract few investments or even incentives for the development of vegetable sector. Opening the eyes of different actors (farmers, government, banks, etc.) on the importance of the use of high-quality inputs is crucial to develop a robust and resilient vegetable sector in Tanzania. Eventually, although a variety of actors are now entering the agricultural sector in Tanzania, a clear understanding of the benefits of these inputs is required for a sustainable development of the sector.

Producing more vegetables does not necessarily means improvements of diets. More work has to be done, particularly by the government or NGOs to promote the consumption of vegetables and more nutritious food. But changing food behaviour and habits will be a long process.

Eventually, a modernization of the entire vegetable value chain in Tanzania will be necessary to improve the profitability of poor farmers. Their market output is still limited with few choices for processing, exporting or more generally adding value to their production. Quality is still low and post-harvest losses high. Once again, a variety of actors and projects including the government will be required for the development of the value chain.

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Annex 5 Case study in China

CASE STUDY 4: SUPERMARKETS IN CHINA

Author: Vincent Linderhof

Case study selection

SPAR International has entered the Chines retail market in 2004, and one of the major challenges faced is the integration of smallholders into the supply chain. This integration has started in 2008. The aim of the project were WUR was involved aimed at the possibilities to integrate smallholders into modern agri-food chains in China and to develop a strategy to improve the fresh vegetables by smallholders in terms of food quality and timing. At that time, SPAR China was operating in four provinces: Shandong, Hubei, Guangdong and Shanxi.

The broader aim of the transition is to increase fresh fruit and vegetables in the supermarket, so that inhabitants can have more micro-nutrient food which is likely to increase food and nutrition security.

Main case characteristics and history (0,5 page)

The case study is focussed on the supermarkets (retail) and the role of small-farmers in the supply chain of fresh fruit and vegetables in China. Due to economic prosperity in China, the food expenditures through supermarkets increased sharply and especially the demand for fresh vegetables increased. However, smallholders often have difficulties to become part of the modernised supply chain of retailers because they produce small amount compared to the demand for produce in the retailers, the quality of the produce is not according to the standards of the retailers, and the smallholders do not have the means to organise activities according the standards of retailers. Therefore, Spar China, one of the retailers, facilitates opportunities for smallholders to produce for their supermarkets by educating smallholders in different aspects. In this way, smallholders (on the left of the food system framework in Figure 1) are linked to Spar China (in the red circle on the right of the food system). And Spar China can better serve the demand of the consumers in the urban area (green circle at the right of the food system framework in Figure 1).

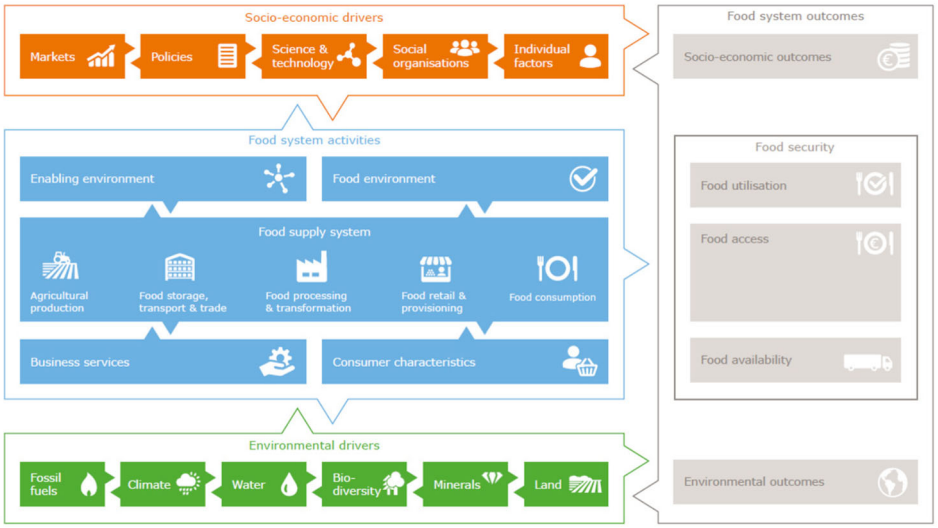

Figure 1 *Mapping food systems activities, drivers and outcomes, see Van Berkum et al (2018).*

LEI (currently Wageningen Economic Research) was part of the implementation of the process to link smallholder farmers to the supermarkets in the four aforementioned provinces.

"In line with the company's commitment to empower local communities, SPAR encourages the independent stores to source their fresh food products from local farmers directly. At the same time, the national or provincial SPAR organization provides support services to the supplying farmers for improving quality and supply chain management." (Bijman et al. 2010).

Moreover, SPAR intended to expand their activities to other provinces in China in which they were not active yet.

Characterisation of the case in MLP terms (2 pages)

The regime
SPAR International (based in the Netherlands) and SPAR China have entered into a project with the Netherlands Agricultural Economics Research Institute of Wageningen University and Research Centre (LEI-WUR) and the Chinese Institute for Agricultural Economics and Development of the Chinese Academy of Agricultural Sciences (IAED-CAAS).

As an example of the results of the supply chain analysis, the roles of the different actors in the supply chain, the purchasing system and the chain bottlenecks of the SPAR tomato chain in Henan are briefly described. The supply chain of fresh tomato of SPAR supermarkets in Henan is organized as presented in Figure 2.

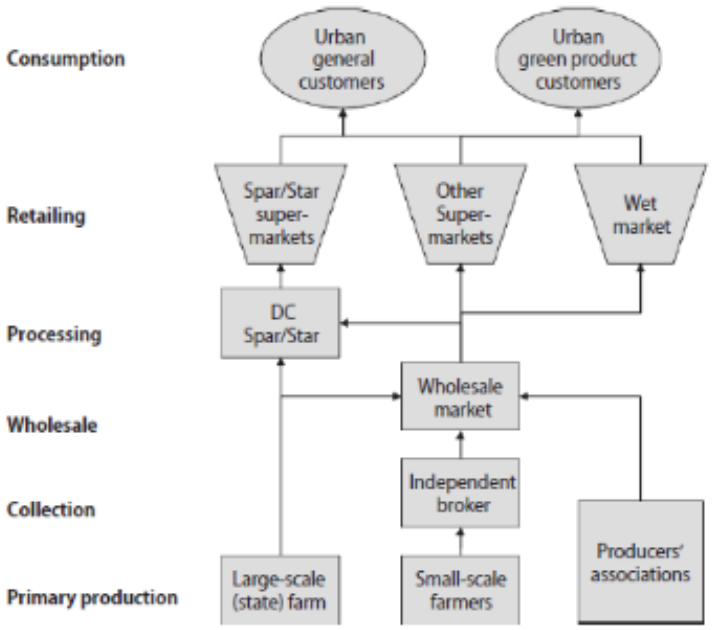

Figure 2 *Fresh tomato supply chain of SPAR supermarket in Henan.*

SPAR supermarkets in Henan order through one of the two SPAR Henan distribution centres. The order specifies the quantity of tomatoes and whether the tomatoes need to have a 'Green product' label (meeting specific government standards on the use of pesticides). SPAR buys a large part of its tomato suppliers from one big state farm that produces a variety of fruits and vegetables. Between January and February there is no tomato production in the region and therefore SPAR sources from other areas in China. The supermarket managers define the daily sales prices of the tomatoes, based on a minimum price and recommended sales price defined by the SPAR information manager.

The state owned farm prefers to exclusively supply SPAR as SPAR has a high reputation in the province capital and the supermarket has a good management system. This state farm produces only 'Green' products and uses its own brand. 'Green' or 'green food' is a quality." (Bijman et al. 2010)

Actors

Actors are

- the fruit and vegetable producing smallholders selling their produce at the wetmarkets and in supermarkets.
- Local governments, who promote the formation of cooperatives by smallholders (Bijman et al. 2010)
- Supermarkets in China provinces (SPAR supermarkets amongst others).
- Consumers of fresh vegetables and fruits in urbanised areas
- Research institutes involved in the project

"SPAR's strategy in China is uniting leading regional retailers into its worldwide network and introducing SPAR international best practices as well as supporting these SPAR partners to enhance all aspects of their retailing activities. The SPAR partner for Hubei province is Hubei Yasi Commercial Chain Co Ltd. At the end of 2008, SPAR Hubei operated 43 SPAR and SPAR affiliated stores. SPAR differentiates itself by means of its fresh offer. The amount of fresh produce sold by SPAR Hubei exceeded a value of RMB 384 million in 2008."(Bijman et al. 2010).

Niches

SPAR supermarkets offer smallholders producing fresh vegetables and fruits the opportunity to sell their products in the supermarket opening a larger group of potential clients. Smallholders commit to a cooperative of farmers that supplies to supermarkets of SPAR China. SPAR provides training sessions on supply management and food quality. And they are encouraged to improve the quality of their products. The new cooperatives are larger than the old ones (more members) and they are not necessarily village oriented such as the traditional ones.

Shorter supply chain (smallholders are directly linked to supermarket), reduction of selling efforts for the small-holders, and reduction of transportation efforts (less time and shorter distances). Many smallholders establish new cooperatives, which actively try to set up trading relationships with supermarkets (Bijman et al. 2010).

With the initiative, SPAR China can better serve the growing demand for (fresh) food by the consumers.

Supply of fresh fruit and vegetables through wet markets is likely to decrease. There is some evidence that smallholders tend to prefer contract farming, with connections to cooperatives or supermarkets, when they do have the opportunity, see Li et al. (2017).

Landscape

"The Chinese agro-food sector is changing rapidly due to income growth, changes in consumers' preferences and migration from the poorer rural to the richer urban areas. In addition, the recently growing demand for bio-energy increases the competition for agricultural products and impacts the availability and prices of food and feed. Despite the current economic and financial crisis, it is expected that economic growth in China will continue at a high level. Over the last decade, income growth per capita was around 10% annually. This growth has led to major changes in consumption patterns, such as a shift from staple products to higher quality food products, a shift from cereals to meat products, and a growing attention to food safety" (Bijman et al. 2010).

Income growth has also lead to major changes in the retail sector, most notably a shift from small individual shops towards large chains of supermarkets (Hu et al., 2006). For fruits and vegetables, supermarkets are still competing with the wet market (i.e. the street market). Originally, competition was mainly on prices, but it is now moving towards quality, and practicality (Bijman et al. 2010). Supermarkets supply a wide variety of food products including processed food products, which is more convenient for urban consumers. In addition, supermarkets search for ways to improve the supply of higher quality fresh produce (Bijman et al. 2010).

Other pressures are the resistance to change. Particular groups of consumers might hold on to the traditions of Chinese culture in which there is no place for modern supermarkets.

Finally, it is uncertain whether or not the Chinese governments will accept these forms of commercial successes.

Sustainability challenges (0,5 page)
The SPAR example will contribute to several SDGs: No poverty (SDG 1), Zero hunger (SDG 2) and Reduced inequality (SDG 11). The poor smallholders in rural areas that will join the SPAR initiative will be able to increase their income, improve their product guaranteeing improved food safety. Moreover, the SPAR initiative might also reduce the fossil fuel and water demand due to better practices, so that it contributes to Clean water and Sanitation (SDG 6) and Climate action (SDG 13) as well.

Changing the system (0,5 page)
The project aims at developing strategies for the supply of fresh fruits and vegetables by smallholders to SPAR supermarkets.

Assessing barriers for change (0,5 page)

Product quality
From the supply chain analysis it has become clear that uniform quality is the main bottleneck in fresh produce supply chains. (Bijman et al. 2010).

Communication
The lack of communication between producers and SPAR procurement managers, so that smallholders are not aware of the procurement requirements of SPAR (Bijman et al. 2010).

Joining cooperation
Zhou (2004) gives three reasons why farmers may be reluctant to join cooperatives. Firstly, farmers may still have bitter memories from past experiences with cooperatives and the people's commune system (pre-1980s). Secondly, until recently the government has been rather reluctant to promote cooperatives. Thirdly, Chinese farmers are experimenting with different collaborative arrangements of which the cooperative is only one.

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Remark
The case is already 9 or 10 years old, and the materials (reports, articles or book chapters etc.) of this case study are limited. In order to improve the case study description, we could schedule an interview with Xiaoyong Zhang, or Jos Bijman. Xiaoyong was involved in the project 10 years ago, and she is currently WUR's coordinator for activities in China. She might have a good impression of how SPAR and it's initiative have evolved. Jos was also co-author of the book chapter, and he has co-authored a journal article on the small-scale vegetable producers in China as well.

On 26-11-2019, I coincidentally met with Ben Kamphuis our former-colleague at Wageningen Economic Research. Ben has retired and he was project leader of the China Spar project at WUR. He mentioned that there are more documents available, which he has in his personal archive. He will look for them and share them.

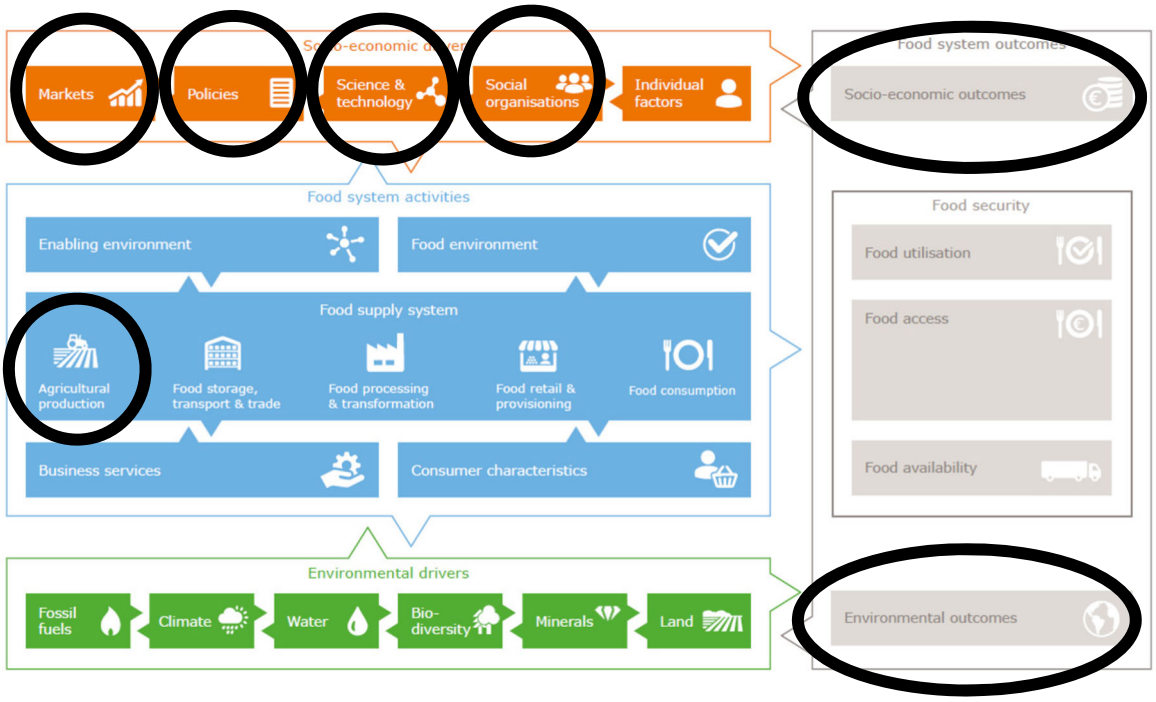
Annex 6 Case study in the Netherlands

CASE STUDY 6: PULSE FISHING IN THE NETHERLANDS
Title of the case: Pulse fishing in the Netherlands
Author, affiliation: Marloes Kraan (WMR)

Main case characteristics and history (0,5 page)
Pulse fishing, a method of trawling for flatfish by making use of electricity, is an alternative to beam trawling. With beam trawling, chains, attached to the beam, are dragged through the sand to startle the fish (such as sole or plaice) and make them leap in the net. The chains disturb the sediment and cause mortality of organisms effected by the trawl. This effect on the ocean floor is much less with pulse fishing, also because it is often combined with the sumwing, which instead of goes over the sea floor, floats above it. Due to the lower towing speed and the lighter gear and impact, oil use with pulse fishing has halved compared to beam trawling. Catch compositions have also changed, with fewer bycatch and bethos, more whilst catching more of the target species sole.

The reason why pulse was developed in the Netherlands was that an alternative to the beam trawl was needed. There was an increase in societal debate, especially criticizing the impact of the gear on the ocean floor and on its high levels of bycatch and the industry struggled to keep their businesses afloat due to high prices of oil and low fish prices and diminishing fish stocks. In 2006 the document 'fishing with headwind' described the problematic outlook of the industry and suggested a number of measures: funds to innovate, social innovation to share knowledge (via knowledge groups) and a societal covenant to support cooperation between NGO's, the industry and the government. This created ample opportunity for innovation, both technological as well as social. Pulse fishing was one of the socio-technical innovations that took off, in addition to other new fisheries (twinrig fishing, flyshoot fishing, nephrons fishing); decommissioning of vessels and a joint effort to certify many of the fisheries (MSC). In Haasnoot el al (2016) the transition is described. The authors have made use of the MLP theory to explore the development of the pulse trawl and the interaction between different levels. As the paper describes the process between the 1980ies till 2015, the period after 2015 has not been assessed.

In the period after 2015, the situation slowly changed. In the Haasnoot (2016) paper it is described how the technological innovation was developed in the Netherlands and became successful (economically viable, technologically it worked and socially accepted by most groups). At the same time criticism started to grow, especially after 2014 when the Netherlands had arranged a second growth in the number of licenses. When in 2010 the number of licenses based on the 2006 derogation were full, the Netherlands arranged the first expansion to the derogation, when that number of licences also was full, a second batch was arranged. This way of arranging more licenses for a technology (electricity) that officially was banned and still was being studied for its ecosystem effects, and which also resulted in new areas being fished and increased competition for some gear groups (Belgian beam trawlers in the North Sea, Dutch gill net fishers, British fishers in the Thames delta and French fishers) resulted in a movement of opposition. Opposition against the Dutch approach to arrange more licenses, the outfishing in a number of places and against a forbidden gear still under research being yet being fully commercially deployed. In 2017 a French NGO Bloom entered the scene and began a successful campaign and lobby against the pulse. Whilst politically the cards started to turn, scientific results began to come out slowly. Resulting in the interesting situation that where there is scientific consensus that pulse trawling is better than beam trawling (ICES 2018), politically there is no (more) support for the new gear at EU level. As electric fishing was banned in 1988 in the EU, commercial application of the gear and further gear innovation could only take place with a derogation (granted in 2006). Whilst initially there was support at EU level for the development, in 2018 the EP voted against the pulse suggesting to completely ban it. In 2019 this came into effect after the trilogue (with council and commission). From 2021 pulse fishing will be banned.



Food system: Black circles indicate: 1-2 [at the right]) pulse aims at improving outcomes of trawl fishing for flatfish: improved environmental and socio-economic outcomes (for pulse fishers). 3 [top left]) At landscape level oil and fish prices have driven the development of pulse. 4 [middle]) It mainly impacts the agricultural production of the chain. 5-6[top]) It requires science and technology and social organisation.

Characterisation of the case in MLP terms (2 pages)

The major events per level have been described in Haasnoot et al. 2016 (see below). Here we describe them for the last period 2015-2019.

Table 1. Summary of major events during pulse trawl transition organized by phase and transition level.

Socio-technical fishing gear transition			
Phase 1	**Phase 2**	**Phase 3**	**Phase 4**
Transition levels			
Landscape			
Stable oil prices, but growing concerns and criticism on effects conventional beam trawl	Growing concerns and criticism on conventional beam trawl. Fish quota are under pressure and oil prices rise	High oil prices, poor economic results and concerns and criticism on conventional beam trawl result in high pressure	Concerns and criticism on the effects of trawling continue to grow and oil prices decrease
Regime			
Dutch regime actors and institutions stimulate research and development on a pulse trawl at the niche level	Cooperation between regime and *selected* niche actors leads to technology push	Dutch regime actors organize themselves in the FIP and Study Group to facilitate the breakthrough of the pulse trawl	European regime actors and institutions are increasingly being involved (North Sea AC) by Dutch regime actors and institutions
Niche			
Weak cooperation between niche actors; weak pressure from landscape level	The pulse trawl is stabilizing into a dominant design	Pulse trawl proofs to be reliable and profitable and the gear is ready to breakthrough	Research continues on the effects of the pulse trawl

The regime

In 2016 a new actor pops up: Bloom. They start their campaign in 2016 and use a mix of strategies to fight against pulse fishing. Lobbying for a ban against pulse in legislation (revised technical measures) and filing complaints to the EU commission and OLAF (the EU anti-fraud office) against the Netherlands and campaigning against the pulse (with petitions, demonstrations, mobilizing opposition (at different levels and actor groups: fishers, MEP's, chefs), press conferences, writing letters, launching tools, discrediting the opposition (Dutch sector) but also the underlying science). Due to the upscaling of pulse in NL, and the revision of TM at the horizon (2019) the spread of pulse fishing over the North sea (from 22 vessels in 2010 to 78 in 2017) more and more actors at EU level become involved.

Niches
The pulse is being fully deployed in the Dutch demersal fleet. Most former beam trawlers for sole, now use pulse (with or without the sumwing). Of the 84 licences, 78 are in use. Some licenses are also used for shrimp fishing, a development that has had its own development trajectory. As the Dutch regime actors have realised that pulse acceptance at EU level is also important, they start organising Stakeholder dialogue meetings (2015, 2017,2018) to explain the processes, develop a research agenda and share research outcomes. They also start lobbying in the EU to get the pulse accepted. As they realise that research should be more coherent and result in a mechanistic understanding of the effects of pulse compared to beam (instead of ad-hoc research projects) in 2016 they start a major multi-year research program in which fundamental research is funded and multiple institutes participate (NIOZ, ILVO and WMR, ICES). Also an international scientific steering board is appointed.

Landscape
The oil price stabilises and is not impacting the sector in this period, fish prices are better and quota are large (stocks grow). The legislation that gives space to pulse fishing (the Technical Measures), is up for a revision, resulting in increased attention for pulse fishing at EU level.

Sustainability challenges (0,5 page)
Pulse has been called 'a Dutch solution for a Dutch problem'. That has been said because the Dutch have quite a large beam trawl fleet, which aims to catch sole in the North Sea. Pulse is particularly good in catching sole (of which the Dutch hold the largest share of the quota in the North Sea). Although this framing of the problem is understandable from an economic and political perspective, it disregards the broader shared positive impact of the gear on the environment. To catch sole, you need a mesh size of 80mm, if you use a larger mesh you lose the sizable (>24cm) flexible sole (it escapes). Unfortunately this results in quite some bycatch of undersized plaice (>27cm), which due to its shape and being less flexible, can't escape from the 80mm mesh. As pulse catches more sole and less plaice it improves this situation, but in addition it catches less benthos and debris because it goes over rather than through the ocean floor, resulting also in cleaner catches and more lively fish. As pulse penetrates less deep in the bottom than beam, the impact on the ocean floor is diminished. The fact that pulse fishers can fish slower and have less drag, they reduce their oil use with 50%. At the same time pulse has some unknown and negative effects compared to the beamtrawl. Spines of lager cod can break, as these cod are then retained in the net this is mainly an animal welfare issue. Full impact on life in the ocean floor is not yet understood completely. Yet overall there is scientific consensus that pulse performs better than beam in terms of ecological and biological impact (see ICES 2018 for an overview). In that sense it is not only a 'Dutch solution to a Dutch problem'. Less bycatch, less impact on the ocean floor and less CO2 are three important sustainability challenges in fisheries management. It is therefore surprising that this innovation is yet to be banned again.

Sustainability is not only about environmental impact, but also about people an profit. Where pulse was a solution for the Dutch pulse fishers in this respect, working with pulse (after the technology was fully developed) overall is easier and less costly than beam and results in much better economic performance. Thereby contributing to fishing remaining an attractive job (with good salaries for crew). Yet the impact of the pulse introduction has not been studied for non-pulse fishers. Whereas many fishers have complained about this (see introduction). As the socio-economic effects of measures are not well studied generally, this aspect remains out of sight. Due to the criticism of these fishers, which got a podium due to the campaign of Bloom, it became clear that there was a possible correlation between their decreasing socio-economic situation and the introduction and roll-out of pulse fishing.

Studying the introduction of the pulse trawl through the perspective of MLP theory has shown how seemingly technical changes in fact are socio-technical changes. As they require social acceptance, and have social impacts (next to environmental impacts). The economic side often does get attention but not so much the social side.

Changing the system (0,5 page)
The pulse case has shown a couple of things. First of all, as fisheries in the EU are managed at EU level, the EU is part of the regime-actors. Niche developments within one of the member states needs to address this level of the regime actors (at the EU). The Dutch regime actors have miscalculated

this. The technology push strategy they had between 2006-2014 in the end resulted in a fierce backlash, to which the amendments they made in 2015 did not help. Secondly where in the Dutch context the distance between niche actors and regime actors is rather small, in the EU context this is rather large, and therefore requires different strategies to bridge that distance. This is also a challenge for the EU, as innovation and transformation often requires development at niche level, making sure that promising ideas take off at EU level require a strategy for implementation. As context matters a lot for the success or failure of transformations, the EU should assess how best they can create an enabling environment for change with impact. Thirdly management of fisheries is not only about understanding the impact of fishing on the environment, and the economic results but in fact is very social. It is people whom are managed, and measures always affect their lives, livelihoods and practices. It is also people whom want to influence management, whom are motivated by their knowledge, ideas and values. Seemingly technical or scientific discussions on the impact of gears, thus in fact are about values people hold. In decision making processes there should be space to discuss these underlying values and it would be valuable if scientific data on social impact could feed the decision making process in addition to scientific data on environmental and economic impact. Fourth, the process of managing - the legitimacy of the management system - is as much part of the required transformation path as the topics managed. Who decides? Who has to change? Who are the winners and loosers of change? Are those mostly affected by change also able to take part in the decision making process or not? The EU management system is largely a very-top down system, which undermines the level of support for the decisions taken by those whom have to act (follow the rules, innovate). The challenge for fishing in the EU is:

1. That fisheries are one of the actors that need space on the seas, other uses also need to take place. This limits the space for fishing.
2. That societally we have the wish that the impact of fishing on the wider ecosystem is reduced whereas at the same time we wish to maintain or increase levels of marine production (aquaculture, fisheries) as globally food security is a major challenge.
3. Fisheries need to take place within the limits of the system, fish stocks should be fished at MSY level. But also many fisheries are mixed, so managing all stocks at MSY level is a challenge.
4. Management should be evidence-based.
5. Climate change is impacting the system, for instance stocks change places, due to rising temperature.
6. Political change such as Brexit impacts access of waters and thus spatial distribution.

All of these challenges together require a concerted effort of actors, sharing of knowledge and information, a way to deal with uncertainty in the system and the high stakes.

Transition

The transition in fisheries that is needed, is developing fisheries that produce high enough levels of fish (because of the societal challenge to feed the world), whilst minimising impact on the environment (because of the societal challenge to maintain biodiversity, habitats) whilst making it possible for people to earn a living and maintain their livelihood which also contributes to the social cohesion of fishing communities and resilient coastal systems. This requires not only having the right information (science, local knowledge) but also a shared vision for what the best direction is, the willingness to change and participation of those involved.

Assessing barriers for change (0,5 page)

Challenges for change thus are:

- How to deal with uncertainty?
- How to motivate people to change their practices?
- How to align people towards the same vision for transition?
- How to organise the management process?
- How to bridge the gap between niche and regime actors in a multi-level governance system?

Annex 7 Case study in Etopia

CASE STUDY 7: CASCAPE ETHIOPIA
Author: Nina de Roo

Case analysis: increasing agricultural productivity for food security in Ethiopia, the CASCAPE project
Project title: CASCAPE (Capacity Building for Scaling up of Best Practices in Agriculture, Ethiopia)
Lifespan: 2011-2019 (from 2019 onwards CASCAPE will be merged into a newly developed BENEFIT programme, for which WUR hopes to get funded from EKN in Addis)
Budget: in total the budget for CASCAPE 1 and II was approximately 16.000.000 euro.
WUR involvement: WENR and WCDI are involved as programme leader (WENR) and technical assistance (both WENR and WCDI).

The role of the author of this case study was to give technical advice on socio-economic issues related to social inclusion, linking gender and nutrition to agricultural development, integrated validation of technologies, drivers for adoption, stakeholder collaboration and scaling.

Main case characteristics and history
CASCAPE (part of BENEFIT portfolio) CASCAPE is an Ethio-Netherlands effort funded by EKN in Addis, to increase agricultural productivity and food and nutrition security in high potential areas in Ethiopia through the introduction, validation and scaling of agricultural best practices for smallholder farmers.

The aim of the programme is to increase food and nutrition security of rural populations in target areas through capacity building of the system in identifying, validating, and scaling of best fit technologies that increase productivity in a sustainable way. An important element of the programme is to link nutrition to agriculture through nutrition sensitive agriculture (including the scaling of home-garden approaches, the validation of approaches to improve intra-household decision-making among women, and partnering with others to conduct behavioural change and awareness raising on the importance of nutrition dense food).

The project is being implemented by interdisciplinary action research teams hosted by 5 Ethiopian universities in the four main regions in Ethiopia (in 65 districts in total, serving roughly 200.000 farmers). Other main partners are the district Bureaus of Agriculture, Regional research institutes and at national level the Ministry of Agriculture and EIAR. WUR provides technical, finance and process backstopping.

The universities work transdisciplinary and conduct their research based on a thorough needs assessment of farmers in the different target villages. After testing practices and technologies for 1,2 or 3 years with smallholder farmers (on their farms), an evaluation is conducted by the teams in collaboration with local authorities and farmers in which the agronomic, economic, environmental, nutrition, gender and farmer preference are being assessed as well as the scalability of the practice. When this evaluation is positive, the practices are translated into so-called best fit manuals and handed over to the Ministry of Agriculture for further scaling.

The project provides scaling support to the MoA in several ways (dialogue and lobbying to get best fit manuals adapted, approved, and implemented at zone and district level, support with interdisciplinary recommendation mapping, support with advice on context specific fertilizer recommendations, etc)

What is the place of the case study in the food system, see graph?

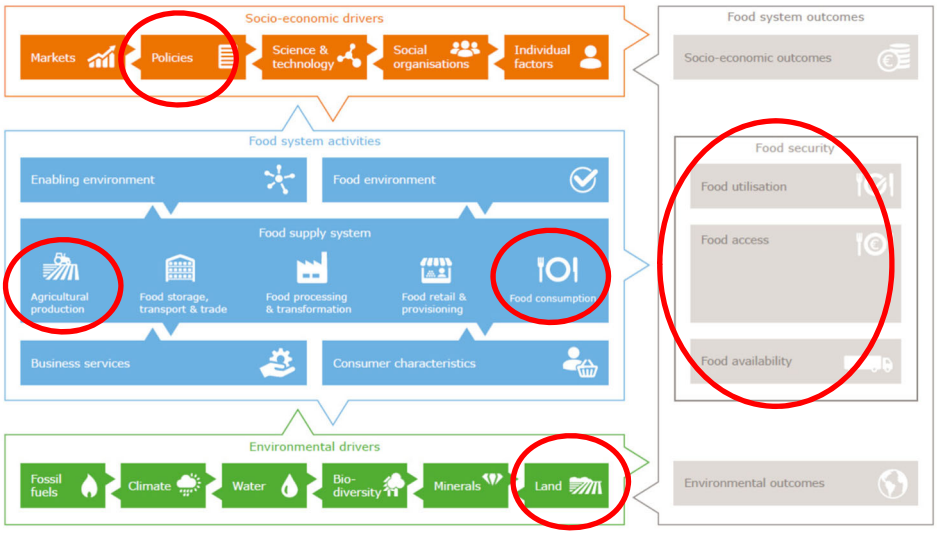


Figure 1 *Mapping food systems activities, drivers and outcomes, see Van Berkum et al. (2018).*

Foreseen transition

The foreseen transformation in agriculture of the Ethiopian government (to which the CASCAPE project abides) is that of modernisation and commercialisation of agriculture (to achieve food security in the country).

Growth and transformation have been the main targets of the Ethiopian public investments in the last decade to ensure sustainable economic growth. As a result, considerable economic growth has been recorded, 9.9% a year from 2007 to 2018 , which was accompanied with a high population growth of 3% , rapid urbanization, infrastructure investments, and income growth.

The underlying paradigm is that of modernisation of agriculture with a great emphasis on the promotion of modern varieties (mainly cereals) accompanied by modern inputs (seed and fertilizer) and mechanisation or modernisation of agronomic practices (row planting, machine-sowing, etc).

Improving the ability of the agricultural system to deliver more nutritious foods is a key priority of the Ethiopian government, with the establishment of the Nutrition Case Team within the Ministry of Agriculture and Natural Resources, which has developed a strategy to increase the nutrition sensitivity of the AGP. The current PSNP was also designed with an explicit objective of improving nutrition security; based on findings that previous phases of the project failed to deliver real change in terms of nutrition status.

Characterisation of the case in MLP terms (2 pages)

The regime

Practices

Ethiopia has always been largely dependent on smallholder agriculture. Subsistence farming is common; markets were of significant importance until relatively recently (1980s) because the vast majority lived on the country side and due to the historical relations between farmers and authorities whereby trade was not important.

Traditionally farmers use local landrace varieties, limited amounts of fertilizer (mainly manure) and the maresha plough (McCann, 1995). Previous governments have always focused on agriculture, however until 1991 the government prioritised large-scale export over the needs of smallholders.

Nutritional status in Ethiopia
A recent food systems analysis of Ethiopia identified a number of key challenges related to dietary quality in Ethiopia. Ethiopia has very low dietary diversity with women consuming an average of 1.67 out of 10 food groups and children under 5 average of 1.3 out of 7 food groups. Fruit and vegetable consumption in Ethiopia is very low, ranked the lowest out of 187 countries for fruit consumption and 186 out of 187 for vegetable consumption (Gebru et al 2018). Poor nutritional outcomes are also linked to food borne pathogens, which are a common cause of illness and death and present a public health challenge (Gebru et al 2018).

The nation's fast-paced, export-oriented economic growth has spurred a rising number of retail and wholesale food outlets, restaurants, and food manufacturers, especially in and around the capital city.

On the domestic market food-borne disease occurrence across the value chain is mainly because of the prevailing poor food handling and sanitation practices, inadequate food safety laws, weak regulatory systems, lack of financial resources to invest in safer equipment and lack of education for food-handlers.

Technologies and institutions
The technological research that the system produces is focused on quick wins, on a single indicator (high yield) and on cereals. The technologies that are being developed are meant to contribute to specialised producers in so-called (geographic) commodity clusters.

The government as well as the CASCAPE project has so far focused on a technology push whereby promising varieties are promoted through field days and farm demonstrations.
Limited attention is paid to contextual factors such as input markets, output markets, organisation of stakeholders to increase collaboration and the political context which influences access to markets and resources (de Roo et al., 2019; De Roo et al., 2017).

The research system is organised in such a way that validation is meant to be successful, which implies that the validations are biased towards better soils, better farmers, better inputs, more attention for management. As such, the validations are not representative for scaling. This results in the fact that adoption of modern varieties and modern fertilizers remains behind.

The system is focuses on technology push with limited attention for the holistic lives and needs of farmers. One size fits all technologies are being pushed, while farmers have multiple objectives that they want to meet. Moreover, in- and output systems do not function effectively so that when a variety is popular, it is difficult to bring to scale because the seed and fertilizer and market (buyers) systems are not developed with the variety.

The system is top-down and politicised which makes it difficult to bring constructive criticism from bottom-up and therefore it is difficult to adapt and change.

Farmers have a difficult relation with the government (from historical events) and are thus hesitant to rely on the government.

Actors

Main actors	Role/aim/mandate	How?
Farmers	Have a decent and healthy livelihood, have a respectable social life	• Produce food and crops for the market • When farmers believe their life will get better from a certain practice/variety, they will try it at their farm • Build and maintain good relationships with local authorities (DA and kebele)
Kebele and woreda administrators	Execute annual agricultural plans, be accountable to higher level on the implementation of plans	• support farmers in the modernisation of agriculture, • adhere to rules and policies from above, • find farmers that want to support the execution of the policies • find projects that can help the promotion of modern agric practices
University team	Support farmers through action research, make local governments happy, be successful in the eyes of other universities and management in the promotion of modern agricultural practices	• Provide evidence on the performance of new varieties, new practices • Build and maintain good relationships with local authorities (DA and kebele • Build and maintain good relationships with farmers • Find scaling partners
Rural consumers	Have a decent and healthy livelihood, have a respectable social life	• Produce food crops • Purchase (cheap) food in case of shortage
National Ministry of Agriculture	Develop and implement agricultural policies to increase agricultural productivity and food and nutrition security	• Produce food and crops for the market • When farmers believe their life will get better from a certain practice/variety, they will try it at their farm Build and maintain good relationships with local authorities (DA and kebele
WENR	Ensure that the quality of the project is according to WUR standards Ensure that project objectives are met Support the agronomic/soil aspects of the project	• Backstopping visits • Stakeholder meetings • Trainings • Technical advice on reports/planning/etc • Financial control of budgets
WCDI	Ensure that project objectives are met Support the socio-economic aspects of the project (including scaling)	• Backstopping visits • Stakeholder meetings • Trainings • Technical advice on reports/planning/etc

Other actors		
Main actors	**Role/aim/mandate**	**How?**
Research institutes	Execute agricultural research, develop and test new varieties	• Produce food and crops for the market • When farmers believe their life will get better from a certain practice/variety, they will try it at their farm
Other governmental agencies such as cooperative agency, extension department, etc		
NGOs/CBOs		

Niches
(in my view most of the technologies that CASCAPE introduces are not niches because they are part of the overall paradigm on modernisation).

A niche practice could be the integrated validation protocol which is used for the validation of new technologies and whereby next to the field testing also attention is paid to the scalability of the technology.

Another niche practice could be the holistic home-garden approach which we are validating at the moment.

Another niche way of organising is the joint testing of new varieties with farmers, local authorities, research institutes and universities. This is a new thing in Ethiopia because previously this type of work is done in isolation (see below at 1.3.3). Actors work together to identify problems and potential solutions are based on farmers needs and tested with farmers. During the testing the university has the lead, but local authorities are heavily involved in the planning, priority setting, and sourcing of inputs. Also during field days the local authorities take the lead and authorities of neighbouring areas are invited to increase exposure.

A niche institution could be direct seed marketing, whereby farmers are allowed to sell seed directly to others (which is still forbidden).

Landscape
Since 1991 when the ERDPF came into power the government of Ethiopia has heavily invested in smallholder agriculture as dual strategy : (1) to achieve food security and alleviate poverty and (2) to remain in power (Berhanu, K., Poulton, 2014). The government has put in place numerous policies and programmes to promote food security and agricultural transformation. Growth and Transformation Plan I&II, Agricultural Growth Plan I&II (for high potential areas) Productive Safety Net Programme I, II, III and IV (for low potential areas).

The government of Ethiopia can be characterised as a developmental state, implying that the government is committed and highly active in promoting modernisation and commercialisation of agriculture.

A "down side" of this is that the private sector has limited possibilities to influence the government or other actors in the country and agricultural sector. While the government has reached out to the private sector to contribute to the Ethiopian development in some cases, privatisation of public enterprises is slow and many public enterprises are still in hand of the state (in particular in the fertilizer and seed industry)(Berhanu, K., Poulton, 2014).

From the outset, the Ethiopian government system has been rather top-down which has resulted in government agencies working in splendid isolation. A cultural factor that contributes to the lack of

collaboration is the lack of trust in another which has been cultivated through several regimes in the past centuries. This is particular for Ethiopia and hampers effective collaboration at almost all levels.

Another institutional factor that is important for this analysis is the lack of organisation of citizens. This has also been a product of the political history, but as a result there is a limited capacity of citizens to organise themselves, while at the same time most organisational structures at local level are captured or initiated by the government (such as cooperatives, seed unions, "development groups", 1-5 system).

Sustainability challenges

- The system produces technologies and solutions which bring negative effects on women in rural areas. Women have limited decision-making power, while new technologies increase their labour burden.
- The technologies which are being introduced are often inaccessible for the marjority of smallholders who lack the financial means to invest up front in fertilizer and seed (or who cannot access seed and fertilizer because the limited availability of these inputs).
- Most technologies introduced by CASCAPE promote inorganic fertilizer. The production of fertilizer is not environmentally sustainable. On the other hand, inorganic fertilizer increases the productivity of food crops thereby significantly contributing to food secutiry. Also, if no fertilizers are used, the acidic soils will be mined.
- A third sustainability issue is the use of pesticides. The project has a hard time dealing with pesticide management, since this is a relative new topic in Ethopia coming up now many farmers start to increase their productivity (especially in vegetable production)

Changing the system

One could argue that the CASCAPE programme as such is a change actor. The programme was invited by the EKN upon request of the AGP to be the "speed boat" to try out new things which could then be taken over from the government. Because CASCAPE is relatively independent from the government (as compares to most government and parastatal agencies), in CASCAPE we could try out new approaches and practices. among others this has resulted in the development of the integrated validation protocol and the process of developing and institutionalising Best Fit Manuals (through joint testing and scaling).

However, within the CASCAPE programme I see myself as a change actor because I have been trying throughout the lifespan of the CASCAPE programme (together with my direct colleagues at WCDI) to broaden the scope of the programme to more holistic and integrated approaches towards agricultural development.

(I am not sure if this is the right forum to describe our challenges?? If so I could write more about this but it also implies a critical reflection of the colleagues of WENR because they are the programme lead).

Assessing barriers for change

The TransPath project will focus on exploring transition Pathways. Starting point for these will be the sustainability challenges from section 3 and the change attempts from section 4. These attempts, however, will face barriers from the present system, e.g. by mismatches in technology, institutional barriers, actors refusing to cooperate or resisting, etc.

In this section you should discuss the most important barriers in your agro-food system for the various change attempts from section 4. Indicate to what extent these barriers are technological, institutional or actor related (i.e. social) or a combination of these.

This text has an underlying assumption that the change agents are the ones who try to overcome the sustainability challenges. But who says that this is the case ? In my case the change agent introduces technologies and practices which may contribute to the overall transition towards modernisation in agriculture, but they are not necessarily environmentally friendly or socially equitable. So in this case the change agent may actually increases some of the sustainability challenges, rather than

overcoming them. In the larger transition towards modernisation in agriculture, some trade-offs will be accepted by the major players.

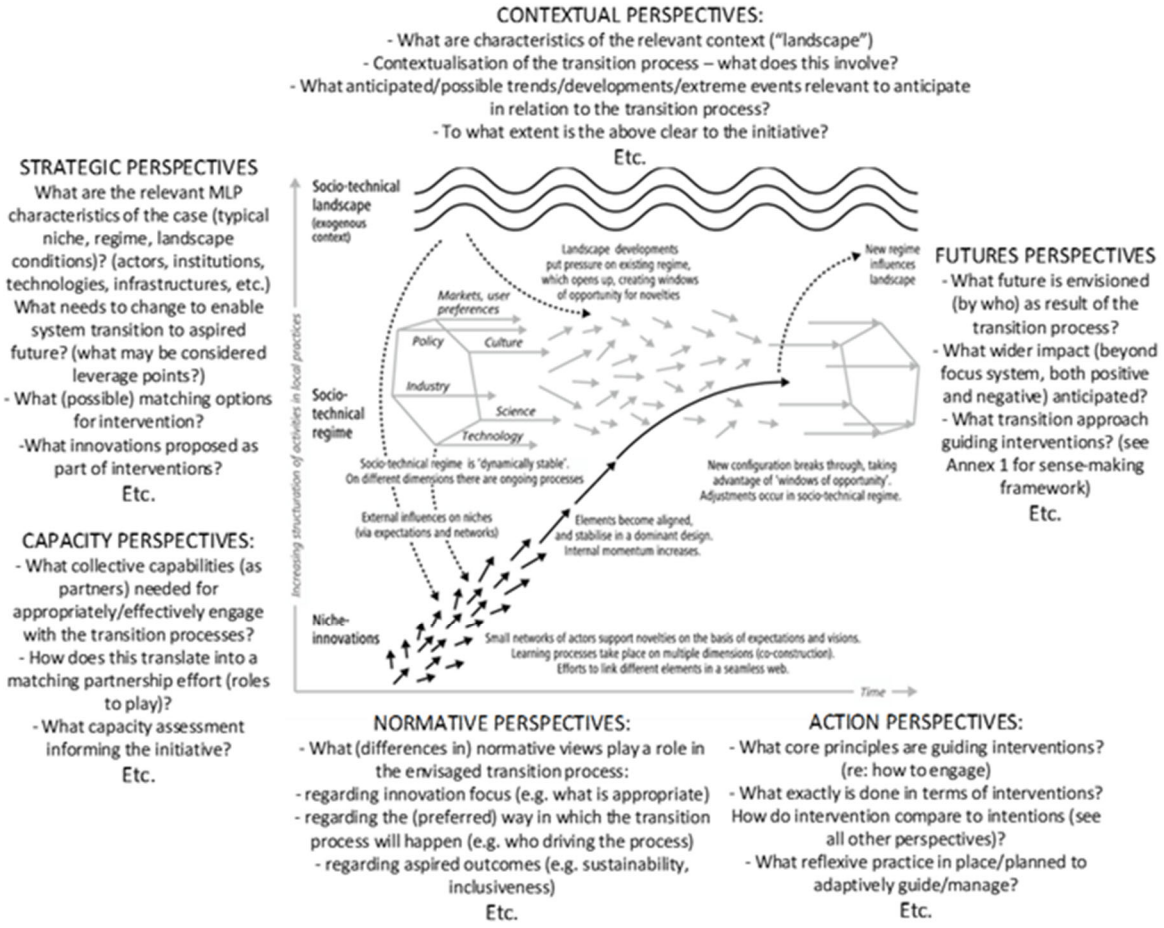
The change attempts are not necessarily answers to the sustainability challenges, but the sustainability challenges can also be a result of the actions of the change agent.

External barriers
The barriers that CASCAPE faces are mainly institutional and technological. At the local level, some practices are widely accepted by farming communities and local authorities. However, to get these practices introduced in other communities, they have to be adopted as "Best fit manuals" by the Ethiopian Ministry of Agriculture. And for this process to happen, there are a lot of institutional barriers. Firstly, the commission has to accept the evidence that was produced by the project on the performance of the technologies on-farm. Because the on-farm trials were done together with farmers, data requirements are sometimes violated and also there is a great internal variation in the results which make it difficult to do claims on external validity. Secondly, the bureaucratic procedures of changing a Best fit manual are not transparent. Finally the project decided to second a full time staff to the MoA to speed-up this process of institutional change at the level of the Ministry. The other barrier is also institutional. Technically, most high yielding varieties and agronomic practices have great potential to increase productivity. However, practically, seed and fertilizer are difficult to access for smallholder farmers. this is because fertilizer and seed supply is inefficient. The developmental state is strong in Ethiopia so the state keeps the mandate to itself when it comes to seed and fertilizer supply.

Another external barrier is the ethnic unrest in Ethiopia.

A third external barrier is land tenure and overpopulation.

Internal barriers
My personal view on this is that the project management does not focus on social and institutional aspects of change. As a result, the project activities are biased towards technological innovation (agronomy and soil science in particular) and less attention is paid to the institutional setting in which the technological change is supposed to take place. For instance, the university managers are mostly natural scientists and are not selected based on their competence to do networking, people management, or institutional bricolage but more on their technical capacity in their discipline.



Normative perspectives

There are difference in normative perspectives between WENR and WCDI (for instance on management issues described above, on what type of solutions are needed, on how to do research for development), between WUR and the Ethiopian management (about who should be driving the process and inclusiveness issues), and between most government agencies, universities and research institutes in Ethiopia and a minority of NGOs and farmers on the necessity to move towards mono-cropping, specialisation and agriculture that relies on high levels of external input. Also, most government agencies and universities see farmers as "backward people" who need to be educated and enlightened.

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To explore the potential of nature to improve the quality of life

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