CoP in Focus

Community of Practice on Metropolitan Food clusters, Resource Use Efficiency and Climate Adaptation

Remco Kranendonk, Sebastian Hoechstetter, Arturo Castillo and Peter Smeets,

ALTERRA WAGENINGEN UR

MFC4CLIMAG
METROPOLITAN FOOD CLUSTERS FOR CLIMATE-SMART AGRICULTURE

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This Pathfinder project develops a focused EU Community of Practice (CoP) on development of Agro food-clusters that focuses on innovation of high tech, large scale, industrialized and sustainable agriculture and food production for Metropoles. The CoP works with a trans disciplinary way of working, in which exchange of scientific concepts and tacit knowledge will take place. The solutions offered in Metropolitan Food clusters comprise the total value chain from production to retail and are strategic in new solutions for climate adaptation in agriculture and food production. The Metropolitan food clusters significantly contribute to reduction of the carbon and water footprint of metropolitan areas. In the exchange of concepts, this CoP will work out the benefits for climate from MFC in real regional innovation trajectories, towards business cases. The focus will be on co creation in KENGi networks and applyimg the innovation pathways opf MFC design.

Keywords: Metropolitan Food Clusters, MFC, Climate KIC, Climate smart Agriculture, Community of Practice.

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Preface

Title: CoP in Focus - Community of Practice on Metropolitan Food clusters, Resource Use Efficiency and Climate Adaptation

Climate-KIC Theme	Production – zero carbon systems
Project duration	01.04.2012 – 01.04.2013
Lead partner	Wageningen University and Research – Alterra
Project type	Pathfinder
Project lead	Madeleine v. Mansfeld/Remco Kranendonk

Summary

The goal of the pathfinder is to develop an international working group on the case development of agro and food clusters (so called metropolitan food clusters) that focuses on innovation of high tech, large scale, industrialized agriculture and food production for European Metropoles, in the context of climate smart agriculture.

MFC
Metropolitan Food Clusters (MFC) are innovative high tech, large scale, industrialized agriculture and food production clusters in and around metropoles with improved resource use efficiency and with vertical and horizontal integration of food supply chains. The MFC can be seen as a concept, which relies on 5 operational design principles, which could be also seen as innovation strategies:

- Resource Use Efficiency: the continuous search for the minimum of each production resource that is needed to allow maximum utilization of all other resources. This principle prompts a thorough rethinking and redesign of the agricultural value chain, in which an integral approach is key and maximizing the productivity of the energy, water, nutrients, other production factors and space used is leading.
- Vertical Integration: the integration of steps in a certain agrofood value chain (from primary production to retail) in order to improve the co-operation between the activities in the vchain and to be able to capture a larger part of the added value and avoid losses in between.
- Horizontal Integration: combining of animal and plant production and processing chains to optimize their waste management, in which waste streams from one element of the agricultural production system function as resource for other elements as much as possible. Horizontal leads in modern agriculture to Agro parks: spatial clusters of several value chains in an industrial set up that contain a variety of different agro-production, -processing, agro logistic and agro and food linked services and functions
- Agro Logistics: a system that is able to keep the agro products as fresh as possible in order to offer maximal shelf life in the supermarket. It is based on transport technologies and conditioned packaging and information systems for tracking and tracing and quality control.
- Integral Design of Hardware, Orgware and Software: MFC's are system innovations, meaning that not only the invention and application of new technology (the hardware) does matter but also the relations between the stakeholders involved should significantly be changed (the orgware). And, most important of all, MFC's are built on knowledge and knowledge exchange (the software).

In the pathfinder project we have selected four cases, which represent the different positions within the MFC value chain: production (agroforestry Brandenburg), production and logistics (MFC Proteine Empire), consolidation and processing (MFC Bag) and retail (MFC London). The cases also represent three of the largest European Metropoles (Berlin, Randstad/Ruhr and London), as well as an interesting agrologistical hub to the East, the Budapest Metropole of Hungary. All cases cannot be seen as stand alone processes and will be connected in the context of the total production, processing and value chains as well specific locational and cultural contexts.

Community of Practice
MFC development requires new forms of management approaches in order to create new knowledge and businesses. MFC is a complex problem (wicked) which needs to be developed in interaction between research, market and public sector (triple helix). We use the concept of the Community of Practice to arrive to trans disciplinarity, common design and development of MFC, social learning and alignment strategies. Design of the project is based on CoP concept and, learning processes and tools and techniques (presentations, discussions, design workshops, excursions, network management).

Climate
The Metropolitan food clusters significantly contribute to reduction of the carbon and water footprint of metropolitan areas. An inventory of possible climate benefits from the various parts of the value chain,

corrresponding with the cases within CoP in Focus have been developed. For each of the cases the potential benefits have been described, to make them usefull for case development in order to maximize the outcome within the different trajectories. The inventory also contributes to develop a benchmark, a system of indicators for monitoring the success of the measures taken in order to provide a means to enable the comparison of different adaptation options and to communicate their respective potential.

The cases
In alle cases we have been working on the same manner. The project group has organized meetings in all four regions with presentations of the MFC concept, discussions with stakeholders, site visits, and first design workshops, focussing on:

- give meaning to MFC and scoping the MFC potential in the region, searching for vertical and horizontal integration opportunities and finding optimal perspectives (feasibility and first phase of business planning),
- developing the KENGi network: strengthening collaboration and alignment,
- inventory of climate benefits and optimization of RUE.

The case holders have worked continue on case development in interaction with the regional networks or business and entrepreneurial counterparts.

The regional case of *Protein Empire* has led to engaged entrepreneurs and a supporting environment of different levels of government and various disciplines of research willing to invest in an Innovation project on new stable development. Early indications on climate benefits can only be estimated. The ultimate objective which has been set by the group of intiators is, to diminish methan emission with 100%. In the CoP in Focus trajectory, we found committed partners who are willing to implement mitigation measures integrated in business strategies. The regional development Agency, Oost nv, has actively be involved and have learned about MFC development, leading to new ambitions and initiatives in the East of the Netherlands.

The German case contributes in knowledge transfer in order to be able to select the most promising functionalities and value strategies for MFC development, in terms of added value and climate benefits (Greenhouse gas reduction and contributions to resilience). The characteristics of the Brandenburg area and the needs of the urban population ands industries of the capital of Berlin, have been the leading perspectives of the case development. So, ideas and potential business cases of new possible functionalities(dairy) and values (energy, feed and food) from agroforestry, which could be added or newly developed, have been shown up, and led to a concrete business development process, which will be taken place within the follow up MFC4Climag.

In Hungary, the case was the investment of the project developer in a consolidation centre in the Budapet region. In this center, the collection of agricultural products, some processing, agro logistics and distribution is optimized for the city of Budapest, but also for Hungary as a hub in the European Agro and Food logistics. This has been done in order to achieve a state of the art MFC development which leads to new products and services, new employees and a reduction transport and handling steps within the food production chain, beneficial to climate. The conceptual knowledge and the MFC experiences from other initiatives is beneficial for first steps in orientation towards and design of Metropolitan Food Cluster development in Hungary.

In the UK, the businesscase on retail failed, because of the unwillingness of Sainsburies to collaborate. The complementary activities were focussing on measurements and benchmarks of climate benefits have been contributed to new service and product development: the commercialisation of a benchmark business, which leads to employability and enhanced applications on benefits on climate and economics from MFC developments, which will take place in Climate KIC IP context.

Results
The CoP has been set up, by various meetings within the partner regions. The community has been formed consisting of a broad project team of initial partners between the project team, experts on climate, MFC, CoP regional stakeholders and the CKIC network (innovation team, regional Co-location

centers, Platforms Flagship Initiative Climate Smart Agriculture and other pathfinder and IP-initiatives). The following fields of results can be presented:

(1)Climate indicators: we have developed an overview of climate indicators related to the MFC concept /aspects/sectors and parts of the chains, which will be elaborated further within a commercial benchmark service and be used to optimize the climate benefits of MFC development.
(2) Case development: we have developed MFC cases in four participating regions and contributed to definitions, planning and progressing the development. The case descriptions have been translated in two business cases for an CKIC Innovation Project.
(3) network development: we have formed a CoP, an establishment of a network on MFC development on the level of EU, which is willing to be part of the KIC community, as the innovation ecosystem.
(4) MFC-concept: we have enriched the concept of MFC with climate indictors, insights of benefits and routes to realise and optimise performances a group of people, in a regional MFC design and in an inventory of climate benefits, which are applied in some case descriptions, and in the development of new business perspectives.

This CoP contains much drive for further development of the cases, the techniques into business development and to broader development of business services. Alignment has been found within two of the four regions: Brandenburg and Proteine Empire. A broad range of stakeholders met each other in MFC perspectives, alignment with policies and strategies has been found and there seem to be willingness to invest in a common trajectory of specific MFC.

Reflection

All cases have led to the formation of a group of engaged participants, who are willing to co-operate in MFC business design and planning processes. The CoP in Focus trajectory has also added the context of climate benefits objectives to the Metropolitan Food Cluster concept. We have developed the CoP in Focus in interaction with pathfinder trajectory Admit. This trajectory has led to new insights in bio based aspects of MFC development. MFC has a focus on food production and on strategic coupling from waste between plant and animal production, as well decomposition. In the pathfinder trajectory also new forms of capturing values and optimization strategies have been introduced. Especially in the Brandenburg case, agroforestry production finds new and higher values in energy. In the Protein Empire case, the introduction of algae production in combination with dairy production as well as feeding insects on organic matter that normally is no part of the human food chain, both look promising. So the MFC business cases seem to have opportunities to augment and to add all kind of new production processes in order to optimize production, processing and adding value to biomassa and waste materials. New forms and sizes of agro production and processing units will come up, which show higher benefits on climate and business wise, and will give regions and producers new perspectives.

The CoP in Focus project has been succesfull in delivering and preparing two concrete cases that now can be further elaborted in an IP proposal for Climate KIC:They provide demonstration cases – the regions in which KENGi parties have committed themselves to a MFC business case, which will be executed to realization, in close cooperation between CKIC, project team MFC4Climag and the regional network, to be seen as a complex problem of optimization of resources, investment, space, energy and interactions.

Also further development of the network, the CoP is foreseen by spreading the promising concept of Metropolitan Food Cluster as a good example of agricultural production and sustainability. They contribute on the anhancement of smart agriculture initiatives in Europe and outside and development of new business cases.

The CoP will be helpfull to further case development, commercialization of MFC services functionality within a front office: advice, design techniques, business case consulting, benchmarking, masterplanning, market research etc., and they identify real measurements of climate benefits, in order to communicate with neighbours, governments and consumers. They will deliver building blocks for new Licence to operate, and develop of new standards and indices.

For the Climate KIC initiative itself, the continuation of the pathfinder CoP in Focus project into an integrated project will identify and elaborate key areas for climate smart agriculture as well as deliver showcases for these innovations to be feasible. Moreover it would integrate the Climate KIC objectives with the innovation principles of Metropolitan Food Clusters and use these innovation principles as a vehicle for global implementation.

Next steps

The most promising trajectories of the pathfinder will be continuated within the MFC4ClimAg-Innovation Project. This project aims at elaborating the business opportunities by developing:

1) climate related benchmarks that can be used to provide MFC businesses with climate labels/certificates,
2) business models and plans on Inventions that deliver Adaptation to and/or Mitigation of Climate Change (IAMCC), and that can be implemented in the Metropolitan Food Cluster concept, and as such can help create innovative ways of making money,
3) an IAMCC-MFC Front Office at EU level that can stimulate the development of MFCs in Europe.

These activities are fed by inputs of data and experiences from case studies in actual demonstration areas of MFC development, where contacts were built during the pathfinder-project, CoP-In Focus, and by quantifying the resource use efficiency: MFC Protein Empire and MFC Brandenburg.

1 Introduction: objectives of the project

1.1 Background

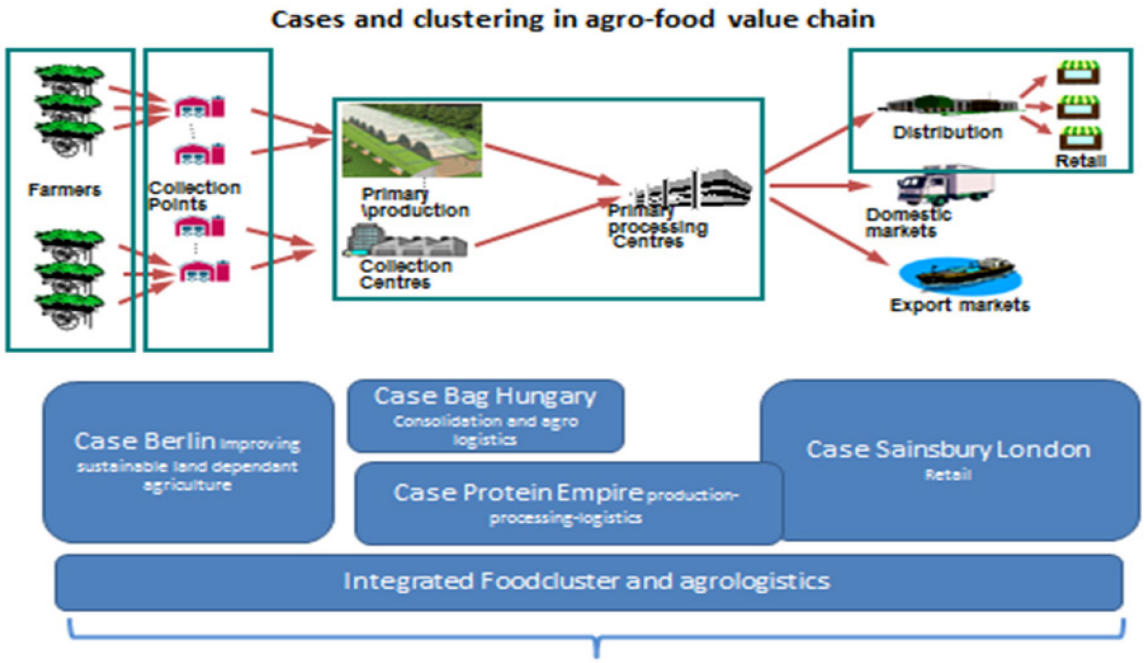
Within the context of the Knowledge innovation community, transforming climate change ideas into commercial successes (Climate KIC), in the theme 'production and zero carbon system', this pathfinder project CoP-In Focus aims at smart agriculture and food production, via sharing and developing new ideas on business development of Metropolitan Food Clusters (MFC) in four case areas in Europe, of which three are very urbanized (Berlin, Randstad/Ruhr Area, London) and an Eastern European semi-urban area, that is a transit region in agro logistics near Budapest.

The project is committed to build a network via knowledge exchange between knowledge institutes and small and medium sized enterprises (SME) on Metropolitan Food Clusters. These are innovative high tech, large scale, industrialized agriculture and food production clusters in and around metropoles with improved resource use efficiency and with vertical and horizontal integration of food supply chains. In this project the focus is explicitly on development of climate adaptation and mitigation strategies with smart concepts and solutions.

MFC development requires new forms of knowledge creation. It's a complex problem (wicked) which needs to be developed in interaction between research, market and public sector (triple helix). Also interaction with Society (quadruple helix) is necessary. So new knowledge and competencies on all domains are needed, which should be part of education. Also new forms of project management are required.

The way to induce effective solutions for the wicked problems of sustainable climate proof agriculture and food production is via a so called KENGI approach. This is a 'creative research by design' process (co-design), in which Knowledge Institutes, Entrepreneurs, Non-Governmental and Governmental Organizations co-operate closely together, in the social network, region oriented, that can only come up with innovations if they act together, thus answering to demand driven research and innovation from entrepreneurs and a facilitating pro-active government with public support. This approach answers to the requirements of business orientation of Climate KIC.

In its execution, the pathfinder project has developed an EU working group, extending an already existing Dutch Community of Practice (MFC Kombi-CoP), focusing on Metropolitan Food Clusters. We apply this concept of Community of Practice as a management concept to strengthen imagination, engagement and alignment in order to design and realise MFC initiatives. The aim is to create an international network, acting as a focused think-tank and incubator-innovator in the EU arena, with centres of excellence in agriculture and food, as well as links to SME partners and large value-chain parties. The CoP will work in a trans disciplinary manner based on the exchange of scientific concepts and tacit knowledge.



Metropolitan Food Clusters could significantly contribute to reduce the carbon and water footprint of metropolitan areas. The CoP In Focus project will bring together scientists, public-sector and private-sector representatives working at the crossroad of climate change and highly productive agriculture. Through an exchange of concepts, this CoP will work out the climate benefits from Metropolitan Food Clusters and develop real regional innovation trajectories of MFC case development. As an innovation springboard, the CoP acts as an EU consortium with a package of solutions for growth in food security and food safety in developing countries as well. The focus will be on the co-operation with local or regional SMEs, as a pull factor for the implementation of the food-cluster model. These SME's will be included in the network and best practice examples.

We expect to deliver results on three aspects:

- *Climate relevance:* The exchange of knowledge and knowhow on Metropolitan Food Clusters around specific cases will influence the insights of the linked up SME's and will stimulate climate adaptation strategies with significant reduction of fossil fuel input in greenhouse farming, greenhouse gas emissions from animal farming, reduction in transport and its CO2 footprint and of indirect fossil fuel input and water use in arable farming.
- *Concrete innovation outputs – case development:* Metropolitan food clusters are integrated designs of Agro logistic networks that renew and transform the agro and food value chain in a systemic way. The approach deals with the total value chain, and the exemplary cases selected represent parts of that value chain. It does not only focus on hardware but also on orgware and software of the innovation. Metropolitan Food Clusters in each particular situation are never simple copies of a general concept but tailor made and adapted to the specific regions and its physical, social and cultural characteristics.
- *Partnership and cases:* Starting point in addressing the user needs is the rapidly changing demand for food and other agro-products as a consequence of on-going urbanization and rural decline all over the world. The metropolitan food cluster development focusses on maximizing resource use efficiency. In doing so a number of targets that come with adaptation and mitigation on climate change can be reached. In the partnership and exploitation plan, the four regional innovation trajectories (see below) will address user needs presented by their own KENGi networks. These partners will be involved in the CoP meetings and will be listed as such with the case specific list of participating business partners, researchers and innovation managers.

1.2 Work plan

1.2.1 Work Packages

With regard to the implementation of alternative land use systems and specifically the effect of development of food clusters, the first year will be dedicated to the identification and the establishment of a set of regional innovation trajectories or demonstration locations that represent different edaphic and climatic conditions in Europe and which are linked to the context of the four urban spheres/metropolitan contexts. To manage and to use these cases for demonstration purposes, partners from agro and food business, government and research will be asked to join in and will define and select the key parameters that reflect climate mitigation and adaption effects, productivity, economic revenue, nutrient efficiency, land use technologies, and ecosystem services within integrated food clusters. This survey will be complemented by literature review. Both will form the basis for the development (after 2012) of a joint management and monitoring plan for sites being selected. The management aspects of this planning will address the testing of new technologies and the monitoring will provide information on ecological and economic effects. The work plan consists of four work packages:

Position paper integrated Food clusters and Climate benefits
The position paper will describe the conceptual framework of integrated food clusters and its climate adaptation strategies, based on the input from the 4 regional innovation trajectories in European setting as partial input of a total value chain approach. Per case aspects will be described of trends, policies, cultural differences and approaches. In the CoP meetings the outcome will be used as base for the position paper, and will focus on a joint understanding, reframing and formulating of integrated food clusters and its effects on climate adaptation. Lessons learned will be distilled, to describe possible strategies of vertical and horizontal chain integration and its climate adaptation benefits. The results will be reported in this publication.

Community and network development
The CoP will be set up and will grow over the year in meaning, communality, identity and number of participants. Responsible: Alterra Wageningen University and Research Centre for Environmental Policy will be responsible for the CoP development, the organization of the meetings (preparation, facilitation, evaluation and report), the exchange between participants, the originating of unifying concepts, steps forward and the dissemination of results in the outer world of KIC Climate, the cases and the scientific domain. Contribution from all partners is requested.

Regional innovation trajectories
In the four regions, MFC case development will be set up and elaborated. CoP will be introduced and climate benefits will be made explicit.

Business plan
In this business plan we will point out how we will work the next years, what deliverables can be expected. Also the concept of the MFC, de approach of the CoP and the rationale behind the regional innovation trajectories will be described. The CoP will develop a common agenda and strategy, which will be elaborated in the business plan. As well the smart goals of the cases will be worked out more in detail. Responsible: Helmholtz-Zentrum Potsdam, Deutsches GeoForschungsZentrum GFZ.
Contribution is requested from all partners.

1.2.2 Deliverables

The following deliverables are expected:
- An international network (community) of Integrated Food clusters.
- Locally organised workshops with key actors and key SME's as task force for business development.
- Bench marking methods and standards.
- Reports on best practices, position paper.
- First actions on business planning development: program office.

1.3 Partners

- Alterra Wageningen UR -Project management, regional case on Metropolitan Food Clusters 'protein Empire', CoP management.
- Imperial College London CEP, Position paper, research and regional case on retail and involvement of SMEs, Climate benefits of MFC.
- GFZ – German Research Centre for Geosciences, regional case on raw material supply with land dependant agriculture Cottbus, Climate benefits of MFC.
- Szent István University Gödöllő, Regional Case Consolidation Centre BAG .

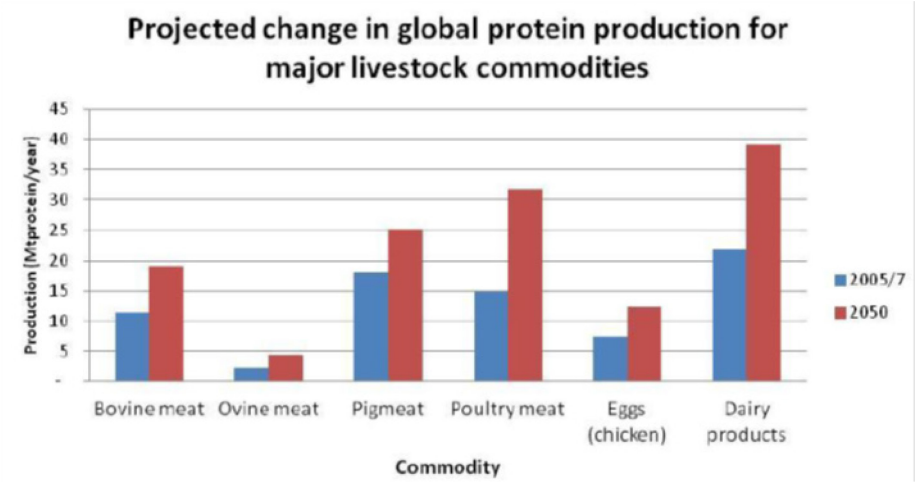
1.4 Report structure

This report is been structured in the following way. In the next cChapter (2) we will elaborate the concept of the Metropolitan Food Clusters (MFC). In Chapter 3 the methodology and the way of working will be described: the concept of the Communities of Practice (CoP). In Chapter 4 we will report from the inventory of possible climate benefits from MFC developments. In Chapter 5 the four case studies will be described from perspective of MFC development, CoP development and Climate benefits. In Chapter 6 we will reflect on CoP development and we will finalise with a general reflection, observation and conclusion. In this Chapter we will introduce the follow up activities, within the Innovation Project of MFC 4Climag.

2 Conceptual framework of Metropolitan Food Clusters

2.1 Background: trends and developments

The world is urbanizing and already half of the growing world's population lives in cities. The world's economic growth is centred in these cities and in a few decades the urban share will approach three quarters of predicted 9 billion people. These typical large metropolitan areas often usurp the space most suited for agricultural production with urban land use and functions linked to large urban conglomerates. Inside the metropolis there is a strong growth of the urban middle class with an increasing purchasing power, which revolutionises food consumption patterns, first of all in quality but also in quantity. Urban middle class workers need fewer calories from staple food as rice, wheat, potatoes. They consume much more fruit and vegetables, meat and fish and drink milk products, fruit juices, soft drinks, beer, wine and spirits. They do not accept health hazards and demand perfect freshness and excellent taste. Their food must be easy to purchase and prepare, and must be according to the latest fashion.



The reverse side of this development is that the rural areas are faced with marginalisation through depopulation, ageing and brain drain. Young and smart people being attracted to the opportunities in education, jobs, health care and culture, that urban conglomerates offer, are more and more rejecting futures of subsistence farming as move away. Yet these rural areas are still pre-dominant in world food production.

Within the metropolitan areas the distinction between urban and rural areas is vanishing. Agricultural production and processing is an important economic activity and vital to the economic sustainability of expanding cities. In an urbanized society as the Netherlands, 10% of all employment is in the agro food system.

A system innovation is needed to increase the demanded quality and quantity of food production in a sustainable manner. A rise in agricultural productivity is necessary. Reliable food-chains that provide the products demanded by the increasing urban population are becoming of strategic importance worldwide. Metropolitan Food Clusters are designed to create this system innovation.

2.2 The system innovation of Metropolitan Food Clusters

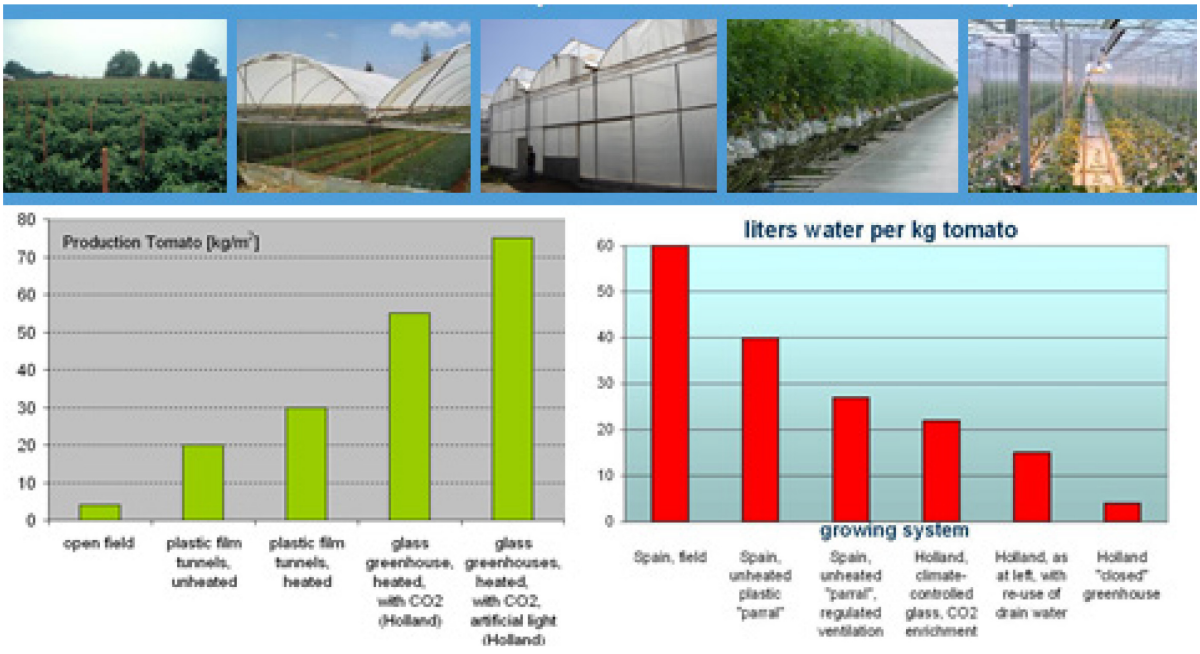
Together with other Wageningen UR institutes, Alterra has since 2000 been elaborating the concepts of agro parks and integrated metropolitan food clusters (Smeets, 2011).

Metropolitan Food Clusters can be defined as a system of agro production with the ambition of being able to satisfy the changing and competing demands of the urbanized population on a sustainable basis through new and intelligent connections inherent to the network society (between producers, sectors, raw materials, energy flows and waste flows, between stakeholders and between their value systems). Its design based on principles of sustainable development uses a trans disciplinary approach, in which co-operation between science and stakeholders in society is essential. The concept of Metropolitan Food Clusters is based on five key innovation principles:

2.2.1 Resource Use Efficiency

The principle of Resource Use Efficiency is the driving innovation: it calls for an integrated approach of the continuous search for the minimum of each production resource that is needed to allow maximum utilization of all other resources. This means in reverse that the efficiency of any isolated innovation or improvement is still dependent on the least advanced part of the system as a whole. The principle of resource use efficiency prompts a thorough rethinking and redesign of the agricultural value chain, in which an integral approach is key and maximizing the productivity of the energy, water, nutrients, other production factors and space used is leading.

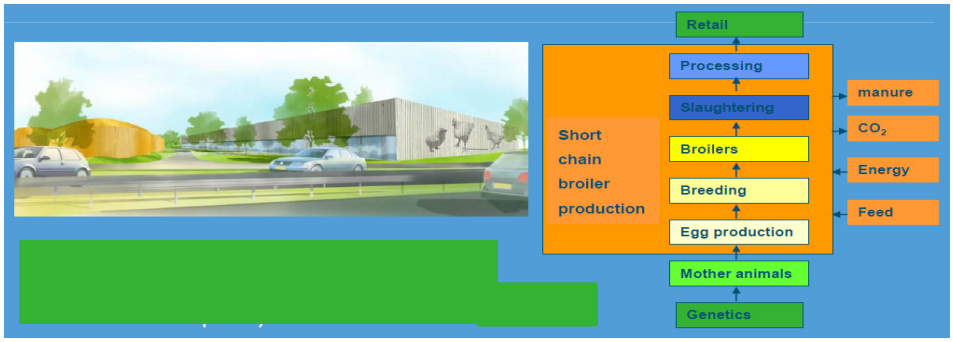
Increasing resource use efficiency through integrated management of ever more production factors as shown in the example of tomatoes.



2.2.2 Vertical integration

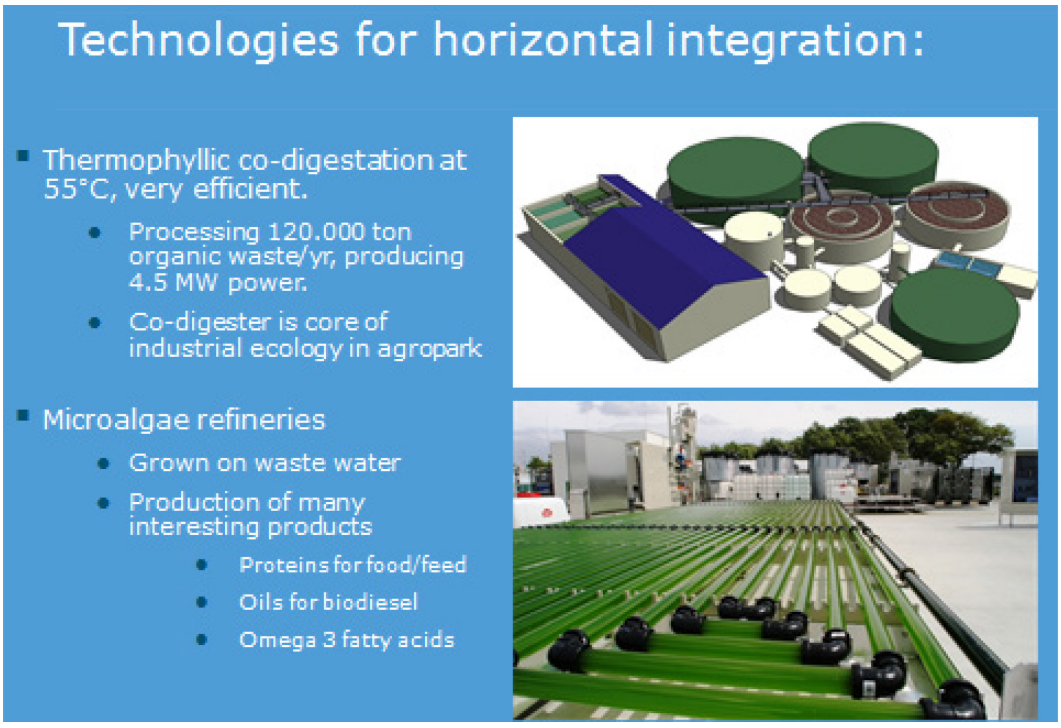
The second innovation principle is called vertical integration. It aims at the integration of the different steps in a specific production chain from primary production to retail in order to improve the co-operation between the activities in case and also to be able to capture a larger part of the added value that is produced in the chain as a whole so that it can be applied for innovations where they are most effective. In itself, vertical integration is a special application of resource use efficiency.

Example of vertical integration in the poultry chain. In the common chain organization every phase in the production of poultry is done by a specialized entreprise. In the integrated chain many of these phases are operating in one company:



2.2.3 Horizontal integration

The third innovation principle is another special application of resource use efficiency, now focusing on horizontal integration, aiming at the skillful combining of animal and plant production and processing chains to optimize their waste management, in which waste streams from one element of the agricultural production system function as resource for other elements as much as possible. Horizontal integration is in other words the application of industrial ecology that is since decades successful in chemical industrial plants and leads in modern agriculture to Agro parks: spatial clusters of several value chains in an industrial set up that contain a variety of different agro-production, -processing, agro logistic and agro and food linked services and functions.



The purpose of horizontal integration that is reached by spatial clustering is to optimize resource use efficiency of water, energy, CO2, CH4, heat, cold, minerals and space by focussing on the rest- and by-products. In leads to substantial reduction of the H2O, greenhouse gas and mineral footprint, efficient use of waste heat and focused on renewable energy, answering to the required adaptations to climate change in agricultural practice. Moreover the clustering approach serves reduction of transport costs and through the reduction of transportation. It leads also to reduction of veterinary and phyto-

sanitary risks and animal discomfort. Clustering with non-agro-industries like energy production and waste management further decreases economic costs and environmental emissions. Integration with water management offers another core element of industrial ecology, reducing water usage to a minimum and thus can be considered as adaptation to climate change.

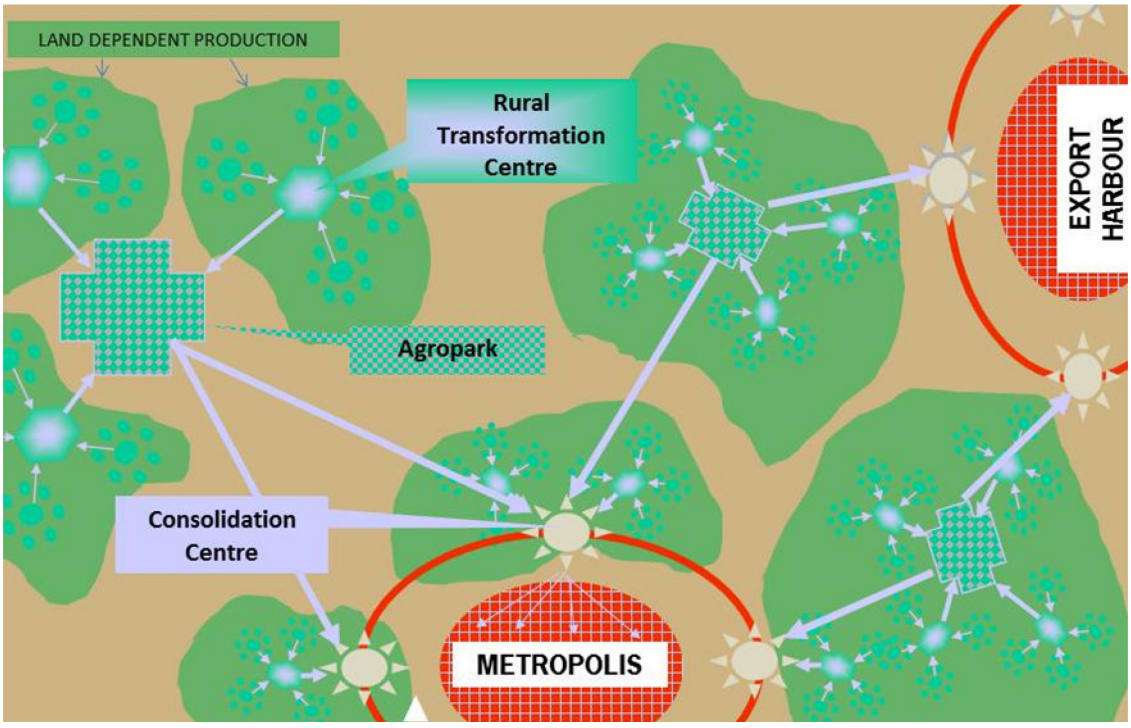
2.2.4 Agro logistics

The fourth key innovation is agro logistics. The production system that produces the food for the metropolises is just like the metropolises themselves organized as a global network. The retailers in these metropolises offer throughout the year products from all parts of the globe. Behind this global network is a system that is able to keep the agro products as fresh as possible in order to offer maximal shelf life in the supermarket. It is based on technologies as reefer containers and conditioned packaging and information systems for tracking and tracing and quality control. Extensive international agreements regulate trade and control risks of veterinary and phytosanitary diseases.

2.2.5 Integral design of hardware, orgware and software

The fifth key innovation of Metropolitan Food Clusters is the integrated design of so called hardware, orgware and software. Metropolitan Food Clusters are system innovations, meaning that not only the invention and application of new technology (the hardware) does matter but also the relations between the stakeholders involved should significantly be changed (the orgware). Entrepreneurs that engage in vertical integration have to work together instead of trying to squeeze each other with low prices or competition. Governments must create experimental space to enable application of new technologies etc. And, most important of all, Metropolitan Food Clusters are built on knowledge and knowledge exchange (the software).

Metropolitan Food Clusters are intelligent agro logistic networks. They are simultaneously oriented to the nearby metropoles and to the world market to which they deliver their products and from which they receive inputs that cannot be produced locally. Metropolitan Food Clusters fit into the context of the network and information society as the third development stage of humankind after the agricultural and industrial societies.



Typical components of the Metropolitan Food Cluster network are, at one end of the chain, production regions and satellite farms, centered around 'rural transformation centers', at the other end ' distribution and consolidation centers' directly servicing metropolitan or export markets to which they deliver their products and from which they receive inputs that cannot be sourced locally and in between 'Agro parks' forming the linking pin between the two.

A consolidation center serves a metropolitan market in a consumer responsive way throughout the whole year. From consolidation centers, products, produced and processed by Agro parks and other upward elements of the chain, are distributed in tailor made quantities and combinations that the city demands. Consolidation centers are situated close to the metropolitan areas. They receive large, homogeneous flows of (often fresh) products that either originate from collection centers, or Agro parks (and occasionally also from imports), and split them up into smaller quantities that customers (retail chains, the out-of-home sector, etc.) require, and then recombine them to packages that exactly fit each customer's demand. Consolidation centers also serve as export centers from where products enter the world market.

An Agro park is a spatial cluster of several value chains in an industrial set up, situated in the wider environment of the metropolis. The clusters contain a variety of different agro-production, -processing, agro logistic and agro and food linked services and functions. Within the cluster the principles of industrial ecology are being applied.

The Agropark thus combines units that represent the different parts of different value chains from primary production to secundary processing of ready to eat food product, with added compartments of essential agro business services like R&D, education and training facilities, trade and logistics facilities, park management services. Clustering with non-agro-industries like energy production and waste management can further decrease economic costs and environmental emissions.

Nieuw Prinsenland, an Agropark in the Netherlands where waste flows of sugarbeet processing industry are fed into a digestor producing power for the grid and heat and CO_2 for greenhouses in the park.

Rural transformation centers function in the network as collection and storage point for raw materials supplied by local farmers and as satellite farm themselves. The most important function of rural transformation centers is the key role that they play in offering education and training services to the local farmers. They can also house several secondary functions like education, health and financial services, shops and rural housing. The sourcing areas of raw materials, the production regions for feed, fodder, grains, fruits and vegetables that are land dependent are thus linked in a network cooperating through Agro parks, from which the demand for high quality induces the same level of jump innovations also in the sourcing areas of land dependent production. This transformation in land use practice, with good water practices, precision agriculture techniques, but also improved collection and agro-logistics will have to be supported with adequate education, training and extension to facilitate this required transition in land use and also in its linked social transitions, into other forms of cooperation.

The spatial clustering of different agro-production chains and the spatial combination of agro-processing, logistics and non-agro- functions in Metropolitan Food Clusters enables many prosperous scenarios. The concept is based on the principles of sustainable development (balanced development between planet-people-profit with an adequate process). In some cases building blocks will stand alone, in other cases they may be combined. An Agro park may double as a collection center, or as a consolidation center. Or it may be combined with a knowledge center or an export/import center. Such combinations need a flexible approach in order to make the resulting network fit exactly the needs of the specific region.

3 Conceptual framework CoP approach

3.1 Theory

MFC development generally is a path dependent almost evolutionary process which cannot be planned by using a blueprint. MFC development can be stimulated by interventions aimed at the functioning of networks and the absorptive capacity to knowledge at businesses and other organizations. The integration processes which are characteristic for Cluster development and the design and development of an MFC are complex and can be seen as a 'wicked' problem and a transition challenge in itself (Regeer, 2010). Integration between the various parts of the production chain (vertical integration) or integration between different sectors (horizontal integration) requires collaboration of all kind of stakeholders, from various domains (public, private or knowledge), with different backgrounds (cultural, disciplinary). Further the development of MFC has different problems in it selves: organizational, energetically, spatial, financial and personal.

Many actors are involved with strong interdependencies; there is limited consensus on the issues at hand on what is valid knowledge. Interventions have to cope with feedback loops which lead to unpredictable effects. Therefore MFC development and the emerging bio based economy require new forms of design and development, and therefore new applications of knowledge, management and business creation. New services to support MFC development are also needed. One way to induce effective solutions for sustainable climate proof biomass production via the so called KENGi approach, a 'creative co-design' process, in which **K**nowledge organizations, **E**ntrepreneurs, **N**on-governmental and **G**overnmental Organizations co-operate closely together to enable systems-**I**nnovations in the Food production and processing industry.

The management theory and the theoretical concept of the Community of Practice (CoP) (Wenger, 1998) in which academics and practitioners participate in order to come to social learning seems to fit this challenge very well. The CoP will promote in a trans disciplinary way the exchange of scientific concepts and tacit knowledge. In the transition to a green economy, (system) innovations will be needed in the agro business sector in order to create new perspectives for a highly efficient food production in terms of profit (more productive) and planet (resource efficient) and people (social responsibility), exemplified by the clustering of agro business chains in Metropolitan Food Clusters, including the reuse of waste flows. These promising propositions meet with resistance from existing structures, lack of an educated workforce, lack of knowledge and from vested interests. Knowledge alliances are needed in which stakeholders from business, society, research, Higher Education, intermediaries and the public sector participate and engage in new ways of working and the development of innovation Services (Gerritsen, Kranendonk and Coninx, 2012; Van Mierlo, 2010).

CoP is a widely used management concept for collective and social learning and can be seen as a tool for the creation of social networks. The central publication has been written by Wenger (1998) 'CoP: Use around the world as a learning resource and be a learning resource for the world.' People are social individuals and learning takes place in social environments. The social aspect determines the success of the organisation. Within specific social environments people come up to new ideas, products etc. So, growth arises from the social learning processes. Not individuals have a central place, but interaction between people and the formation of a group. The organisation can be seen as the (temporary) result of the process of social learning.

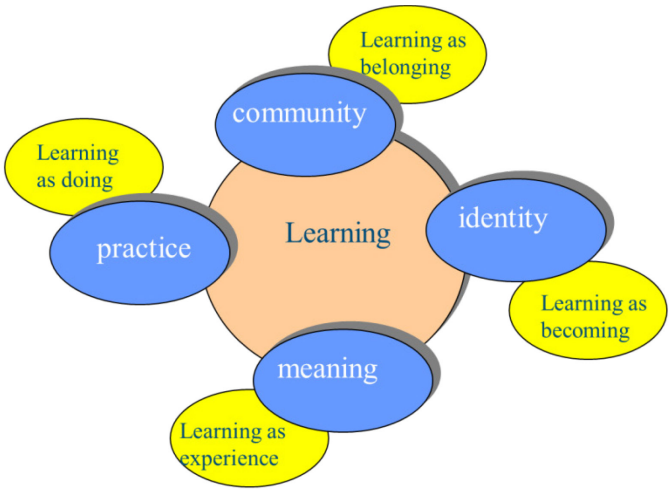
The concept of Community of Practice is an approach that enables different stakeholders together to innovate. A CoP offers management techniques which can be made useful for innovative regional development. This methodology contributes to new forms of regional planning for dealing with complexity and increasing the capacity for learning and knowledge. This can be applied to achieve Metropolitan Food Clusters in the regions and the exchange of knowledge and experiences within and between regions and initiatives.

The concept has four elements:

Community: the CoP often consists of participants from different domains, including the public, private and the knowledge domain. It is important that participants know and understand each other. This is an important basis to achieve shared initiatives.

Practice: the concept 'Learning by doing' will be put into real practice in order te create something common. This means that there is a joint exercise, group discussion, business case development occurs.

Meaning: Companies and organizations look differently at MFC and different aspects. Meaning means collectively exploring the issues of the future, naming trends and developments and new policies. Exchange of meanings serves as a basis to create new shared meanings, understandings, plans and initiatives.



Identity: In here the concept 'learning by belonging' is central. Through active exhange and co-creation in a joint practice and development of new common meaning also a new common identity will be created. Feeding marks and logos and other identity carriers reinforces this feeling. This can collectively stronger outward action. The CoP is as visible to the outside world, the other stakeholders in the regions, researchers CoP to explore their knowledge to decision makers and to deploy funding.

The members of a community are to a greater or lesser extent, a community on the basis of a shared identity and joint actual perspectives. In the community a common discourse (about content and direction) will be formed. This discourse occurs through social interaction. The participants are committed people within the communities organize temporarily in a particular domain. Development of the CoP can be promoted by strengthening the commitment of the participants, by ensuring meetings and promoting the exchange of meanings.

Essential within the concept of the CoP is the fundamental exchange of knowledge, know-how and meaning between members, which leads to a higher level of insight. On this stage problems can be overcome and renewal can be realised (Regeer and Bunders, 2003). The practice is directed to interdisciplinary, creativity and innovation. Many examples show that social learning processes can be very stimulating and motivating. However, some clear working conditions need to be established in order to support social learning processes in CoP's. (Wenger, 1998).

Facilitating and inspiring learning and development processes, is the main objective for the management of CoP's. Working together, sharing and especially common social learning and transformation processes are seen as key factors. Only in social settings, individuals come to insight, innovations and new identities that define the existence of the organisation (Wenger, 1998). Wenger gives only a few conditions for starting a CoP, by presenting the learning infrastructure. Design of a CoP has to be minimal and opportunistic. A CoP must be seen as a common enterprise. Innovation

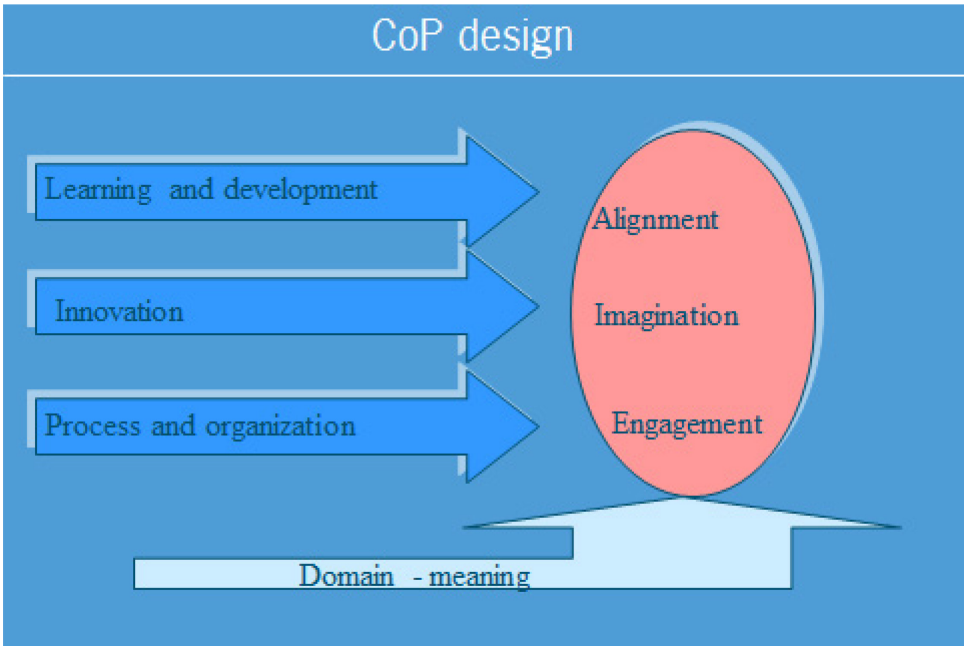
does not take place on schedule. You can't plan a CoP on a spreadsheet. It takes experimentation, risk and time to create. (Kranendonk, 2002).

The means on corrective steering on the Cop after the start are limited. Only the use of the three Master-roles (Process, Innovation, Learning and Development) will be (hardly) accepted:

master of process: strengthening the engagement can be realised by changing the organisation and the processes within it (network). Mutuality has to be stimulated, by creating physical and virtual interactions, common tasks and activities and by involving various levels and views. Also competence of the participants (initiative, inventiveness, creativity) and continuity (knowledge management and documentation) are important parts of stimulating the mutuality.

master of innovation: strengthening the power of imagination will support the creation of innovative plans and generation of solutions of the object of planning (use of creative techniques and a common working process). Imagination plays an important role to reach a higher level, to make the step from global to local and to stimulate learning processes. Enlarging the orientation, the knowledge and the experience of the participants can stimulate the power of imagination. Also reification can be very important. Creating new symbols, logo's, definitions and notions will bind the members.

master of learning and development stimulates the alignment and the direction of the innovative outcomes from CoP by using the boundary processes, coordination and planning processes, and harmonising with the wider world (organisations and processes). In the meetings the CoP is inward-oriented, but to fit the solutions to the wider world there must be an alternation between looking inward and outward. This can be stimulated. The CoP has to send enthusiasm, identity and new meaning into the wider world but also test these and search for synchronisation and matching with the wider world. The person who is the master looks for ways to achieve this and develops strategies with the participants.



In order to arrive at new ideas and concepts, a boost to innovation and new business case developments, creative techniques may be used. It can also be enhanced by alignment of the ideas within the CoP are developed in the outside world. Participants ensure that this impact found in strategy, policy and action by businesses, governments and research institutions, in clusters, but also at the level of national government and EU investors.

In the CoP, we exchange meaning, perceptions, experiences and information about the diverse aspects of the MFC concept in order to optimize the concept and the aspects and to operationalize it

into realization. The innovation and alignment takes place based on the knowledge and knowhow and the means of the different participants and the interaction between them.

The innovative ideas and initiatives will be applied on the level of firms, chains and regional clusters and will deliver return of investment to the participating private parties and to (inter)national and regional policy and research partners. In short, by creating this CoP we focus on the development of concept of integrated food clusters, of trans disciplinary knowledge, of regional clusters and of impact on (inter)national agro en food business initiatives that deliver benefits in new climate adaptation and mitigation strategies.

3.2 Connection with Climate KIC

The approach of CoP fits very well in the innovation approach of Climate KIC, focussing on 'the creation of new innovation from our ecosystem'. The Climate KIC-strategy focus is lied on:

> *European knowledge and innovation community specialising in climate change mitigation and adaption. We create new partnerships to integrate research, business and technology to transform innovative ideas into new products, services and jobs.*
>
> *We have developed a dynamic and open network whilst simultaneously managing integrated community partnerships to create climate innovations. These projects rally companies, cities and academic institutes around delivery of new projects and services.*
>
> *We build and connect the wider climate change entrepreneurship community including students, young entrepreneurs, research and development centres and venture capital investors. The aim is to generate more climate-related business start-ups, help start-ups grow faster and generate market growth into the business.*

CoP in Focus can make a perfect fit within the Climate KIC. Especially in this pathfinder trajectory there is room for discovering the concept of MFC, the benefits for climate, find out the optimum for case development and the social aspects of meeting and exchange. In CoP in Focus, four geographically different KIC partners, with their own case and own network, are involved. This is also the starting point of the working approach in co design of integrated food cluster as a so called KENGi network with knowledge partners, government and entrepreneurs involved. The current projects, level of knowledge development and networks of the four partners will be linked. Also a link will be made with other pathfinder trajectories, for example the KIC project Sustland (Germany) and Land adaptation and mitigation toolkit (Admit). The other cases are Protein Empire and Food cluster business case in Bag, in the central region of Hungary. Each own case of food cluster development is tailor made, taking the specific local ecological, social and cultural situation as a starting point, while at the same time connecting to each other's knowledge base.

3.3 CoP in Focus approach

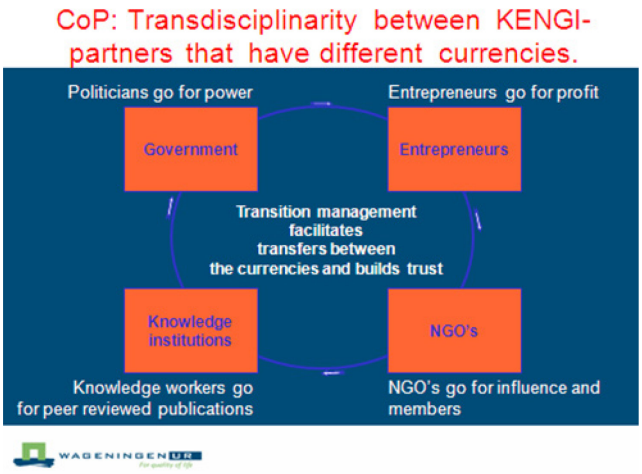
In the Netherlands the present Community of Practice Metropolitan Food Clusters (CoP MFC) explores the concept of the Metropolitan Food Clusters to operationalize it into practice. It is a method to share best practices, to identify joint challenges, opportunities and to take new initiatives. This CoP represents front runners from the public and private sector and from the domain of knowledge, on national level, as well on regional level. In the CoP, we exchange meaning, perceptions, experiences and information about the diverse aspects of the concept in order to optimize the concept and the aspects and to operationalize it into realization. The innovation and alignment takes place based on the knowledge and knowhow and the means of the different participants and the interaction between them. The CoP community consists of corporate and public actors, in a balanced composition of KENGi stakeholders, (Knowledge-Entrepreneurs-NGO's and Government for Innovation), because in that kind

of arena, new discoveries on adaptation and mitigation measures in this new forms of agriculture have the largest chance of implementation.

With this KIC project we want to expand the CoP on the level of Europe, to bring further the outcomes of the Dutch CoP and to contribute to the European innovation era. For this reason, collaboration between top institutes on food security and food safety, as Wageningen UR Alterra, the Helmholtz-Zentrum Potsdam, the Centre for Environmental Policy of the Imperial College London and Hungarian University of Gödöllő, Szent István University, and their linked networks, has been set up. These key partners are well situated in the large Nort Western European Metropoles of resp. greater Berlin area, Greater London, Randstad/Ruhr area and in the central Hungarian area that is considered an important agro hub for Central Europe and Russia. The integrated concept of Food clusters and the operationalization in these international regions have the potential of the development of new European business case development, which can be rolled out worldwide by European consortia.

Bring together the developers of regional innovation trajectories – from Hungary, The Netherlands, Germany and the UK - and get to know each other and leveraging partner skills and resources between the cases. Further goals, ambitions and activities of the CoP are:

- 3 meetings in 2012, one in 2013 in the four case areas.
- give meaning to Food production chain and cluster development – MFC development.
- Rolling out the fundamental principles behind the model of Metropolitan Food Clusters in the EU arena with focus on its climate mitigation and adaptation benefits. Discussion on this holistic model, to be enriched and transformed by other EU knowledge carriers from all KENGi groups. It is the arena to start further strategic partnerships.
- Growth of the CoP from 20 to 40 participants: participation of so-called supporters, representatives of KENGi partners on regional level. Participation of Climate KIC –network: (regional) management and project managers of comparable innovation projects.
- Create a community and build a Trans-European network of front runners and practitioners network - connect EU MFC initiatives.
- Exchange of knowledge and experiences on MFC design principles, work and management strategies, value chain (market and supply) models, business models on specific commodities, GIS based decision support tools, education and training strategies and possible curricula.
- Exchange and development of foot printing protocols etc.
- Exchange of the cases: approaches, concepts, mistakes, best practices, lessons learned, benefits, experiences, ambitions from the regional innovation trajectories.
- Give meaning to adaptation and mitigation strategies on climate change, on sustainability in Metropolitan Food Clusters – towards unifying concepts, measurements of climate benefits.
- Create new common initiatives and new projects on concrete MFC development in metropolitan areas, on regional development and rural transformation tactics.
- Embed the CoP on Integrated Foodclusters in the Climate KIC Innovation Ecosystem: CLC's, Platforms and RIC's and its linked SME's and innovation processes.
- Being helpfull to case development.
- Getting to know each other and better understanding.



The CoP management will be executed by the lead partner Wageningen UR - Alterra. They will prepare the meetings in collaboration with the representatives of the regions, make a design for the agenda, including exchange and mutual presentations, networking, use of creativity tools, excursions, facilitation of the meeting by the selection and mobilization of masters of process, innovation and learning and development. In between the meetings the CoP management will circulate reports, information to the project team and the CoP members.

4 Conceptual framework for climate benefits

4.1 Framework for analysis and definition of variables

This Section details the common approach based on benchmarking methods and standards across case studies, to measure climate contributions germane to mitigation and adaptation objectives. It's is based on a common work session of the Community of Practice in the Netherlands. In this meeting an expert from Alterra Wageningen UR has given an introduction of some European studies on climate effects of agriculture. Afterwards we did a workshop in which we all aspects of MFC and the agro food production chain have discussed and all forms of emissions have been summed up. The results of the workshop has been worked out and structured by Imperial College in collaboration with GFZ.

4.1.1 Common approach to impacts and indicators

Part of the main contribution of the project is to formalise the logic of linkage between case studies along the value chain. The clarity of knowledge created relies on structuring the variables according to the thematic focus of each case study and to the logic of linkage itself. The structure of variables reflects the difference in environmental service intensity ranging from primary production to secondary processing and retail as shown in Table 4.1.

Table 4.1
CoP-in-Focus impacts and indicators.

Note: Case study acronyms: AF refers to Agro-forestry case; MFC to Metropolitan Food Clusters NL, retail to UK and Distribution to the Hungaria case.

	Mitigation Measures		
Climate impact	Indicator – Contribution of new technique	Units of measure	Conventional practice baseline
Greenhouse gas abatement			
N_2O emissions CO_2 emissions	Reduction of fossil fuel consumption by replacement with renewable material, e.g. for heating (wood) (*AF*)	t C_{eq}/ha/yr saved	Compared to heating energy equivalent of fossil fuels
N_2O emissions CO_2 emissions	Reduction of fossil fuel by more efficient cultivation equipment runs (*AF*)	t C_{eq}/ha/yr saved	Compared to conventional intensive cultivation of crops and wooden biomass in separate plots
N_2O emissions	Reduction of N_2O emissions by greater nutrient uptake in agro-forestry plots (*AF*)	t N_2O/ha/yr saved (can convert to t C_{eq}/ha/yr saved for climate-only analysis but should also keep record of N cycling)	Compared to conventional intensive cultivation of crops and wooden biomass in separate plots
CH_4 emissions	Reduced CH_4 emissions by enhanced forage quality (*AF*)	t C_{eq}/ha/yr saved	Compared to conventional intensive cultivation of fodder plants
CH_4 emissions	Reduced CH_4 emissions due to improved manure management and utilisation (*MFC*)	t CH_4/ tonne produce /yr saved, also expressed as t C_{eq}/ tonne produce /yr saved for climate-only assessment	Compared to conventional manure bulking and management practices
CH_4 emissions	Reduced CH_4 emissions due to improved stable methane emissions capture techniques (*MFC*)	t CH_4/ tonne produce /yr saved, also expressed as t C_{eq}/ tonne produce /yr saved for climate-only assessment	Compared to conventional stable and grazing management practices

CO_2 emissions	Reduced CO_2 emissions due to reduced transport of manure and digestate (*MFC*)	t C_{eq}/ tonne manure and digestate/yr saved	Compared to conventional fragmented used of manure and by-products
CO_2 emissions	Reduced CO_2 emissions due to reduced electricity and fossil heat requirements for lighting, powering and heating coordinated meat-dairy-horticulture operations (*MFC*)	t C_{eq}/ha/yr saved and also t C_{eq}/tonne produce/yr saved	Compared to conventional fossil (or grid average) energy requirements of separate meat, dairy and horticulture operations
N_2O emissions	Reduction of N_2O emissions due to greater nutrient recycling across coordinated husbandry and horticulture operations, i.e. reduction of industrial fertilisers. (*MFC*)	t N_2O/tonne produce/yr saved (can convert to t C_{eq}/ tonne produce /yr saved for climate-only analysis but should also keep record of N cycling)	Compared to conventional intensive cultivation of crops and wooden biomass in separate plots
CO_2 emissions	Reduction of refrigeration energy requirement though optimised distribution (*Distribution*)	t C_{eq}/km^2 consolidation surface/yr saved and also t C_{eq}/tonne produce/yr saved	Compared to conventional fossil (or grid average) energy requirements in uncoordinated meat, dairy and horticulture logistics.
CO_2 emissions	Transport in distribution (*Distribution*)	t C_{eq}/tonne produce/yr saved	Compared to conventional fossil fuel requirements of transport in uncoordinated meat, dairy and horticulture operations.
CO_2 emissions	Requirement for certification on energy-efficient farming (*Retail*)	t C_{eq}/tonne produce/yr saved	Compared to conventional uncoordinated animal husbandry and farming practices.
CO_2 emissions	Requirement for certification on energy-efficient produce transport (*Retail*)	t C_{eq}/tonne produce/yr saved	Compared to conventional fossil fuel requirements of transport in uncoordinated meat, dairy and horticulture operations.
CO_2 emissions	Reduction of consumer transport through convenience store trend (*Retail*)	t C_{eq}/£1000 sales/yr saved	Compared to conventional fossil fuel requirements of transport in uncoordinated meat, dairy and horticulture operations.
Non-greenhouse gas emissions abatement			
Particulates emissions	Reduction of particulates emissions from transport through coordination across meat-dairy and horticultural operations (*MFC*)	kg PM10/tonne produce/yr saved	Compared to conventional fossil fuel requirements of transport in uncoordinated meat, dairy and horticulture operations.
Particulates emissions	Reduction of particulates emissions through improved heating and ventilation systems in meat/egg-dairy and horticultural operations (*MFC*)	kg PM10/tonne produce/yr saved	Compared to conventional heating and ventilation systems in meat/egg, dairy and horticulture operations.
Adaptation Measures			
Management of threats			
Crop loss prevention	Reduction of losses due to extreme weather events by improving microclimatic conditions (*AF*)	M€ damage / yr	Compared to conventional intensive cultivation of crops and wooden biomass in separate plots
Safeguarding biodiversity	Diversity of organisms supported through diverse habitats (*AF*)	Species / ha	Compared to conventional intensive cultivation of crops and wooden biomass in separate plots
Safeguarding biodiversity	Increase structural and functional diversity to maintain and protect natural resource services (*AF*)	Number and type of ecosystem service functions maintained at regional scale	Compared to intensively and conventionally used landscapes
Production risk diversification	Diversified production to spread risk of impact of fluctuating climate	€ income / decade	Compared to conventional farm layouts

	(*AF* and *MFC*)		
Adaptation to water scarcity	Reduction of exposure to water scarcity through the incorporation of water use along harmonized material and energy flows in an *MFC*	m^3 / tonne produce	Compared to conventional irrigation and animal husbandry practices
Managing the risk of extreme weather events	Locating key infrastructural facilities away from drought or flooding-prone regions (*MFC, Distribution and Retail*)	Number of infrastructural facilities outside areas at risk.	Compared to conventional location-decision practices
Adaptation to water scarcity	Diversification of suppliers of water-intensive produce across different world regions (*Retail*)	Number of suppliers growing climatically and economically viable produce	Compared to conventional sourcing practices
Adaptation to water scarcity	Enforcement of requirement to certify cultivation of crops suitable to water-stressed regions (*Retail*)	Number of suppliers growing climatically and economically viable produce	Compared to conventional sourcing practices
Enhanced resilience			
Soil quality preservation	Improvement of the ability to preserve physical (reduced erosion) and chemical (nutrient availability and flow) characteristics through innovative agro-forestry techniques (*AF*)	- ha protected from erosion/tonne produce/yr - ha protected from nutrient depletion or sturation/tonne produce/yr	Compared to conventional uncoordinated agricultural and silvicultural operations.
Water preservation	Improvement of moisture retention capability and reduction of irrigation requirement through targeted application of agro-forestry techniques (*AF*)	m^3 / tonne produce / yr m^3 / tonne woodfuel / yr	Current water requirements of separate sylvicultural and agricultural operations
Water preservation	Enforcement of certification for water stewardship and efficient farming (*Retail*)	m^3 / tonne produce / yr	Current level of enforcement and characteristics of water stewardship in food production
Phosphorus preservation	Reduction of industrial fertiliser needs and application due to improved crop distribution and soil preservation achieved in agro-forestry (*AF*)	t fertilizer/ tonne produce / yr t fertilizer/ tonne woodfuel / yr	Current fertiliser requirements of separate sylvicultural and agricultural operations
Phosphorus preservation	Reduction of industrial fertiliser needs and application due to improved manure management and digestate production (*MFC*)	t fertilizer/ tonne produce / yr	Current fertiliser requirements of separate sylvicultural and agricultural operations
Biological Carbon stock preservation (above and below ground)	Maximisation of above and below-ground biological carbon stocks due to crop distribution and different cultivation cycles in agro-forestry (*AF*)	t C biological stock/ha/yr	Compared to current separate sylvicultural and agricultural operations
Material intensity	Requirement for light-weighting of produce packaging (*Retail*)	t packaging / t produce /yr	Compared to currently enforced standards for packaging:product ratio

The final visualisation of all individual *improvements and savings* that were quantified in each case will be showed and described in the case studies (H5).

4.1.2 Particular elements per case study

Storylines
Each case has been developed along a specific storyline of problem with status quo, possible solutions and recommendations. It is estimated that the highest share of positive climate impacts will reside within the MFC case Protein Empire (Chapter 5). That is why a leitmotiv during the project has been 'the impacts of the meat and dairy we make, sell and eat.' Each case, however, will relate to the MFC case by virtue of being a preceding or subsequent node along the value chain. Consequently, each case relates to the overarching storyline or guiding thread presented in Section 3.3.

Key commodities
In order to hang onto the guiding thread coherently, all cases have highlighted the main commodities or services whose flows or impacts can be followed along the virtual value chain. In addition they have highlighted their relevant modifications to the status quo, for example modal shifts, fuel switching, energy transmission avoidance, increased efficiency of conventional means and the obviating of transport steps.

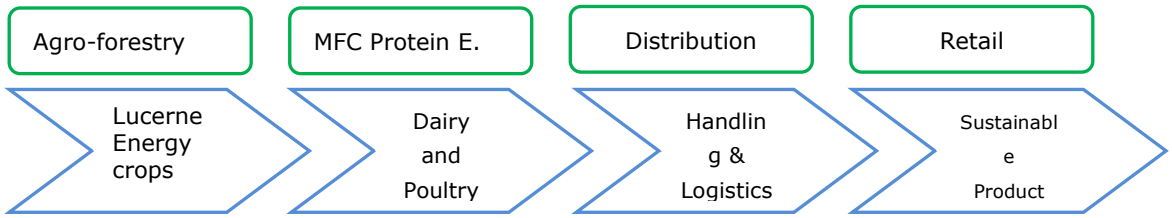


Figure 4.1 *Key commodities and activities across case studies.*

4.2 Relevance of indicators for estimating effectiveness of adaptation measures

4.2.1 Motivation and challenges

The effects of climate change are already observable in many regions of the world. Adaptation to its unavoidable consequences is, therefore, the main strategy of dealing with climate change alongside mitigation efforts. It is crucial to estimate the effect of adaptation measures in order to implement the most effective initiatives that achieve maximum value for money. Moreover, there is a common need to share information and experience among practitioners and researchers involved in the implementation and evaluation of adaptation measures. Therefore, a system of indicators for monitoring the success of the measures taken is needed in order to provide a means to enable the comparison of different adaptation options and to communicate their respective potential (M. Harley, 2008).

4.2.2 Concepts and categories of adaptation indicators

Adaptation is a concept that can be viewed from different angles. Firstly, adaptation may refer to the 'adjustment in natural or human systems in response to actual or expected climatic stimuli,' thus implying a development of institutions or procedures towards a certain goal of safeguarding a level of wellbeing perceived as desirable and feasible (Tirpak, 2006). Furthermore, adaptive measures may also stimulate processes that help to cope with the undesirable effects of climate change or to take advantage of its beneficial aspects. Finally, adaptation may also be judged by its actual outcome, i.e. by the achieved reduction in harm and risks or the realization of chances and opportunities.

Pragmatically, in terms of choosing appropriate indicators of the effectiveness of adaptation measures, one will have to focus on process-related as well as outcome-related parameters. This is mainly because the adjustment of systems refers largely to abstract aspects that are difficult to measure.

→ Indicator systems for climate adaptation actions mainly focus on the progress in the implementation (process-based indicators) or the effectiveness of an intervention (outcome-based measures).

A number of specific challenges is associated with the definition of suitable adaptation indicators, which, among many, includes (M. Harley, 2008); (H.McGray, 2011); (DEFRA, 2010).

- long timescales involved.
- uncertainty of climate projections and emission scenarios.
- interrelations of 'hazards' and 'opportunities'.
- availability of relevant data, in particular the lack of baseline data and historical trends.
- insufficient sharing of information across stakeholder groups.
- the multi- and cross-sectoral nature of adaptation options.
- wide range of adaptation options.
- missing agreement over what constitutes 'success' in terms of climate adaptation.
- the fact that the act of implementing mitigation measures is per se a sign of adaptation.

The different categories of potential indicators relate to adaptation measures that change something, such as:

- awareness, knowledge and engagement.
- changing exposure.
- changing vulnerability or adaptive capacity.
- changes in actual impacts.

Thus, a classification of success indicators derived from these measures may consist of the following subgroups:

- Indicators for Building Adaptive Capacity.
- Indicators for Implementing Adaptation Actions.
- Indicators for Sustained Development in a Changing Climate (H.McGray, 2011).

These categories may serve as a guideline for selecting appropriate adaptation indicators in respective fields of action.

Similar to mitigation indicators, setting an appropriate baseline for comparing conditions before, during and after taking an adaptation action is a crucial step. In order to set a proper baseline, one will have to 'review existing information on current vulnerability, climate risk, and current adaptation measures, describe adaptation policies and measures in place and develop baseline indicators of vulnerability and adaptive capacity that take into account the underlying historical trend in the indicator value over time' (H.McGray, 2011).

4.2.3 Examples for potential adaptation indicators connected to MFCs

The kind of indicator chosen for measuring and monitoring adaptation action obviously depends on the observed sector and the problems to be dealt with. So far, there is no international standard for adaptation indicators, nor a generally accepted framework. Many countries, however, have put in place their own monitoring systems for evaluating their national climate adaptation schemes. The German Environmental Agency, for example, has proposed such an indicator concept for its adaptation strategy (UBA, n.d.). For a number of different action fields, relevant indicators have been defined and prioritized. Action fields include amongst others:

- human health
- water
- soil
- biodiversity
- agriculture
- the energy industry
- trade and industry
- transport infrastructure
- spatial planning
- population protection

The action field 'agriculture' within CoP-In-Focus, will be of special importance. For several aspects of this action field, relevant indicators have been defined. For example, the sub-theme 'Changes in the stability of yields' encompasses 'Changes in yield of winter wheat (per hectare)' and 'inter-annual variability of yields' as potential measures to evaluate the adaption status. Another sub-them of focus is 'Adapting the cultivation management (such as soil cultivation or fertilisation),' which encompasses indicators such as 'Inland output of pesticides in all categories: Quantities of chemical agents, dominance indices of chemical agents' or 'Application of pesticides per hectare. A promising classification alternative is to draw categories of what society is adapting to. For instance, we fertilise because land is eroding, drier and hotter. This could be subsumed in a category of physical changes. Similarly, we fumigate because hotter weather gives rise to more pests. This could be subsumed in a category of biological changes.

In general, this elucidation of indicators can be regarded as a pool from which appropriate indicators are selected for all Cases Studies in the project.

4.2.4 Key principles

The following key principles were part of the rationale to select adequate adaptation indicators for CoP In Focus:

- Indicators should be unambiguous and, if possible, sectorally distinct to avoid providing duplicate information.
- The chosen set should include both process-based and outcome-based indicators.
- The indicators should be as simple and as transparent as possible for communication purposes.
- A correct baseline must be defined.
- Indicators should possibly include narrative reporting alongside quantitative indicators.
- The database needed for monitoring the adaption progress by using the respective indicators should be publicly available on a long-term basis (M. Harley, 2008).

4.3 Guiding thread of climate benefits along value chains

CoP in Focus strove to create a rationale that would remain coherent despite being studied in different regions. Focusing on high impact products and on the steps up-stream and down-stream the value chain achieved that coherence. This is akin to focusing resources according to the 80-20 rule that states that 20% of the cases create 80% of the effects. Previous studies on the impacts of food value chains, as shown in Figure 4.2, helped in the definition of the key commodities to be studied (Lesschen, 2011) (Velthof, 2009).

The nexus across all case studies within CoP in Focus is substantiated through the sequential relevance of their core activities. They reflect exemplar steps of a coherent supply chain. CoP in Focus set out to demonstrate how elements of communities of practice can be built within and across regions, rather than seeking to exemplify all steps in a single location. One of the main contributions of the project is precisely this ability to initiate communities of practice based on geographically removed steps of the supply chain, which can then branch out to other immediate stakeholders. Characterising these geographically removed possibilities, and their potential hurdles, helps to demonstrate the feasibility of full-supply-chain communities and the preparation needed to accelerate their development.

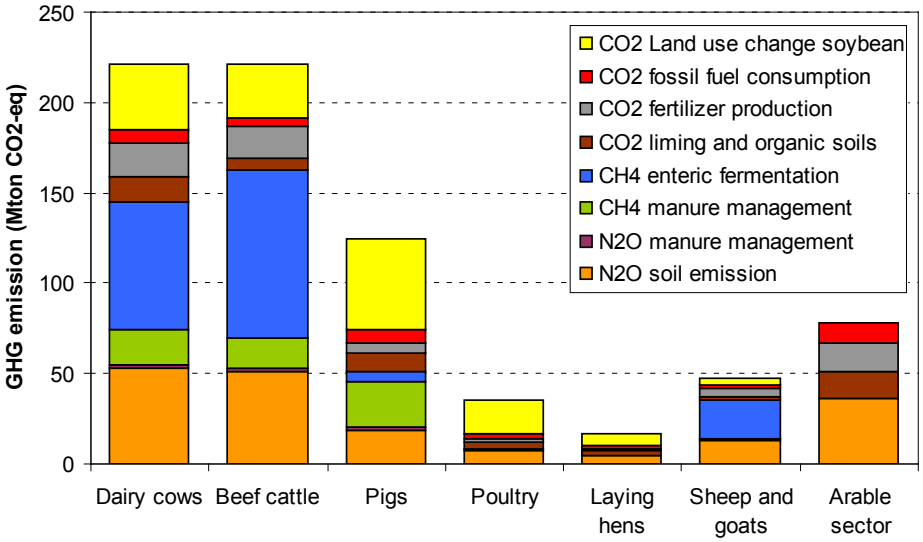


Figure 4.2 *Greenhouse gas impacts of principal food value chains*

The guiding thread across all case studies is described as follows. The connection between the agro-forestry and the meat and dairy value chains is achieved through focusing on the feed production node. In case study of Lower Lusatia, lucerne is grown in alley-cropping plots, which is used as feed in livestock raising. An additional benefit of this particular example is that the plots constitute the regeneration of open-cast mining sites. Through the additional income from the energy crops, the ecologically beneficial production of lucerne becomes economic and improves the viability of both ally-cropping and dairy production whilst increasing to the ecological performance of the latter. Most benefits germane to agro-forestry can also be applied to silvo-pastoral and other systems combining forestry with cereal production, for instance in southern Europe. Continuing onto the next node in the supply chain is the explanation of how agro-forestry and dairy farming inputs are processed within the Protein Empire case study, which is an exemplar Metropolitan Food Cluster (MFC). In this case physical inputs, along with energy flows, are harmonised across value chains through industrial ecology techniques. The nexus between lucerne, dairy products and, for example, horticulture is thus created.

The relevant functions of the logistical distribution node are represented in the Consolidation and Distribution case study. The infrastructure relevant for the handling and shipment of the dairy products as well as animal feed of the thematic thread are studied. Finally, in order to show how the optimised outputs from MFCs can be marketed, the retail case study focuses on the significance of the strategy of supermarkets in enabling the access to products from previous nodes. In essence, how accessible to consumers products from MFCs can become. Influence on the decisions of suppliers can foster or hinder the practices that produced the lucerne and other feed, the optimised dairy and poultry products and the suitable logistics for these optimised chains. Following this thread, it was revealed that to change the actions of key influencers engagement with standard-making entities and industry associations is needed.

5 Case development

In this Chapter the four cases studies will be described. Two cases can be seen as best practices, because the seemed to have potential for business case planning and have apparently led to further initiatives on MFC development. We will present MFC Brandenburg (5.1), MFC Proteine Empire (5.2), MFC Bag (5.3) and MFC London (5.4). The cases will be described on: description of the region, MFC development in the region, regional climate analysis, regional network development and the regional visit of the CoP in Focus project team, in which common MFC planning activities will be described.

5.1 MFC Brandenburg - Land use and agroforestry

5.1.1 Background and description of the study area

The GFZ German Research Centre for Geosciences in Potsdam, in cooperation with the Brandenburg University of Technology in Cottbus (BTUC), has been carrying out a variety of studies in different set-ups of agroforestry plots for more than 15 years. These sites are mainly situated in the Lower Lusatian region of the State of Brandenburg close to the city of Cottbus (see Figure 5.1).

The region is characterized by a continental climate with low precipitation and extended drought periods in the summer season.

The region is and has been subject to intensive and large-scale open-cast mining. Lignite mining started in the 1920s. More than 20 mining areas can be found in this region, with about five of them still active today. The affected area sums up to approx. 80,000 ha. Marginal sites, generally derived from nutrient poor periglacial soils, extend to a total area of about 31,000 ha (2009). Major ecological problems resulting from mining are groundwater table depression (about 2,100 km^2 are affected) and soil loss and degradation (numbers provided by BTU Research Center Mining Landscapes). Therefore, reclamation of soils and restoration of landscapes of former mining areas are the main challenges with regard to the re-establishment of sustainable forms of land use.

At the same time, these conditions offer a unique opportunity to test the resilience of agricultural systems with regard to climate and nutrient stress. Agroforestry systems, such as alley-cropping systems with trees managed as short-rotation coppices (SRC), appear potentially suitable for both the reclamation of such post-mining landscapes and the management of agricultural set-aside areas and marginal land. Various studies have shown the positive impact of agroforestry practices on soil organic matter formation and on water and nutrient efficiency.

At the landscape level agroforestry systems are well known to foster the biological diversity and to positively influence the microclimate. Further benefits relate to the aesthetic gain resulting from such systems and from potential recreational value. With regard to food provision for large metropolitan areas such aspects may play an important role in fostering the connectivity between rural and urban production areas in the future which may, in turn, contribute to the lowering of the CO_2 footprint and also help to meet the quality requirements of consumers who increasingly demand higher ecological standards regarding primary production.

Agroforestry systems may also serve as building blocks in the formation of multifunctional landscapes that allow for the harmonisation of different societal needs such as food provision, energy supply and recreational demands and improvement of the microclimate. The revenue coming from agroforestry systems may even exceed that of agro-industrial production even at lower yield levels as to the reduced application of fertilizer and pesticides. Therefore, the concept of 'metropolitan food clusters' also requires an in-depth analysis of these cultivation schemes as an option for bridging the gap between the food production chain in rural areas and urban markets.

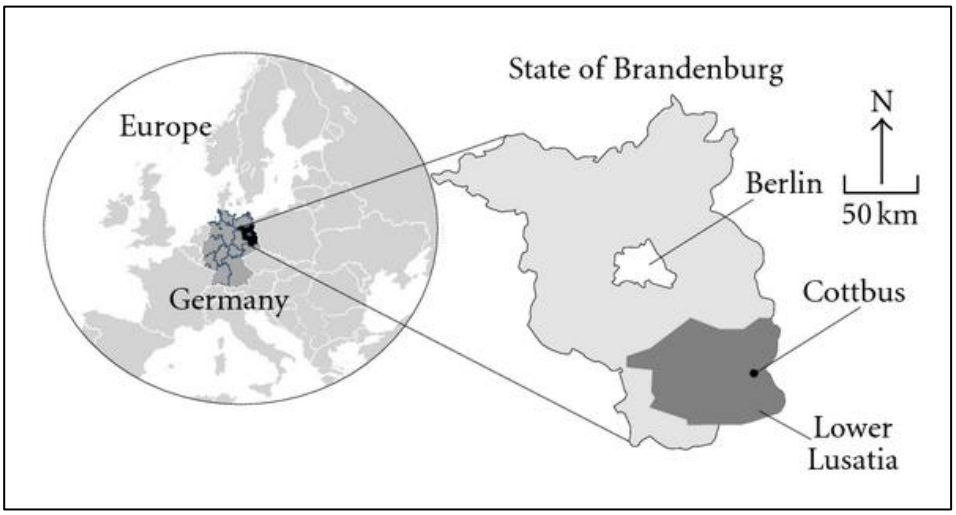


Figure 5.1 *Location of the lignite mining region of Lower Lusatia in Germany (Source: Quinkenstein, Pape, Freese, Schneider and Hüttl, 2012).*

5.1.2 The role of sustainable land use practices in metropolitan food clusters – climate relevance and potential contributions to mitigation and adaptation

Few human activities are as vulnerable to climatic variability as agriculture. Agricultural yield highly depends on climate and weather, particularly temperature, radiation, CO_2 and precipitation, and is also strongly affected by site factors that are indirectly determined by the climate, such as soil organic matter, water holding capacity, nutrient cycling, salinization and soil erosion. In return, the global trend of intensified agricultural management practices is generally regarded as one of the main drivers of climate change as to the enhanced turnover of soil organic matter and the release of greenhouse gases (CO_2, N_2O, CH_4) into the atmosphere.

At the same time, the world will experience an increasing demand for both food and renewable primary products due to the growth of the global population in the next couple of decades. This trend and the increasing exposure of agricultural systems to extreme climatic events call for an adaptation of existing land use schemes.

Agroforestry systems may offer an alternative concept for optimizing the production of energy crops and trees beyond the productivity of traditionally managed forest and agricultural land. This approach is also highly suitable for re-validating agricultural set-aside areas, to reclaim degraded sites (e.g. due to mining), and potentially also to restore contaminated sites. Agroforestry systems are known to contribute to (a) control of wind and water erosion, (b) optimization of the water and nutrient efficiency, and (c) enrichment and stabilization of soil organic matter and, hence, to carbon sequestration. Furthermore, agroforests and intercrops enhance biological diversity and results in an improvement of self-regulatory mechanisms for pest control. Diversified systems require lower management inputs (fertilizer, pesticides etc.) and can, therefore, achieve high revenue, even at lower production rates.

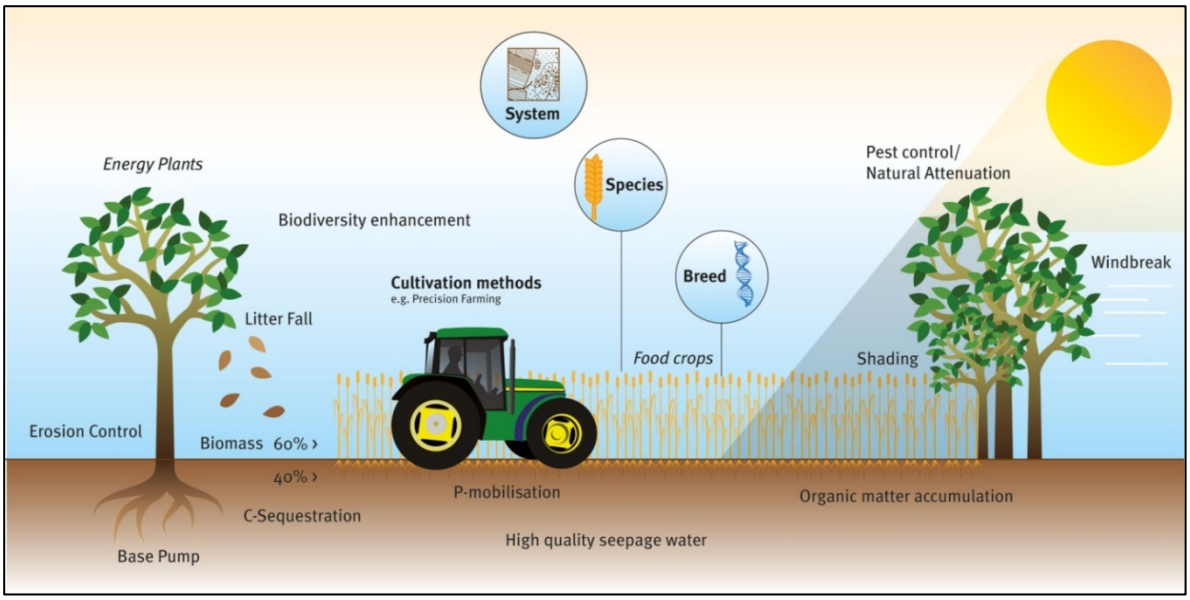


Figure 5.2 *Diagrammatic scheme of the potential benefits of diverse agricultural cultivation systems such as agroforestry.*

Agroforestry and other alternative agricultural production systems may hold great potential for carbon sequestration which, in turn, calls for more differentiated consideration in future CO_2 certification approaches. Agroforestry has even been recognized as having the greatest potential for C sequestration of all land use forms analyzed in the Land-Use, Land-Use Change and Forestry report of the IPCC (Jose and Bardhan, 2012).

Carbon sequestration and emissions of greenhouse gases depend on external input and management strategies within crop rotations. There are many interactions of these factors regarding their effect on soil fertility and crop performance. However, a systematic quantification of carbon sequestration for different crop-tree-combinations and varying cultivation regimes is still largely missing and should be subject to further research and application activities.

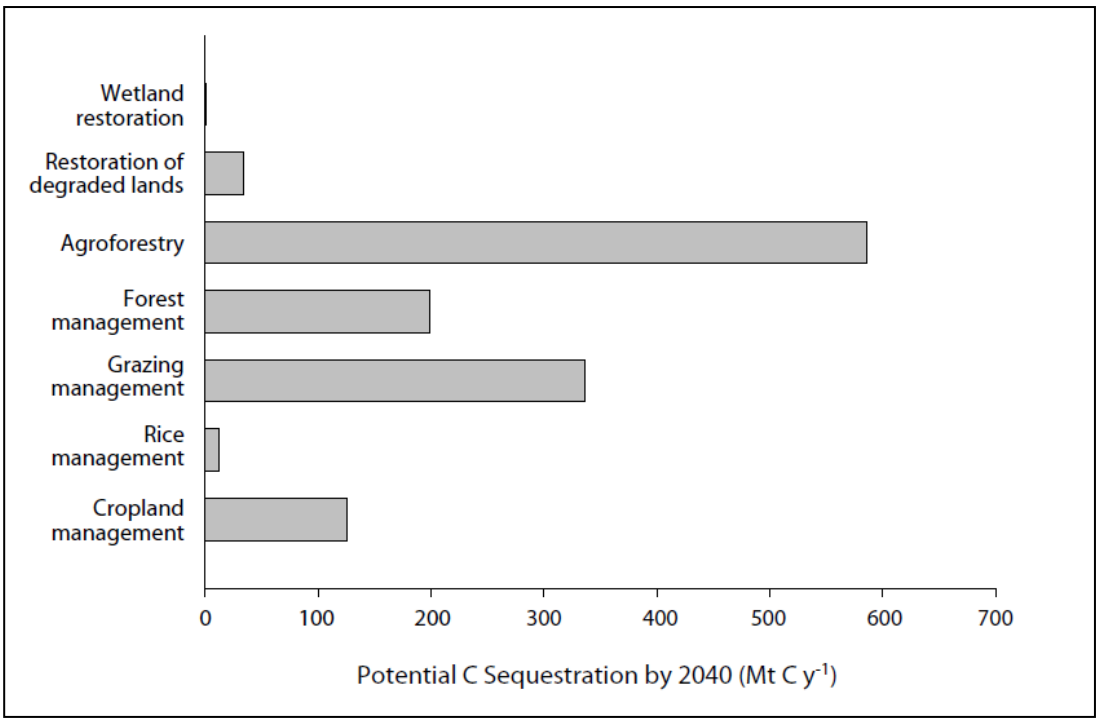


Figure 5.3 *Carbon sequestration potential of different land use and management options (Source: Verchot, Noordwijk, Kandji, Tomich, Ong, u. a., 2007).*

In order to implement the most effective schemes and methods and to achieve maximum value for money it is crucial to quantify or estimate the effect that these cultivation measures actually have in terms of climate mitigation and adaption. Therefore, meaningful indicators need to be defined, also for monitoring and comparing the climate benefits of different cultivation methods in an MFC-context. The following list of potential mitigation and adaption indicators is, in parts, based upon the proposal of Schoeneberger et al. (Schoeneberger, Bentrup, Gooijer, Soolanayakanahally, Sauer, u. a., 2012) and modified accordingly.

Category	Sub-category (Impact function with regard to climate change)	Contribution of agroforestry	Indicator	Baseline
Mitigation	*Reduction of greenhouse gas emissions*	Reduction of fossil fuel consumption by replacement with renewable material (wood)	t C/ha/yr saved	Compared to energy equivalent of fossil fuels
		Reduction of fossil fuel by more efficient equipment runs	t C/ha/yr saved	Compared to conventional intensive cultivation of crops and wooden biomass in separate plots
		Reduction of N_2O emissions by greater nutrient uptake	t N_2O/ha/yr saved	Compared to conventional intensive cultivation of crops and wooden biomass in separate plots
		Reduction of N_2O emissions by reduced fertilizer application	t N_2O/ha/yr saved	Compared to conventional intensive cultivation of crops and wooden biomass in separate plots
		Reduced CH_4 emissions by enhanced forage quality	t C/ha/yr saved	Compared to conventional intensive cultivation of fodder plants
	Carbon sequestration	Accumulated C in woody biomass (above-ground)	t C/ha/yr stored	Compared to conventional intensive cultivation of crops and wooden biomass in separate plots
		Accumulated C in the soil (below-ground)	t C/ha/yr stored	Compared to conventional intensive cultivation of crops and wooden biomass in separate plots
Adaptation	*Reduction of threats and enhanced resilience*	Reduced impact of extreme weather events on crop production through improved microclimatic conditions	[Financial loss in € / yr]	Compared to conventional intensive cultivation of crops and wooden biomass in separate plots
		Greater habitat diversity to support organisms	Number of species / ha	Compared to conventional intensive cultivation of crops and wooden biomass in separate plots
		Provide greater structural and functional diversity to maintain and protect natural resource services	[Number of pre-defined ecosystem service functions maintained (on a regional scale)]	Compared to intensively/conventionally used landscapes
		Create diversified production opportunities to reduce risk under fluctuating climate	Farm income in € / decade	Compared to conventional farm layouts
	Enhanced system resilience by increased biodiversity	Provide travel corridors for species migration	Number of species / ha (on a regional scale) m travel corridors / ha	Compared to intensively/conventionally used landscapes

5.1.3 The value chains of land use regimes for food/feed products and bioenergy/biofuels – Potential contribution of agroforestry measures to the establishment of metropolitan food clusters

In order to have viable, robust value chains that integrate the demands of both food and energy crops we must design and manufacture harvest systems that provide the following: high biomass quality, low cost, minimal disruption of the harvest, and environmental benefit. Another aim would be the minimisation of costs of transportation from field to storage. These criteria are particularly important

as several European countries and especially Germany have formulated ambitious targets for bioenergy utilization. Therefore, reliable value chains with sufficiently large volumes have to be identified. It will also be important to design all links of the agricultural supply chain in concert in order to optimize all phases of the system.

On-farm production of timber and non-timber agroforestry products fits into this broader context of multi-functional landscapes. As mentioned above, in addition to the economic goods provided by agroforestry systems there are also several ecological benefits such as habitat protection, landscape enhancement, protection of water resources, carbon sequestration, etc. However, in order to make managerial and operational decisions leading to the production of these agroforestry goods and services producers need resources.

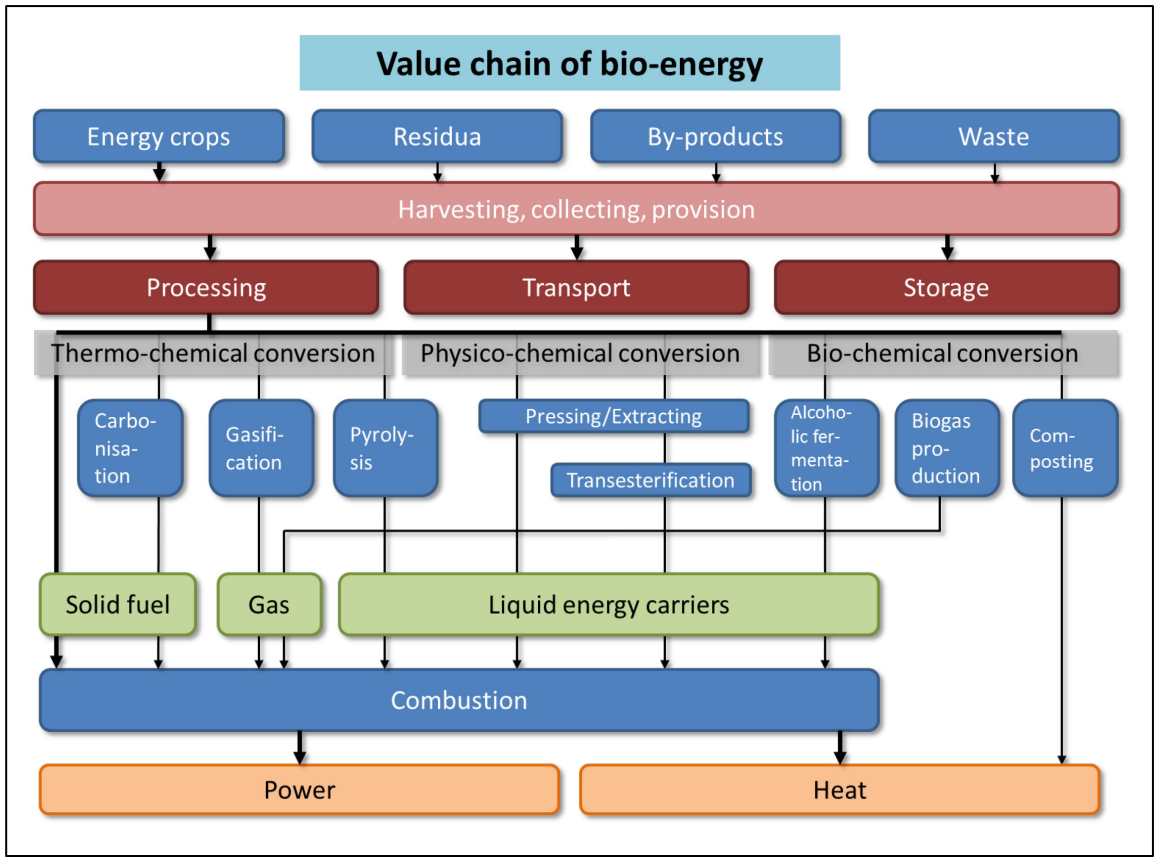


Figure 5.4 *The value chain of bio-energy production.*

The idea of integrating multiple uses through agroforestry is increasing in popularity among planning authorities and economic development agencies. Agroforestry practices are being incorporated into various land management and development projects. This and related land use practices have the potential to generate environmental goods and services that support the creation of networks of small and medium-sized spin-off enterprises, which will provide services to support producers' operations as well as product harvesting, processing and marketing.

In summary, under certain preconditions the integration of agroforestry plots into metropolitan food clusters can contribute to the establishment of sustainable food and feed production schemes and to a synergetic connection of value chains, as farmers receive additional revenue from the parallel cultivation and marketing of energy wood.

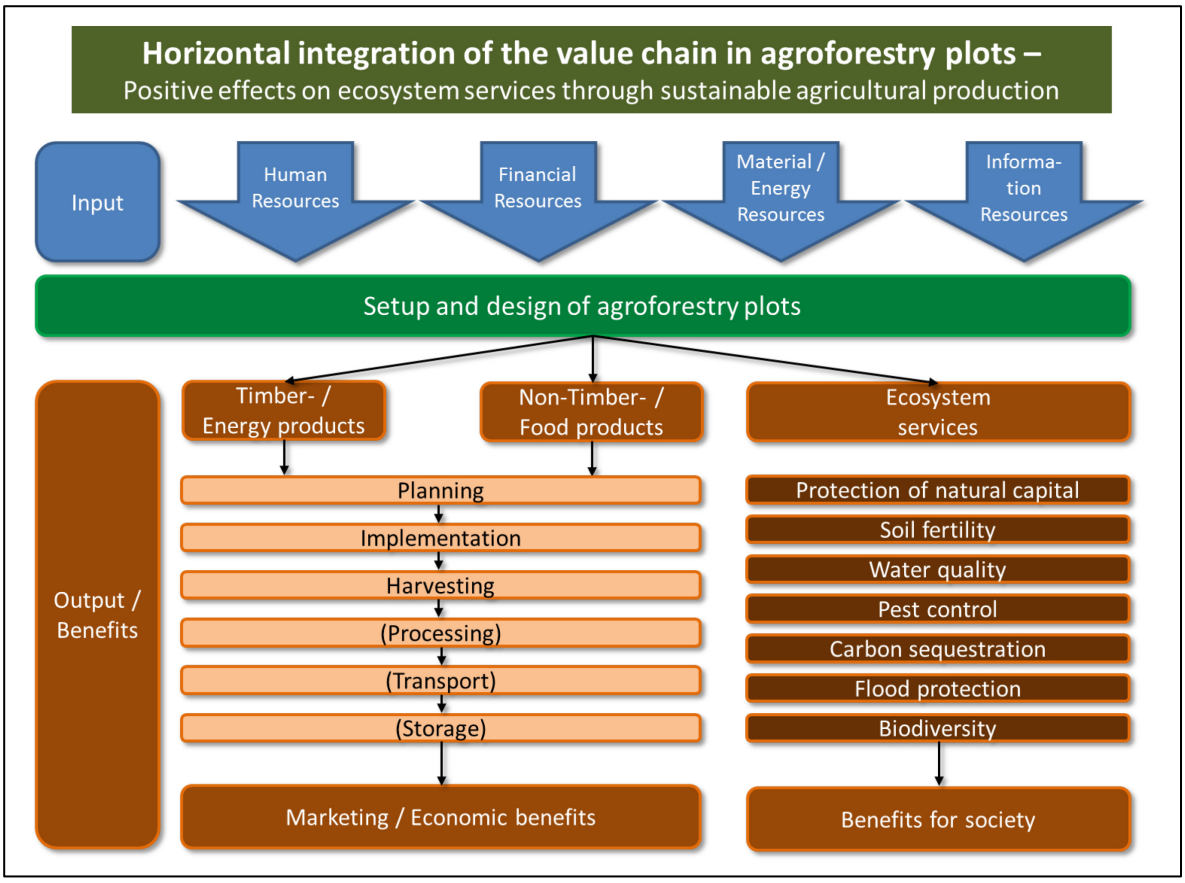


Figure 5.5 *Horizontal integration of the value chain in agroforestry plots.*

5.1.4 Network development – KENGI

Apart from the scientific interest, the potential ecological benefits of novel sustainable management and cultivation systems have also economic implications and are, therefore, highly relevant for enterprises dealing with technology-development in different realms of the agricultural sector. This is reflected by the commitment of several business partners who are interested in getting involved in activities emerging from this pathfinder initiative.

The implementation of land use systems such as alley-cropping systems, which, for example, offer manifold ecological advantages over conventional management schemes, will put different demands on the design of farm machinery used for cultivation and harvesting; therefore, the *Claas* company as a leading agricultural machinery manufacturer has in earlier project initiatives expressed its strong interest in accompanying further Climate-KIC-activities and possibly acting as a supporting partner to utilize the findings from relevant projects for the future product development and adaptation.

Sustainable and ecologically sensitive pest and disease management is another challenge when talking about the design of novel agricultural methods of land utilization. *Bayer CropScience*, member of the Climate-KIC community, holds a global leadership position in crop protection and non-agricultural pest control. The company is also active in developing seeds and crop plants with genetically optimized properties. Bayer CropScience is particularly interested in Climate-KIC-projects as an opportunity to develop new sustainable land use approaches and to investigate ways of transforming existing agricultural systems into a more sustainable practice. Demonstrating the potential positive impact of diversity requirements of crop species and varieties and comparing different intensive production systems will be one important objective of future research activities.

Vattenfall Europe New Energy GmbH can actively support future initiatives by providing two large-scale agroforestry demonstration sites, one located in the reclamation area of the Lusatian lignite mining district and a second one which has been established on agricultural farmland in cooperation with the farm company (Lower Lusatia, Germany). Vattenfall provides the financial support for the site

infrastructure and gives access to yield and other economically relevant data. Both areas have been designed for experimental purposes and will, thus, serve as means for both demonstration and optimization. It should be highlighted that the extension of the agroforestry system in this region is underway. Follow-up-projects will benefit, in particular, from the close involvement with local farmers who strongly support this effort. Apart from these business partners, the formation of the *SustLand* project consortium (a Climate-KIC innovations proposal which did not succeed in earlier stages) has led to a core of large European research institutions that have broad experience in land use and agriculture-related research. The research partners were selected in order to reflect all landuse-relevant disciplines, including agronomy, soil science, hydrology, landscape ecology, climatology, environmental planning and the social sciences. Furthermore, the international setup of the consortium, comprised of partners from different European countries (mainly Germany, France, the Netherlands and Italy) reflects the environmental and especially the climatic situation in different parts of the continent when setting up a network of demonstration sites in different regions.

The following list provides an overview of the main partners cooperating with the GFZ that may be involved in further activities in the field of metropolitan food clusters and sustainable land use systems:

Knowledge Institutes:
- Brandenburg University of Technology, Lehrstuhl Bodenschutz und Rekultivierung (Soil Protection and Recultivation) (PD Dr. Dirk Freese).
- Technische Universität Berlin (Environmental Assessment and Planning Research Group) (Prof. Dr. Johann Köppel).
- Institut national de la recherche agronomique (INRA) (France) (Prof. Christian Dupraz).
- National Research Council of Italy, Institute of Biometeorology (CNR-Ibimet), (Italy) (Nicola di Virgilio).

Entrepreneurs:
- Bayer CropScience (t.b.d.).
- Vattenfall Europe New Energy GmbH (t.b.d.).

Non-governmental organizations:
- Lose contacts to various environmental organisations (e.g. WWF Germany, Greenpeace Germany).

Governmental actors:

- Contacts to various German Federal Ministries regarding the implementation of bioenergy schemes and projects (including Ministries for Environment, Economy, Agriculture).

Intermediaries:
- Brandenburg Economic Development Board: Contact for economic development in Brandenburg and energy issues (Dr. Dietmar Laß).
- acatech – National Academy of Science and Engineering: Platform for exchange between science, politics and businesses (Prof. Dr. Hüttl as both President of acatech and Scientific Executive Director of the GFZ).

In Figure 5.6, the main relevant actors to be addressed in the value chain of agroforestry are schematically depicted.

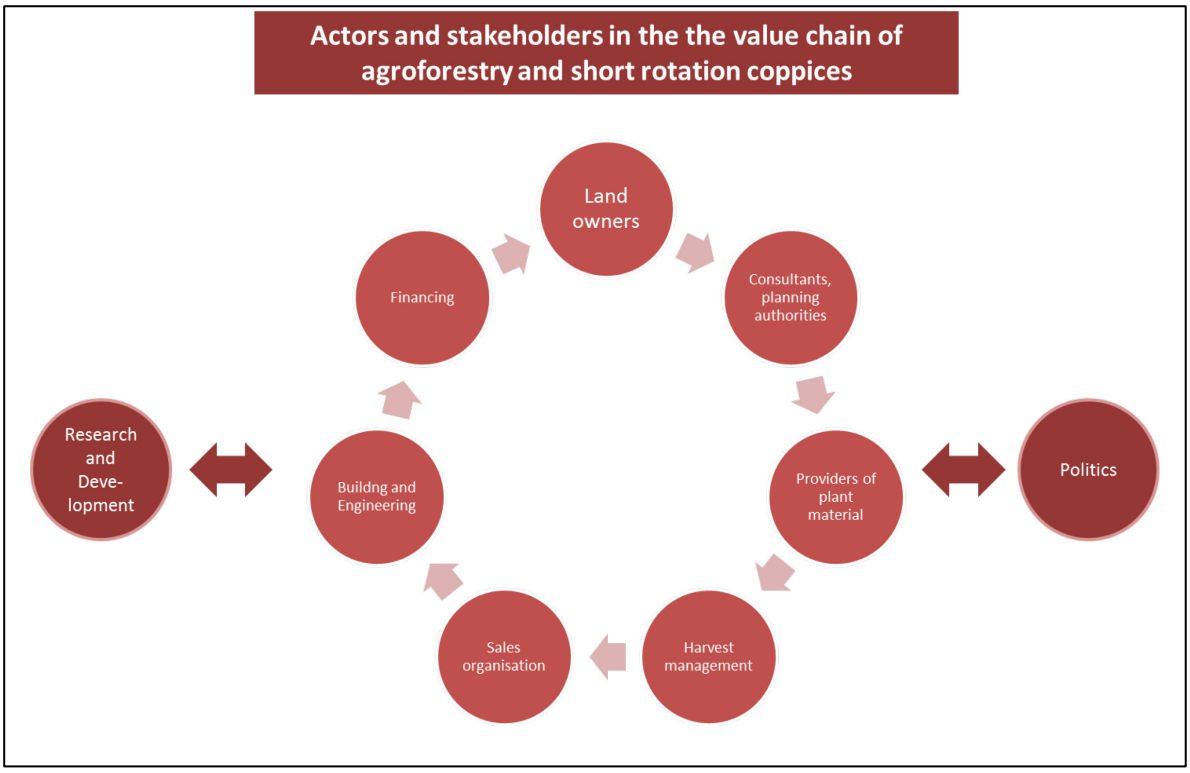


Figure 5.6 *Relevant stakeholders to be addressed in the value chain of agroforestry.*

5.1.5 Workshop and excursion in the study region and outlook on further activities

On January 15th and 16th, 2013, the final project team workshop took place at the GFZ German Research Centre for Geosciences in Potsdam. During the meeting, the strategic approach for the further case development was agreed on.

Further activities during the workshop, at which representatives of the Dutch, British and German project partners participated, included a visit to the agroforestry sites in the former mining areas south of Cottbus, a scientific and practical exchange of experiences with the GFZ's close partners at the Brandenburg University of Technology (BTU) and a final meeting with Climate-KIC representatives at the German Co-Location Centre in Berlin.

The workshop in Potsdam and the pathfinder project as a whole have clearly influenced the development of the German test case and its elaboration as one of the pillars of the follow-up project proposal "RUE2CLIMAG". New aspects with regard to the contribution of the test case in general and agroforestry measures in particular to the overall MFC concept include:

- an even stronger focus on the reconcilability of food and energy crops.
- an emphasis on the examination and establishment of closed cycles of resources and nutrients.
- concepts for using biochar as a means of soil fertilisation and carbon sequestration.
- a clearer focus on the 'food part' of agroforestry value chains instead of solely focussing on the utilisation of the 'energy part';
- a stronger emphasis on generating new sources of income for farmers and land owners.
- an inclusion of producers cooperatives and SMEs as addressees of future activities alongside larger companies (such as Vattenfall).
- the transfer of the findings from the German study region to other areas, including a theoretical examination of the potentials for establishing 'Metropolitan Food and Fuel Clusters' ('MFFC') in different regions of Europe.

As these findings and new approaches reveal, the Pathfinder project and the exchange among the participants have clearly helped to sharpen the focus of the German test case; the impact will be reflected by the modified contribution of the German partners to future Innovation projects within Climate-KIC.

5.2 Protein Empire

5.2.1 Description of the area

De Peel is the border area between the provinces Limburg and Noord Brabant in the Netherlands. It is a former fenland with an area of about 100.000 hectares encircled by a ring of typical villages of cover sand landscapes. In these villages mixed farms predominated with large arable fields and pastures. Since the year 1000 the inhabitants of the villages started the reclamation of the peat land and this happened on a large scale in the 19th and 20th century. Ultimately most of the reclaimed land was transformed in agricultural land. From the second half of the 20th century onwards, the predominant mixed farming system was no longer competitive. The Peel region was a front runner in the development of the land independent high productive livestock systems of pork, poultry and egg production, which imported the biggest part of its feed import from the world market through the harbours of Rotterdam and Amsterdam but also developed very advanced reprocessing of rest- and by products from the human food production systems. Around the city of Venlo large scale horticulture in open fields but more and more in glasshouses became very important. The predominant crops on arable fields became maize and grass. Land re-allotment projects from the late 19th century onwards created a large scale open production landscape with farms and new villages in the former uninhabited peat land. The colonists that started a new living here gave their settlements names as America, Siberië and Californië, reflecting their original unfulfilled dreams (Renes, 1999; Van Och, 2013)

Figure 5.7 *Position of De Peel area in the Netherlands.*

Figure 5.8 *Topography of De Peel area with urban areas in orange, nature areas in green and agricultural areas in white.*

De Peel became the heartland of the Dutch livestock industry that is still one of the most important in the world, not only in terms of export value but also in its efficiency, standards of animal welfare, environmental management and innovation. Within the region also

dairy farms, land dependent vegetable production and arable farms are characterized by large scale and modern entrepreneurship. Table 5.1 shows characteristics of the livestock industry in De Peel. The area around the city of Venlo is the second largest greenhouse production zone in the Netherlands (Cormont et al., 2012).

In the "Nota Ruimte" (Ministerie van Volkshuisvesting Ruimtelijke Ordening en Milieu, 2004), de fifth policy document on physical planning in the Netherlands, the central government identified five so

called Greenports as areas where knowledge intensive agriculture and agribusiness would be concentrated and stimulated. Greenport Venlo was one of them.

Table5.1
Characteristics of livestock sector in De Peel.

Characteristic	De Peel
Employment (nr. of jobs)	20,467
Fattening pigs (nr. of places)	2,545,804
Sows (nr. of places)	402,463
Broilers (nr. of places)	11,914,189
Layers (nr. of places)	19,587,733
Goats (nr. of places)	72,003
Calves (nr. of places)	139,202
Milking cows (nr. of places)	150,884
Manure production (MT/year)	10,389,417
Nitrate production in manure (MT/yr.)	79,391
Methane emission (MT/year)	59,658

5.2.2 Greenport Venlo and Protein Empire as regional innovation clusters

Within the region the concept of Greenport rapidly evolved as a common denominator for focussing innovation activities. It made the active knowledge parties, entrepreneurs, non- governmental and governmental stakeholders complex that they shaped in their close co-operation (Figure 5.9). Many companies in the logistic industry as well as in the advanced producers services and hardware supplying industry are innovators themselves, driven by the continuous flow of innovation assignment that originate from the primary producers.

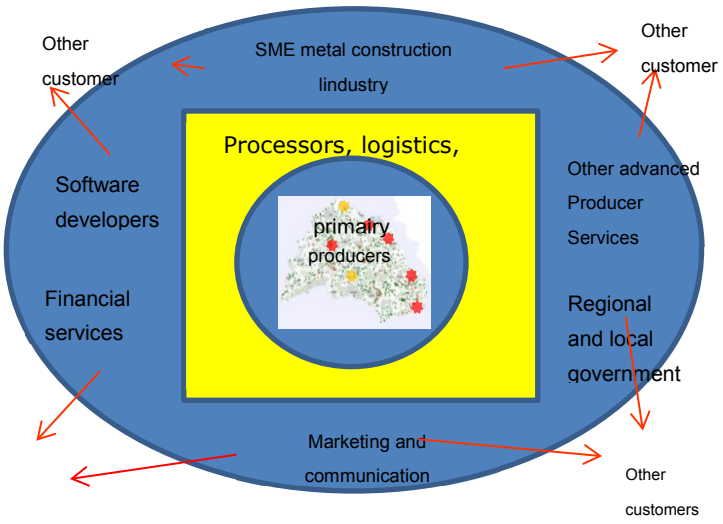


Figure 5.9 *The regional innovation cluster of De Peel.*

Building on the stimulating effect of the Greenport concept, the Municipality of Venray, north of Venlo, together with KnowHouse bv., a regional consultancy, defined the concept of Protein Empire that focussed on innovation in the livestock industry. Protein Empire has as a formal objective to establish the transition from traditional agriculture aimed at mass production towards a sustainable agriculture with focus on high quality protein production. It has since its initiation in early 2012 developed as a co-operation between entrepreneurs in meat, egg and milk production and processing, their suppliers, the local and regional government of the municipality of Venray and the province of Limburg and a

number of knowledge institutions (Figure 5.10). Their co-operation is aimed at a broad range of system innovations to improve their different forms of protein production, including resource use efficiency, vertical and horizontal integration and better use of space.

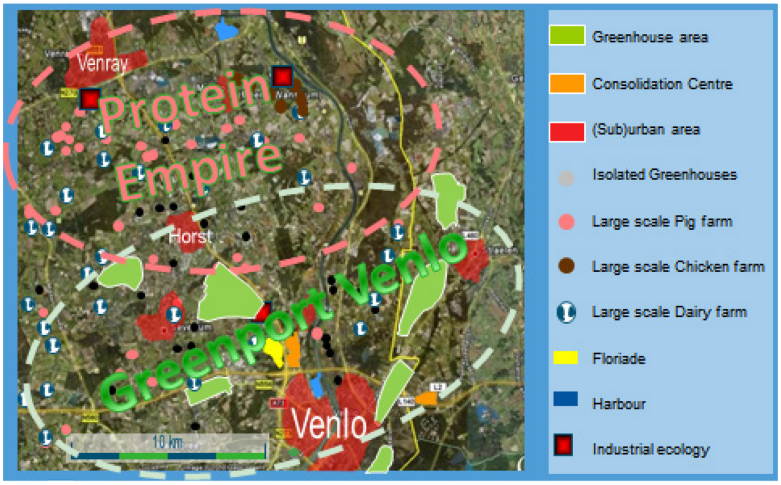


Figure 5.10 *Greenport Venlo and Protein Empire are two innovation trajectories in greenhouse industry and livestock farming initiated by the municipalities of Venlo and Venray in De Peel.*

Cormont et al. (2012) elaborated three scenarios for the livestock industry in De Peel in which future developments were simulated. In the first scenario 'autonomous development', the starting point was ongoing scale increase of holdings that had a successor and without limitations on expansion because of urban development or a nature conservation area within 250 m of the holding. This autonomous development would lead to a strong reduction in the number of holdings (-63%), combined with a slight decrease in number of animals. The amount of minerals produced in manure would decrease proportionally but this would only lead to a decrease of manure export out of the region.

In the second scenario it was assumed that all livestock production would be concentrated in 9 agro-industrial parks that would be situated adjacent to the 9 existing inland harbours in the area. In this scenario it would be possible to expand the number of animals in the livestock industry because the processing of manure in the agro-industrial clusters becomes a source of added value. In the agro-industrial setting of the parks it would also be possible to elaborate stable technology that would further reduce emission of ammonia and greenhouse gasses.

In the third scenario it was assumed that the livestock industry should become independent of external imports of feed and would produce no mineral surplus that needs to be exported. In this scenario the number of animals would strongly decrease (-85%). The livestock industry in the area would virtually cease to exist in this scenario.

From this scenario study, it can be concluded that only the second scenario would enable the livestock industry in the region to expand is business and at the same time to keep and further develop its leading position in the innovation of the total sector.

Based on the outcomes of this scenario-study, and taking into account the importance in greenhouse gas contribution of different single production factors (Figure 5.11) in the three most important protein producing sectors in De Peel (dairy, pigs and poultry), the CoP in FOCUS project decided to pave the way for two innovation trajectories that, if realized, could lead to key innovations to enable the second scenario. The first one would be the development of a closed dairy stable enable to capture the methane that is in the stables atmosphere as much as possible. The second one would be the production of insects as the protein basis of poultry and pig feed. Due to time restrictions only the first mentioned innovation trajectory has been elaborated in the COP in FOCUS pathfinder project. Of the second one (insects in poultry) only a brief description will be given at the end of this subchapter.

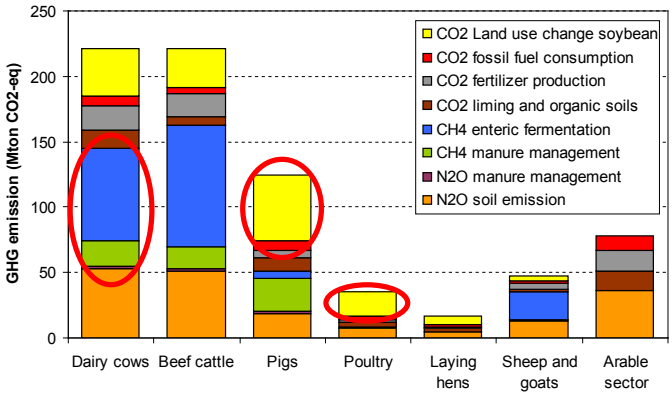


Figure 5.11 *Targeting the most relevant greenhouse gas impacts of principal protein producing chains (dairy, pigs, poultry) in De Peel.*

5.2.3 The working process of the protein empire innovation trajectory

The two selected innovation trajectories were defined in bilateral meetings between Wageningen UR, KnowHouse Bv, primary producers and equipment producers. In these meetings a basic lay out for a prototype was designed as well as the working process for implementation. The descriptions of the innovation trajectories were presented and reviewed in larger stakeholder meetings in which also representatives of different governmental levels took part as well as during the COP in FOCUS meetings in 2012 and 1013. Table 5.2 gives an overview of meetings for the reduced methane emission dairy stable.

The following stakeholders have meanwhile got engaged into the project:

- Knowledge Institutes:
  - Wageningen UR: Environmental Science Group, Animal Sciences Group
  - KnowHouse bv
- Entrepreneurs:
  - Vreba Melkvee, a dairy farmer
  - CAG holding, a dairy farmer
  - Fancom bv., development of IT and automation systems for the intensive livestock husbandry sector
  - Schoonwater Rips bv., design and manufacturing of dairy stable inventories
  - USA bv, design and manufacturing of dairy farm equipment
  - Visser group, designer and manufacturing of greenhouse technology
  - Jansen Poultry Equipment, design and manufacturing of poultry housing systems and manure separation systems
- Governmental Organisations:
  - Ministry of Economic affairs, Topsector Agrifood and Topsector Horticulture, NL Agency
  - Province of Limburg
  - Municipality of Venray

Table 5.2
Overview of COPinFOCUS meetings

Date	Participants	Purpose
20-1-2012	Meeting with Knowhouse bv	Process design
17-2-2012	Meeting with Vreba Melkvee and Schoonwater Rips	Design Innovation Concept Methane Free Dairy Stable
24-2-2012	Meeting with CAG holding	Design Innovation Concept Methane Free Dairy Stable
27-2-2012	Meeting with Topsector Agrifood, Ministry of Economic Affairs	Inclusion of both innovation proposals in topsector policy
28-2-2012	LIV symposium Venray	Informal presentation of both innovation proposals to livestock sector
5-3-2012	Meeting with Ministry of Economic Affairs, NL Agency	Discuss co-financing from Ministry for both innovation proposals
10/11-05-2012	COPinFOCUS meeting Budapest	Inclusion of innovation proposals in COPinFOCUS trajectory
14-5-2012	Meeting with CAG-holding	Implementation of methane free dairy system on Agropark Agriport A7
11/13-07-2013	COPinFOCUS meeting Netherlands	Inclusion of projects in COPinFOCUS trajectory
6-9-2012	Meeting with Fancom bv	Design Innovation Concept Methane Free Dairy Stable
11-9-2012	Meeting with Knowhouse bv	Process design
20-9-2012	Meeting with Fancom bv	Design Innovation Concept Methane Free Dairy Stable
21-9-2012	Meeting with CAG-holding	Implementation of methane free dairy system on Agropark Agriport A7
17-10-2012	Meeting with Vreba Melkvee and Schoonwater Rips	Design Innovation Concept Methane Free Dairy Stable
23/24-10-2012	COPinFOCUS meeting London	Inclusion of innovation proposals in COPinFOCUS trajectory
26-10-2012	Meeting with Knowhouse bv	Process design
15-11-2012	Meeting with KENGi-Community of Practice on Metropolitan Food Clusters	Informal presentation of innovation proposals to Metropolitan Food Cluster network in the Netherlands
19-11-2012	Meeting with Topsector Agrifood	Discussion on support from Topsector
10-1-2013	Meeting with Knowhouse bv	Process design
15/16-1-2013	COPinFOCUS meeting Potsdam	Inclusion of innovation proposals in COPinFOCUS trajectory
8-2-2013	Meeting with Jansen Poultry Equipment	Inclusion of manure processing technology in innovations
21-2-2013	Meeting with Visser Group	Inclusion of greenhouse technology in innovations
25-3-2013	Meeting with Municipality of Venray	Participation of Municipality in Innovation trajectories
12-4-2013	Meeting with Visser Group	Inclusion of greenhouse technology in reduced methane emission proposal
6-5-2013	Meeting with Municipality of Venray	Participation of Municipality in Innovation trajectories
16-5-2013	Meeting with Jansen Poultry Equipment	Inclusion of manure processing technology in innovations
5-6-2013	Meeting with Vreba Melkvee and Schoonwater Rips	Design Innovation Concept Methane Free Dairy Stable
7-6-2013	Meeting with Jansen Poultry Equipment	Inclusion of manure processing technology in innovations
2-7-2013	First stakeholder meeting methane free stable, Vredepeel	Participation of stakeholders in innovation trajectory

5.2.4 The Innovation trajectory of a reduced methane emission dairy stable

It can be derived from Figure 5.11 that methane emission in dairy farming is the most important single factor contribution to greenhouse gas emissions from the livestock industry in De Peel. Moreover, since the global production of dairy is expected to double towards 2050 and since the European Union and within it The Netherlands as one of the most important dairy producers, will increase its share in global dairy production, following the abolition of the quota system in the EU's common agricultural policy, it can be expected that this specific emission of greenhouse gas from dairy will become more important for following reasons:

- Worldwide greenhouse gas emissions from other major economic sectors like transportation, energy production and from consumptive use are expected to stabilize or to go down.
- Within agriculture the other important sources from greenhouse gas emissions will likewise go down. High prices for fossil fuel will cause the decrease of nitrogen fertiliser use, which is the most important cause for N_2O emission from arable fields (the orange legend unit in Figure 5.11). Environmental and biodiversity regulations will limit the land use change from forest to soy bean reservation (the yellow legend unit in Figure 5.11).
- Contrary to these developments, dairy farming in North-western Europe is taking an opposite road: following the insight, that dairy cows feel most comfortable and are most productive in a

temperature range between -5 and + 10C°, modern dairy stables are open and make maximum use of natural ventilation by wind. Moreover there is strong pressure by environmentalists to force the farmers to keep cows out in the open field. Dairy industry and farmers organizations are supporting this, formally to avoid negative publicity that the environmentalists use as a policy tool. But another important reason could be that both dairy industry and farmers organizations have an interest in a keeping a large number of dairy farmers with relative small holdings instead of keeping a smaller number with bigger holdings. The farmer organizations are member organizations: the more members the better. Since their policy is decided by a one man one vote system the majority of members (the small ones) tend to have an overweight in voting and in their policy. The dairy industry can keep its traditional price policy on the basis of many small farmers offering milk. There is no need for negotiation. If the power of milk providers increases because of their growing size, negotiation becomes necessary.

As a conclusion, it can be assumed that the relative importance of methane emissions (the blue and green legend units in Figure 5.11) will increase. Inventions to reduce the methane emission from dairy can theoretically be found in capturing of methane from the dairy stable atmosphere, in changing the diet of cows in order to avoid the emergence of methane and in manure processing in order to avoid the emergence of methane in manure. All these inventions will meet resistance in society, firstly because they can only be implemented as far as cows are kept in stables and not in open fields and secondly because the technology that needs to be implemented, such as manure processing, can be much easier applied by large scale farmers.

Methane emission by dairy farms has also been the focus of a study carried out by the Innovation Network, an organization funded by the Dutch Ministry of Economic Affairs to promote innovations in Agriculture (Dijk et al., 2012). This study focused on the removal of methane by application of a bio filter that would capture methane out of the ventilation air of a cow stable. Although the principle works in theory and very high reduction of methane could be reached, the size of the bio filter would be far too large to be applicable in practice.

Figure 5.12 *Elements of a dairy stable capturing methane.*

Based on this knowledge, the knowledge institutes and stakeholders combined the following existing technologies into a design for an alternative prototype (Figure 5.12 and Figure 5.13):

- The use of greenhouse technology to create a completely closed dairy stable in which cows are kept during their stages of high productivity.
- Within the stable advanced air conditioning keeps temperature and humidity within optimal ranges.
- Minimum ventilation requirements will increase the amount of methane in the air.
- Application of (productive) plant and algae growth inside the stable will reduce the content of CO_2 inside the stable.
- A roof top construction will concentrate the methane level in the upper air layer of the roof.
- The use of manure separation technology to avoid methane generation in methane storage and to maximize methane production out of digestation.
- The burning of the ventilation air with methane in a combustion engine that would be fuelled by the biogas from the digestation of the cow stables manure.

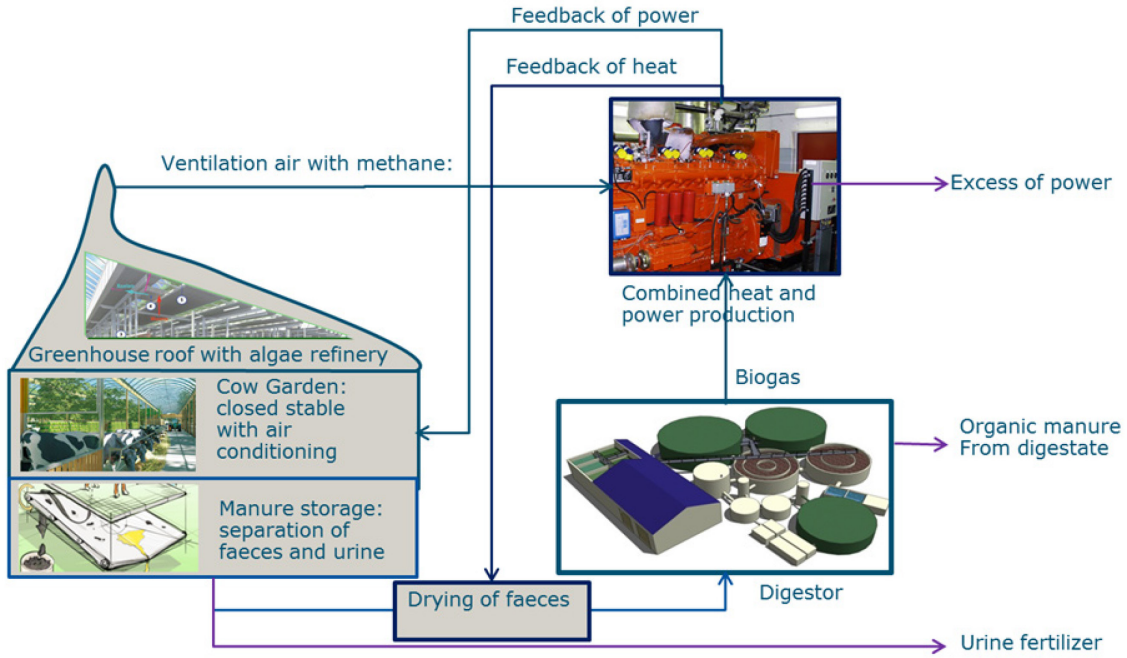


Figure 5.13 *Inventions that together compose the innovation design of the reduced methane dairy stable.*

When elaborating these inventions into the design of a prototype stable, it became clear that a number of synergies would emerge once the original innovation would be successful:

- The manure separation system will also avoid the generation of ammonia and by doing so, induce another improvement of the quality of the stables atmosphere and further reduce the need for ventilation.
- The manure separation system in combination with the biogas plant will deliver digestate and processed cow-urine that both can be used as organic fertilizer with the ability to replace the use of inorganic fertilizer. This will decrease the use of fossil fuel (needed for the production of nitrate fertilizer) as well as decrease the generation of N_2O that is caused by application of inorganic fertilizer. The biogas from the digester can be turned into power that can be used on the farm, in particular for the air-conditioning and cooling of the stables.
- Keeping cows inside during their lactation period in a stable atmosphere, regarding temperature and humidity, will increase their productivity.
- The concept of a closed dairy stable with full air-conditioning can be applied in regions where up until now, no dairy farming with high productive cows has been possible, because of unfavourable climate conditions.

The concept of a reduced methane emission dairy stable has in the course of 2012 been brought to the attention of the Topsector Agrifood and Horticulture, both programs that promote the innovation in agriculture, within the Ministry of Economic Affairs. Early 2014 it will be decided whether the support for this innovation trajectory by the topsectors will be granted.

5.2.5 The Innovation trajectory of using insects as protein source in pork and poultry production

From Figure 5.11 it can also be derived, that the replacement of Soy-meal as the most important protein source in pork and poultry production would establish another significant contribution to the reduction of greenhouse gas emissions in agriculture. A radical innovation that would realize this replacement has been suggested by entrepreneurs that take part in the Protein Empire community of practice. Building on the experience of feed producers for songbirds they suggested to change soy meal as protein source into insects, that would be fed of different sources of waste products such as wood chips, waste from human food industry, specific manure products etc. The prospect of this replacement seems very promising but within the EU it is actually not allowed due to the legislation that forbids all feeding of animal products to animals that are used in the human food chain. This legislation has been implemented as a reaction on the BSE crisis in the 1990's (Veldkamp et al., 2012).

5.3 MFC Bag - Hungary

5.3.1 Business case Food cluster Bag

The aim of CBP Bag project is to create a sustainable collection and consolidation centre using the infrastructural and geographical advantages. With the concentration of the agricultural products CBP Bag will develop a place for resource use efficient and effective distribution of fresh food for high population density areas (Budapest, Bratislava, Vienna). The project will develop the a complex warehouse/processing/distribution centre, as agro logistic hub and market place, where development and operations will focus on use of renewable energies (solar energy), reducing the consumption of fossil fuels, water and elimination of the emission of damaging materials (CO2 footprint, waste water management as well as strategically planning for sustainable trade and logistics.

At this moment the distribution of fruits, vegetables and herbs (e.g. horticultural products, honey, culinary and medicinal herbs) on the whole sale market in Central Region of Hungary does not answer to the demand of the customers. The lack of adequate distribution systems for agro and food supply prevents also chain integration between individual farmers, producers, traders and sellers. This challenge has been recognised by private regional developers, to create together with local government (Bag) and knowledge workers for Gödöllő, Szent István University a consolidation centre. This collection and distribution centre is a market place which is using the geographical and infrastructural advantages to reorganise the grocers and producers in this region and to improve agro logistics and sustainable trade. Better distribution in a 200km radius, and structuring with modern collection and distribution will provide better resource use efficiency via the intended horizontal integration of the value chain. This aim for sustainable development will steer towards reduction of wastes, emissions and the climate footprint of the agro- logistics.

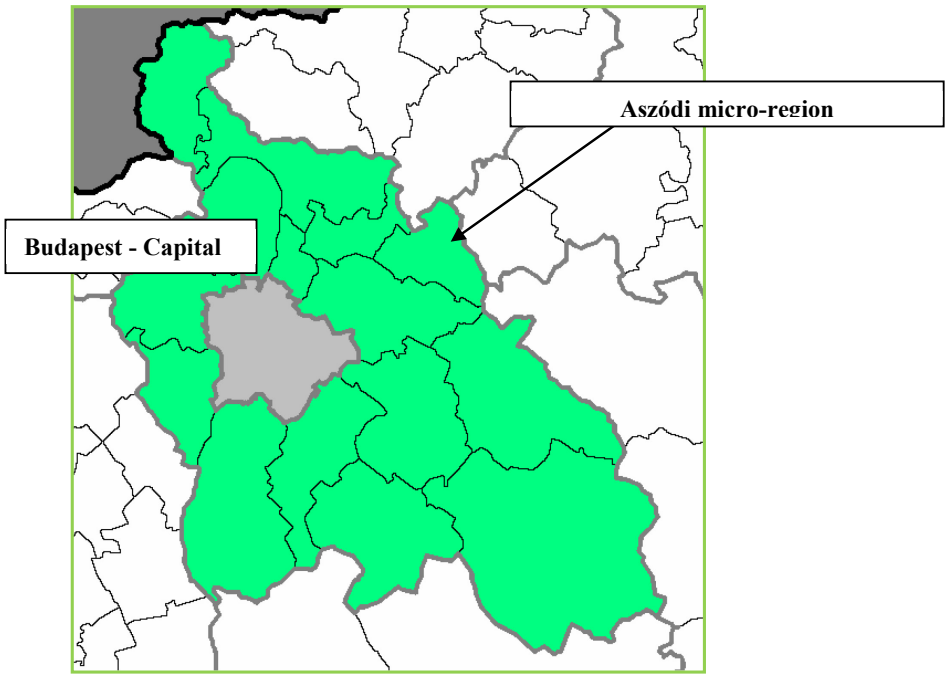
5.3.2 Basic description from the Region

The BAG Centre is in the Middle Hungarian Region, which is the most developed in Hungary. The biggest city is the capitol Budapest. The capital has 1,740 000 inhabitant, the region has 2,925 000 inhabitant. This region is the most populated in the Carpatian basin. The BAG Centre is in the north-west part of the region, in the Aszód micro-region 'Aszód area'. This township was the grocery producer of the capitol. All the families were living producing vegetables and fruits for the capitol.

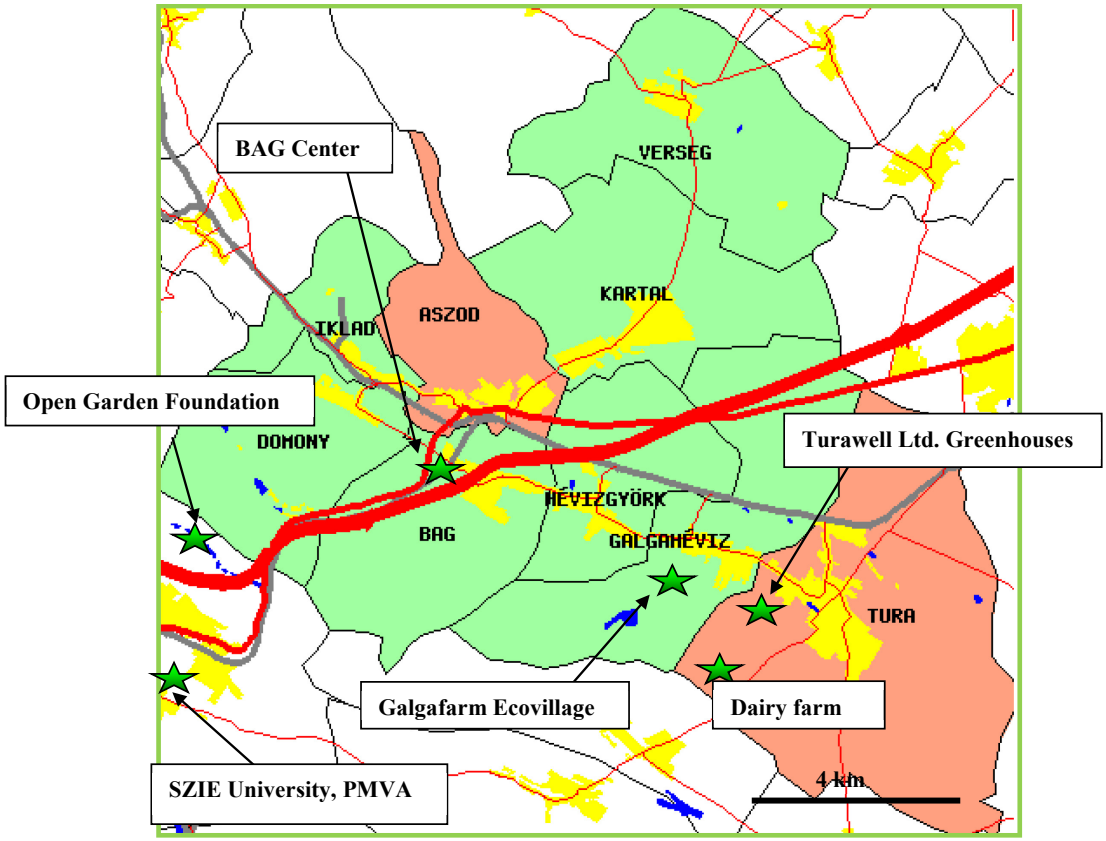
The area has a very well developed transportation system:

- Budapest is 38 km on highway M3.
- M3 highway, near to the highway ring (15 km), M5, M6, M1.
- main railway line to the east (Ukrain and Russia), and main railway junction (north, south) in the city Hatvan, which is about 15 km from the BAG Centre.
- main airport is 25 km from the site.

Middle Hungarian Region:



Aszód micro-region:



5.3.3 Network development – KENGi

Knowledge Institutes:

- **Szent István University of Agriculture** (Gödöllő city),

Entrepreneurs:

- **Cross & Stern Ltd.** (Bag village)
  - Trading, Facility Development
- **Galga- Vidéke Szövetkezet = Galga Province Cooperation -** (Tura city)
  - Diary and vegetable and crop production
  - The Cooperation is handling 3ooo ha agri land, the Dairy section has 6oo milk cows, and producing 13ooo liter milk/day.
- **Turawell Ltd.,** (Tura city) brand new company, just started to install the greenhouses
  - Vegetable (Tomato) production, 12 ha greenhouses
  - 6ooo tones of tomato/ year

Non-governmental organizations:

- **PMVA = Enterprise Development Foundation of Pest County (Gödöllő city),**
- **Open Garden Foundation (Gödöllő city),**
  - High quality organic vegetable farming in small scale

- **Galgafarm Ecovillage (Galgahévíz village)**
  - Organic farming, crop, vegetable and animal-dairy

Governmental actors:

- Ministry of Agriculture and Rural Development
- Regional Development Agency
- Municipality of Bag, Tura, Galgahévíz and Aszód

5.3.4 MFC development in the Region

Because the traditional vegetable producing township activity (which is still ongoing, but in a smaller scale) there is a chance to reorganise and to vitalise the vegetable production in a professional and an environmental friendly way. The citizens of the area have practice and knowledge to produce agricultural products using their very good climatic and soil quality capability.

The BAG centre is an opportunity both for the producers and for the traders to meet with the capital and the foreign market requirements.

5.3.5 Climate analysis – boundary limits, quantification

Save and minimize energy consumption especially on BAG Center:

- Use solar heat for hotwater production. This is the most succesfull renewable energy source, what can be used on the BAG Center. The total hotwater both the municipal and industrial consumption can be satisfied.
- Use solar panels for electricity production: With solar panels on the roof of the Center, about one quarter of the electricity consumption can be saved. Only one way is available to install the solar panels, input system to the country electric network.
- Use biogasplant for electricity production: Installation of a biogas plant next to the BAG Center should be considered. The feedstock of the plant is still unsure. It depends on the future main activity of the Center. One biogas plant is plant next to the dairy farm, using the manure for feedstock of the plant.
- Use thermal water for heating: Thermal water use is a long way plan at the moment. The Turawell Ltd. has the priority of the thermal stock in the developing greenhouse complex in the area.
- Reduce transportation: Railway transport, Electric transportation vehicles inside the Center, Organising the different activities next to each other.

5.3.6 Workshop and excursion in the study region and outlook on further activities

The participation of the Hungarian partner terminated after the third meeting in the Netherlands. The representatives have never ever given any reaction on requests and invitations. So the last part of the case description is missing in the report. Also MFC Hungary will not be part of the follow up activities.

5.4 Case London – Retail, Certification and Branding

This case originally intended to focus on the retail end of the food supply chain. The populations of modern major cities demand a staggeringly large array of products. It became known to the team that of the approximately forty thousand products that major supermarkets normally offer just 1000 products account for about 40% of the turnover but may, or may not, have an equal share of the greenhouse gas emissions arising from the production and supply of those products. For food products, roughly 50% of their associated greenhouse gas emissions occur before the farm gate and 50% in the transport, storage, processing and delivery of the food products. We aim to develop an understanding of the emissions profiles the products that result in the largest share of the overall greenhouse gas footprint looking back from the point of view of final consumption. The regional innovation case from UK will focus on the region of London, evaluating the potential to reduce

emissions in these products. In this case focus is on synthesis of the options that can be deployed by retailers to deliver lower-carbon products to their customers.

In the context of this Climate KIC Pathfinder it will include an evaluation of the potential impact on product emissions if the knowledge developed through the food clusters and protein empire cases were to be implemented in specified supply chains.

This work originally intended to involve Sainsbury Supermarkets Ltd, but this collaboration was unfortunately not confirmed by the different divisions that would have needed to be involved.

5.4.1 Basic description Region

Important features that make London a relevant case study on the interface to consumers are its population and its logistical activities. The population of London can be measured in two ways according to the 2010 census:

- The London metropolitan area has 13.7 million inhabitants
- Inner London has 7.8 million inhabitants.

London is situated in the South East of England and, as the capital of the United Kingdom, is an important transport node. Since its origins as a Roman settlement London has been an important trading centre located at a point where the river Thames was narrow enough to build a bridge but deep enough to accommodate sea-going vessels. In present days, London hosts the world's largest city airport system measured by passenger traffic.

Relevance for an MFC

The main implication for food clusters is that retail links consumer demand with primary and secondary processing. It fulfils the simultaneous functions of responding to demand as well as informing it. Through that linkage, retail has the opportunity to shape the whole supply chain and steer technological development towards innovative sustainable practices. At the most basic level, however, retailers are competitive service undertakings under economic pressure to market products that secure as positive a return to their business as possible. The potential to steer positive developments is created through the interaction with stakeholders such as government departments, industrial standard-making bodies and the evolving convictions of the general population as represented by consumer interest and pressure groups.

Climate change poses significant challenges to food retail due to its impact on supply chain resilience, costs, and customer expectations. A successful offering to the consumers relies on high-quality produce from supplier farms often based in distant overseas locations. In many agriculturally-driven parts of the world, the ability of producers to ensure an adequate supply will be negatively affected by climate change impacts such as water stress (e.g. Israel, South Africa and Morocco) and increased weather variability (GRSA, 2001). Extreme weather events can give rise to infrastructural costs associated with the potential adaptation requirements resulting from damages to physical facilities. Repairs, rising insurance premiums and operational downtime will all result in higher operating costs along the supply chain, and particularly in vulnerable areas (Easterling, 2007).

Another relevant difficulty arises from the reach of supply chains back to places with growing and urbanising population that will demand even more water and goods with embedded energy and water. The interconnectedness of climate change impacts and their exacerbating factors makes responding to them a complex undertaking. Unless they are applied by various members of the value chain, most measures would not be effective. That is the rationale for focusing not only on mitigation but also on adaptation to ensure the sustainability of all the stakeholders. Stewardship of a resilient supply chain, energy efficiency and waste management are three areas of action through which these challenges can be addressed from the retail point of view.

Resilient supply chain

While requests for full audits on GHG performance of suppliers are complex and costly, emissions reductions and energy efficiency discussions are becoming integral part of supplier engagement (Van

Hille and Louw, 2012). In the UK, the Carbon Disclosure Project and the British Retail Consortium could provide insight into such parameters. From an adaptation perspective, sensitive site appraisal may not only be applicable to suppliers but also to distribution centres, offices and stores themselves (Van Hille and Louw, 2012). In general, a key measure of supply chain stewardship is product specification and benchmarking. The cascading effect of specifying a more resource-efficient product can be visualised in Figure 5.14, which depicts the level of GHG impacts along the stages of production and delivery of goods. It also illustrates the relationship of environmental impact and income or value generation across stages.

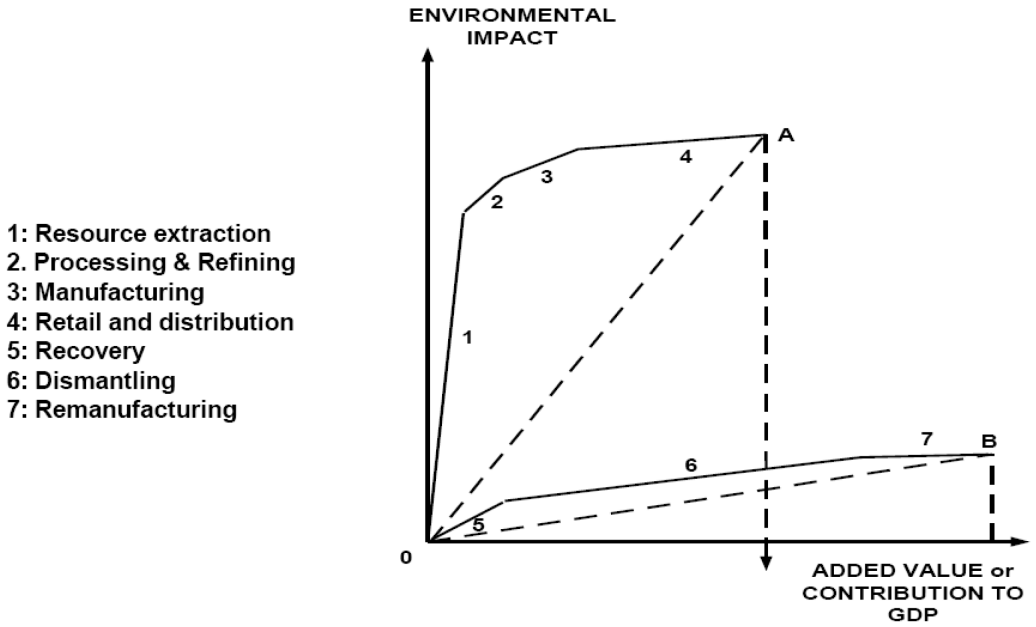


Figure 5.14 *Environmental impact along the production life cycle.*

Energy efficiency

Under future climate change, although a warmer climate will result in a reduction in heating costs, the increased need for cooling and refrigeration all along the supply chain will more than offset this reduction, leading to a net increase in energy consumption (CDP, 2011). Consequently, producers as well as retailers have a strong incentive to reduce their energy costs, and in many cases initial climate change mitigation tactics are indistinguishable from cost management initiatives. Similarly, transport-related measures apply to all steps of the supply chain and can tackle fuel, vehicle or logistics aspects. These are aspects covered in more detail in the study of MFCs elsewhere in this report.

Waste management

Particular financial and reputational pressure for retailers and their suppliers has been created by increasing legislative requirements, particularly in connection with packaging, GHG emissions and water pollution. An important challenge is that brand image of retailers is linked to activities not necessarily under their control, such as the operations of suppliers, of the off-takers of residues and waste and of the fate of post-consumer waste. Nonetheless, retailers can decide to interact at different levels with suppliers, residues off-takers and local authorities to influence best practice. Collaboration can take the form of agreements, product specification, and even joint venture projects. Relevant initiatives that can be implemented include: emphasis on recyclability from the design stages; incorporating recycled material into packaging; and light-weighting of products and packaging from the outset. For instance, increasing the portion of post-consumer recycled (PCR) content into packaging, notably for the packaging of carbonated beverages, water and juice bottles can lead to significant climate benefits whilst saving costs (Van Hille and Louw, 2012).

5.4.2 MFC development in the region

The purpose of the case study is in the investigation of the premise that approximately 50% of GHG of food products occur before the farm gate and 50% in the transport, storage, processing and delivery. This poses several challenges but also presents opportunities for all stakeholders.

Increasing customer awareness of carbon footprints and other environmental impacts is a tangible trend. It entails increasing demand for environmentally friendly products and for communication on climate change. It necessitates robust emissions data to provide clear labelling and allow consumers to make satisfactory decisions that in turn reinforce practices along the supply chain. In addition to environmental awareness, more basic economic pressures also exert significant pressure; thus, in this region, as in many parts of the world, balancing responsibility and price is a key challenge. The consumer market is highly price sensitive due to the fact that fuel, food, water and electricity price increases have affected disposable incomes internationally. Market actors that respond to these pressures have the potential to be more positively regarded by their customer base (Van Hille and Louw, 2012). In response to public awareness, retailers view their climate change action as a means of strengthening customer loyalty. To leverage their role in helping consumers to deal most effectively with climate change impacts, retailers are communicating their efforts and advice through their websites, social media, corporate magazines and in-store marketing materials.

Ongoing efforts of producers and standard-making bodies in the region can help strengthen the basis for developing MFC techniques in the region. The UK representatives of Venco Group in the form of Venco Ltd. Are already promoting the use of energy efficient ventilation and other high-productivity, low-land-take food production technology. In an effort to enable the deployment in the UK of combined hatchery-broiler farms Venco Ltd. has engaged with the Environment Agency and other regulating bodies to provide the evidence and rationale for amending existing rules that currently preclude the use of such combined facilities.

In terms of working towards gaining wider consumer recognition of particularly environmentally effective food produce, LEAF works with food producers and stakeholders along the supply chain up to the point of sale to grant the logo and certificate of performance.

5.4.3 Climate analysis – boundary limits, quantification

All aforementioned challenges call for a combination of mitigation and adaptation strategies. In preparation for, and during, the project meeting in Gödölő, Hungary (in May, 2012), the case study was worked out to investigate the impacts of developments in retail and its influence on previous steps of the supply chain. It resulted in the basis for a framework to catalogue the impacts and, in parallel, explore whether another business arrangement or ownership would make a difference while connecting producers with consumers. It is pertinent to recognise that, as outlined before, the boundaries of corporate responsibility have extended beyond the companies themselves and are now expected to cover entire value chains and to incorporate environmental social governance elements (Van Hille and Louw, 2012). The impacts of climate change that apply throughout the supply chain are aspects such as water, biodiversity, health and human settlement sensitivities.

The result of the analysis for increasing coherence of objectives was the mapping of vertical and horizontal integration options. They can be taken to represent purely strategically shared objectives or actual ownership participation in several stages of the supply chain. Figure 5.15 focuses on the options for vertical integration. It illustrates the simple relationship between the influence on processing stages and influence on GHG performance. Although more complex financially and legally, a share in ownership in selected operations can increase the level of influence in shaping operations to improve the overall footprint of food produce. The red contour lines in the figure denote the level of ownership or control that a retailer could have in each stage.

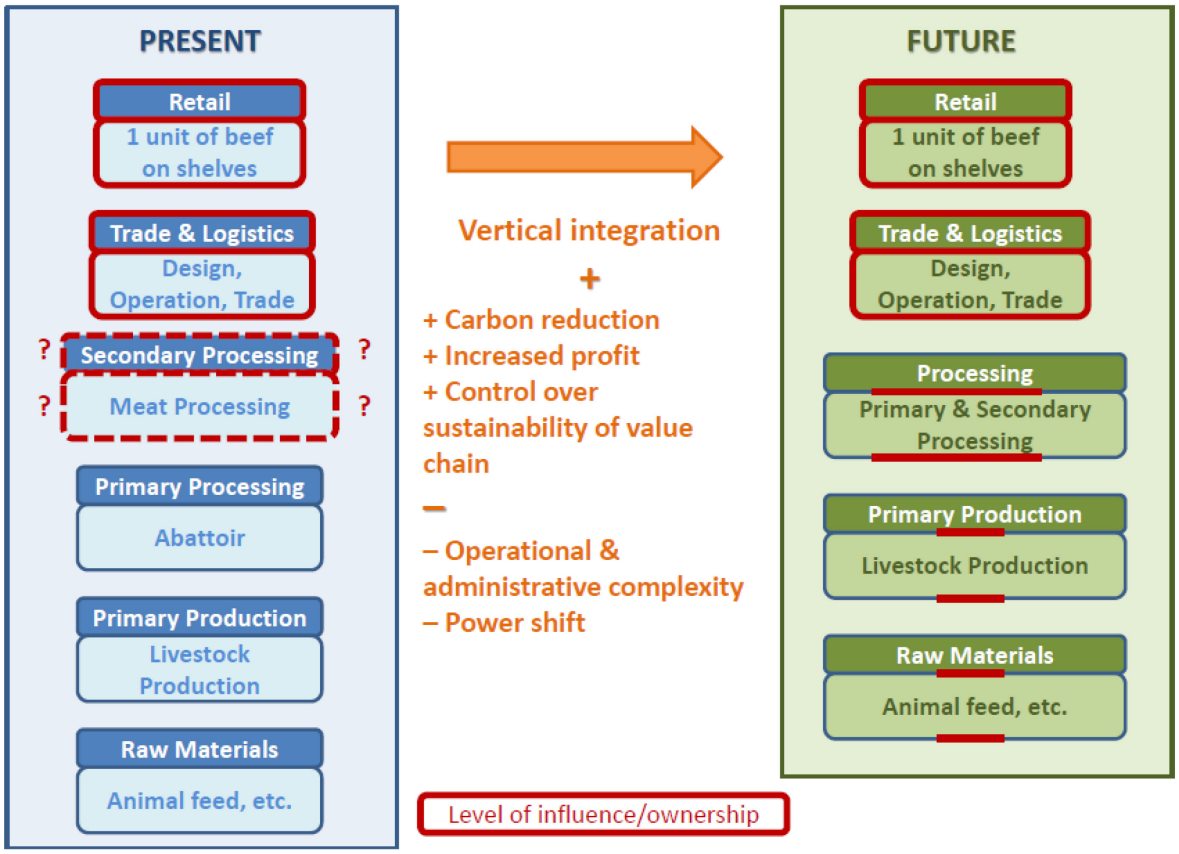


Figure 5.15 *Options for vertical integration in selected operations.*

By contrast, the exploration of horizontal integration through the interaction of the dairy, vegetable and meat value chains revolving around technology such as anaerobic digestion is depicted in the interaction diagram in Figure 5.16.

It illustrates the elements of a full inventory of GHG impacts providing transparency for how the physical units kWh or grams or litres translate into the functional unit of CO_{2e}. Material flows are designated by 'M' plus the inventory number, e.g. M2 denoting the flow of manure from cattle raising into anaerobic digestion. Energy flows are displayed with 'E' plus the inventory number, e.g. E3 denoting the flow of electricity that could be used in nearby food processing facilities. It is worth noting the link between value chains provided for instance by digestate that can be used as input in production of crops that become animal feed as well as for horticultural input.

The inventory can be completed based on the sequence exemplified in Table 5.3.

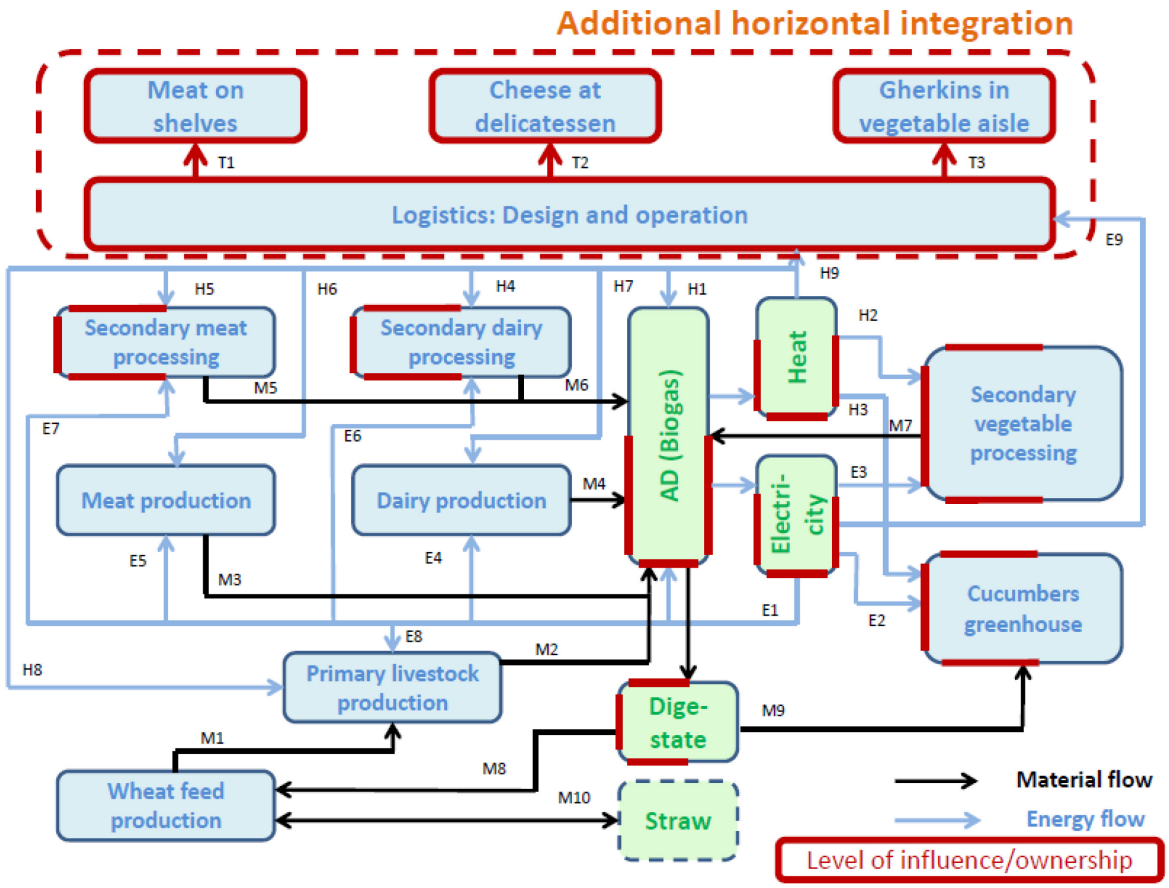


Figure 5.16 *Horizontal integration possibilities across value chains.*

Table 5.3

Present inventory and future targets for identified flows.

GHG LCA

Flow	Description	Current	2020
H1	Heat into digestion process	N/A	500 kW
H3	Heat into vegetable greenhouse	N/A	100 kW
E1	Electricity into digestion process	N/A	700 kW
E2	Electricity into vegetable processing	N/A	100 kW

Practice Benchmarking

Instrument	Description	Current	2020
ROC	Financial incentive	N/A	?
H2O intensity	Material flow saving	N/A	?
Efficiency benchmark	Energy flow saving	? kW ? Label	? kW ? Label

For overall case climate indicators and impacts refer back to Table 4.1 and Figure 4.2 in Chapter four.

5.4.4 Network development – KENGi

Having clarified the influence of benchmarking and specification of climate-friendly products, the relevance of stakeholders with an industry-wide perspective is established. It is through communication, engagement and understanding of standard-making and certification bodies that climate-effective techniques can be fostered at various points of the value chain. The engagement with LEAF (Linking the environment and farming) has the potential to help introduce the advanced concepts of Metropolitan Food Clusters into the UK through a process that could be replicated across Europe and beyond. If some of the key commodities identified in Chapter 3, which feed into the of dairy or poultry value chains can be certified by a scheme similar to LEAF, in the form of labels on the final product, the project will have made a major contribution towards bringing true innovation from primary production to the consumers. In this way, the measurement and validation of good and exemplary practice becomes the linchpin in the juggernaut that involves responding to consumer awareness, further educating the public, creating market pull for exemplary practice in production and making climate-beneficial techniques the new norm.

Knowledge institutions
Imperial College London, Centre for Environmental Policy

Entrepreneurs
Vencomatic Poultry UK Limited (Dr. Leon Furlong, with technical support from Mr. Niels Geraerts, Venco Grop Nederland)

Non-governmental organizations
Lose contact with Forum for the future
Lose contact to Let's recycle and London Remade

Governmental actors
Contacts to DECC and Defra
Potential to engage with Environment Agency and Health and Safety Executive

Intermediaries
Initial links into the LEAF Marque standard for food production

Other intermediaries not yet contacted
Climate Change Committee
The Food and Environment Research Agency
The Food Standards Agency

5.4.5 The project meeting in London - description of CoP in Focus contribution to regional MFC development

A project review was carried out to ensure that progress and understanding were on track, as this was the penultimate opportunity to discuss project-wide methods, content and issues. The stakes and roles of all parties in the different KENGI networks per case were clarified and structured. A work plan to consolidate the methodology and the activities for the next meeting were discussed.

The future perspective for advancing MFC techniques into the UK was enriched by the contributions of Vencomatic Poultry UK and Venco Groep. It was clarified through discussion and analysis that rolling out MFC techniques is not a task for a single retailer or a distribution firm. It is a compound task for health and environment government departments, retail associations, food control agencies and certification bodies. Overall, the main achievements of the workshop can be summarised as follows:

- Identification of the importance to include benchmarking, standard-making and certification as a work stream in the follow-up innovation proposal RUE2CLIMAG as one of the main strands of research and ongoing work transferable to the rest of Europe.

- The methodical clarification of the linking thread between consumer education, consumer demand, climate-friendly production techniques and their further diffusion potential through certification and labelling.
- The completion of the scientific connection between geographically removed regions analysing techniques pertinent to the key commodities from the field to the consumer.
- Clearer guidance for companies that might join Vencomatic in the UK as proponents of MFC techniques by emphasising the importance of working with certification bodies to inform them of the possibilities of the technologies even when that necessitates changes in national regulations, e.g. the exclusion in the UK of the combination of hatchery and broiler farm in one as an allowable technology. Educating the authorities and the certifying bodies will generate the necessary support from consumers thereby underpinning the need to expand the use of MFC techniques.

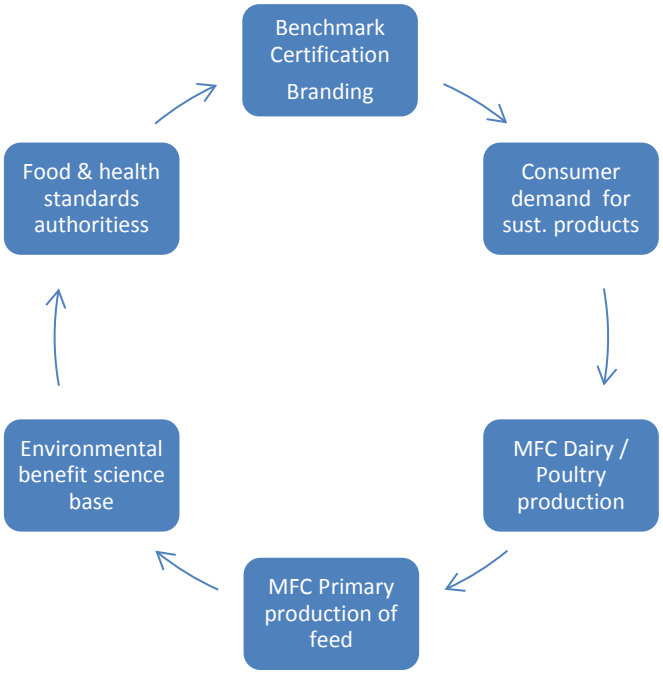


Figure 5.17 *The sequence and function of benchmarking and certification in the food provision cycle.*

6 CoP Network development

The concept of the Communities of Practice will be applied as a new way of working in the pathfinder trajectory. We can distinguish two clear deliverables:

- An international network (community) of Metropolitan Food clusters.
- Locally/regionally organised workshops with key actors and key SME's as task force for business development.

In this chapter we will describe our activities and results on CoP development.

6.1 Introduction and Goal setting

This pathfinder intended to develop a focused EU working group to extend an existing Dutch Community of Practice (CoP) on development of Agro food-clusters that focuses on system innovation of high tech, large scale, industrialized agriculture and food production for Metropoles, in a mode of co design (Smeets, 2011; Regeer, 2011; Kranendonk - Van Mansfeld, 2013 in voorbereiding). A CoP on a specific domain develops according to specific ways of working that brings a group of stakeholders into a trans disciplinary working mode together (Wenger, 1998; Kersten, 2002); in this case towards business development of a regional specific MFC development. The ambition of the CoP has been to stimulate development of Metropolitan Food Clusters in the four selected pilot areas. Essential is commitment and engagement from so called KENGi partners (Knowledge-Entrepreneurs/business, NGO, Government /multilevel and intermediates within a Cop setting. The trigger to market representatives has been substantiated, by activities to involve business partners, supportive government and knowledge institutes in the specified part of the agro and food value chain that was allocated to different cases, as starting point for food cluster development tailor made for their respective agro and food chains.

The CoP development takes place on two levels. We can make a distinction between the project group of CoP in Focus, in which representatives from different backgrounds in culture, disciplines and experiences are searching for communality and progress. The objective is to grow on this level with people who are willing to collaborate on MFC project development, to learn from different practices and to develop new common initiatives. The other level is the level of the case studies. In all regions we have set up kengi-networks in order to start or to optoimize the regional MFC development. Some regional representatives act both in the regional CoP as in the overall CoP. The same can be said about the project team members. So a European (cross regional) – regional interplay will originate.

Within the Community of Practice the following activities have taken place:

- Give meaning to MFC, to Climate benefits, to regional cases and to various relevant developments.
- Kengi network and CoP development Getting to know and understand each other: organization of meetings and processes of exchange of meaning and experiences, networking, helping each other.
- Organization of the Practice (excursion, workshop techniques, dialogues): case visits, dialogue with regional stakeholders.
- Designing and facilitating the CoP meetings in regions in strong collaboration between Wageningen UR and the host.
- Investigate the opportunities for MFC innovation strategies and MFC business case development.
- Inventory of climate benefits.
- Joint action planning – case development, business case development and preparation of an CKIC Innovation Project trajectory - Next steps, business case planning.
- Development of alignment and dissemination strategies within the case studies and with the CKIC community.

6.2 Progress and main achievements

In this paragraph we will describe the activities and achievements of the pathfinder in terms of the main elements of the CoP approach: practice, meaning, community and alignment.

6.2.1 Practice

In all four regions, CoP meetings have been organised to have interactions between the project team and regional network. A diversity of regional stakeholders has been invited and participated or have been visited by the core team of CoP in Focus in a site visit (excursion) in the region.

The following locally organised workshops with key actors as SME's have been organized. Except from the regional case development, other subjects and activities have been set on the agenda in order to optimise the CoP development:

- Hungary: getting to know each other, ways of working CoP methodology, KENGi and network development (may, 2012).

In this meeting an intensive process within the project team has taken place, to get to know each other and to change ambitions and perspectives. Also various people from local communities, university and business have been participating on meetings and within an excursion to different relevant sites (development area, agricultural practice, market place, government and university).

- The Netherlands: best practices MFC, Climate benefits (July, 2012).

In The Netherlands we organised an intensive excursion program to visit some best practice MF developments in the area of Wageningen (Food Valley and Betuwse Bloem) and in Venlo Region – the region of the demonstration site of Protein Empire. In the latter region we met various regional stakeholders and project leaders who gave short presentations.

- The UK: benchmarks and retail (October, 2012).

In the UK the group of stakeholders was quite small. Initiatives have been mainly focussed on the engagement of Sainsburies, which failed after one year trying to connect them. The visit in the region took place with some Dutch entrepreneurs who were interested in the development of a sustainable chicken chain, together with the retail sector. Also sustainable indicators and benchmarking was a central element in the meeting, very much of interest to the business representatives.

- Germany: business planning and next steps (January. 2013).

The meeting in Germany was focussed on scoping the MFC definition, from agroforestry and energy production to horizontal integration with dairy production. An intensive excursion in the region and meeting with some representatives has led to new definitions and aspiration. Also in the German case it was hard to engage business partners as Vattenfall in the case. We came out to focus on farmers and their representatives.

In the practice, presentations and inspirations of experts on various topics (MFC, region, Climate etc.) have been held, followed by discussions within the project group. In all regions we have held basic presentations on the concept and best practices of MFC and discussions in order to be able to judge and to give meaning to the features and perspectives of MFC development. This has happened more on a general level of global developments on world population, urban growth, agro and food production and climate change, as well on the regional level, with specific problems, characteristics and challenges. The regions and concrete MFC challenges have been discovered by presentations of regional representatives from different perspectives and backgrounds (academics, agro production sectors, government (various levels), regional development agencies and a variety of market players) to create a common meaning of MFC potentials, strategies. This critical reflection could be seen as an assessment from MFC aspects, concepts and system innovations phases, focussed on concrete design, advice and alignment strategies to strengthen the ambitions, to come to business planning and to develop an optimal MFC.

The organization of the practice was planned during the regional regional workshops. Next to the regional cases, we have organized workshops on three specific topics with the project team only:

- Community of Practice: presentation of Remco Kranendonk, followed by discussion.
- Network development from the principles of KENGi. We made in the first meeting in Hungary Stakeholder diagrams to get a picture of the actual engagement of partners and the partners which should get involved by the regional initiators.
- Expert meeting on Climate Benefits, which has been held in the meeting in the Netherlands. We organized a presentation of a climate expert and had a exercise in making an inventory of climate indicators in all phases of MFC processes.

KPI (anticipated or achieved)	Deliverables expected in 2012	Status
KPI-2.1 Mobility	Mobilisation KENGI partners Hungary	Realised ,all engaged
	Mobilisation KENGI partners Germany	Realised no direct business participation
	Mobilisation KENGI partners NL	Realised all engaged
	Mobilisation KENGI partners UK	Realised but little participation
	Workshops (4)	realised

6.2.2 Meaning

The concept of MFC entails clear sustainable features, although a thorough framework didn't exist yet. In the pathfinder process, due to an inventory of possible climate benefits in all stages of agro food processing, as well theoretically, as well the practice of a regional initiative, based on abroad range of indicators, developed in different sectors, countries and parts of the agro food production chains. The MFC-concept has been grown, developed from climate perspective, and distinctions can be made between parts of the production chain, between countries and cultures, between sectors involved.

Also on the level of regions and concrete initiatives in Hungary, UK, Germany and the Netherlands, explicitly processes of creating a common meaning of the opportunities of MFC development in the region have been taken place in interaction between the regional network and experts on MFC planning from the project team. New insights have been formed in order to roll out the concepts in the EU food production and value strategy development and have led to two business case initiatives, in the Netherlands and in Germany. In Hungary the development of a consolidation centre in Bag was strengthened by principles of MFC developments. We do not know if the owner and developer of the

project is still applying these and so, optimising the concept from perspectives of market, integration and sustainability.

6.2.3 Community

The CoP has been formed by several meetings of the project team in the four regions, in which mobilization of the regional KENGi network has taken place, information has been shared about the potention of MFC, in order to interest them for MFC case development and engage them in the topic and in the network.

The core of the CoP is the project team, which has been expanded by participation of the regional development agency Oost nv (NL), with expertise from climate perspective (Wageningen UR Alterra) and with colleagues, who have the same ambition in transforming the pathfinder into a business driven IP trajectory from perspectives of benchmarks, MFC product and services developments and the development of (other) demonstration sites. The CoP has also grown by interaction within the Climate KIC community, for example during the processes of the formation of the Platforms, with close relations with Bio economy and Land and Water use. Further the project has mobilised kengi partners along the innovation processes in the regional case developments. Totally more than 50 people have been reached and more or less engaged in MFC de CoP in development initiatives within the pathfinder process:

- Hungary: 20 (university, municipalities, region, investors, consultants, agricultural sector, Embassy).
- NL: 30 (university, SME, regions, intermediates, development company, ministry of Economic Affairs).
- GE: 10 (university, region, CLC, Vattenfall).
- UK: 6 (UK: 6 (University, poultry technology provider).

The activities have had a large outreach in the Netherlands and Hungary. Totally more than 50 people have been participating actively in the pathfinder working processes. We can say that an international network (community) has been set up, consisting of an extended core group, which has been initiating the follow up activities within an Innovation Project proposal, including two demonstration regions, representing an engaged network, willing to invest in further activities on business planning.

Focus participants (50) – see Annex	
Mobilisation kengi partners Hungary	Done, all engaged
Mobilisation kengi partners Germany	Done, no direct business participation
	Done, all engaged
Mobilisation kengi partners NL	Done, small participation numbers
Mobilisation kengi partners UK	

A major obstacle has been the Hungarian partner, who has been active only until end of 2012. They have provided a very preliminary draft report on the case development, but have not anymore been shown up in the last meeting and the position paper activities. They are not incorporated in translating the CoP in Focus results in Innovation Project development (MFC4Climag).

The focus of the UK case has been shifted during the pathfinder. At the end, active involvement of Sainsbury's in MFC development initiatives has not been established. Here the focus has concentrated towards MFC Climate benchmarking as business development in UK retail (at present search for another retail organisation).

6.2.4 Alignment and Communication of CoP in Focus

The formation of a common identity and communication strategy are part of the CoP way of working, which focusses on strengthening the core group, spreading the messages and expansion of the CoP, in order to realise alignment in the surroundings, as well with people and organizations to realize a KENGi network, as with politics and policies, spatial and financial. In the four meetings on case sites

we have applied these strategies. To all regional stakeholders and networks we have actively searched for optimal alignment with KENGi partners and existing strategies, planning processes and business development and planning activities.

The CoP in Focus network has made the following strategic connections:
- we are linked towards regional development strategies (NL, Hu, G).
- we are linked to business initiatives (NL, HU).
- we are linked to MFC developments in NL.
- we are linked to sustainability indicator development (UK, G, NL).
- we are linked to large research projects (UK, G).
- we are linked to policy priorities (NL, G, Eu smart specialization).

The initiatives in the Netherlands and in Germany both fit very well in the regional innovation strategy of smart specialization. In the Netherlands, the region of Protein Empire Agro food is the driver of the regional economy, with a focus on integration of plant and animal production, food processing and finding added value in processing activities. An important element is the development of innovative and sustainable stables. In Germany an important element of the RIS3 are the mining and forestry activities and developing initiatives with an added value on energy production. In this perspective new MFC development fits well. So in both regions, support for MFC development, as well organizational as well financial, is available, the coming years.

Next to alignment within the regions, also alignment within the CKIC network was one of the objectives in the pathfinder trajectory. We have done many things to align CoP in Focus, which is showed by the following activities:
- Participation in pathfinder projects: Sustland, Admit.
- Participation in Market place meetings and Platform design Preparation in the Marketplace agricultural production and bio renewables – towards Challenge Platforms. In these meetings exchange with a wide range of experts from Wageningen UR (diversity of Science Groups (Plant, Animal, Environment, Food and Bio based), University of Utrecht, Deltares, province of Utrecht, DSM, Arcadis, took place.
- Within the Climate KIC community we presented the CoP in Focus project, on the level of platforms (Bio economy) and to CKIC innovation team as well in Schiphol, as at the CKIC Co Location Centres in Utrecht and Berlin. Also we participated in the pathfinders Admit and Sustland, in which we presented our pathfinder project, the concept of CKIC and the CoP approach.
- We presented the KIC in the regional networks of MFC stakeholders.
- Active IP development, from four separate project proposals (RUEland, RUEFood, RUEDSS and RUETrans) towards an integrated MFC4Climag Innovation Project proposal.
- Contribution to flagship initiative on Climate Smart Agriculture.

6.3 Conclusion

The CoP has applied a trans disciplinary way of working, in which exchange of scientific concepts on agro and food production and processing, on Resource Use Efficiency and on concepts of learning, and tacit knowledge, has taken place, to pave the way for integrated Agro and Food Cluster development in the four different EU regions that have partnered into this Community of Practice. All four cases have taken up their specific part of the value chain (respectively production, processing, agro logistics and retail), as the basis for establishment of a network of regional stakeholders that are mobilised for, and informed and stimulated into, the approach of an integrated vision towards spatial and large scale agro and food clustering. An exercise on scoping the MFC development opportunities has been done per case-specific agro and food value chain with the stakeholders, to broaden perspective of individual agro and or food business as part of the value chain, towards a scaling up and linkage of their business into a total value chain approach with horizontal and vertical integration, resource use efficiency, intelligent agro-logistics and climate benefits (case specific benchmark). Also exchange of approaches and ideas has taken place.

The pathfinder has developed into a first set of location linked specific groups to form the first EU network (community) on Integrated Food Clusters, as focused think- tank and incubator-innovator in the EU arena. It has the ambition to link with Centres of Excellence in agriculture and food, its linked business partners of SME's and two large value chain parties, which are directed towards more sustainable development of their business, in terms of climate adapted agro and food production and trade.

In every location of the four cases the connection with entrepreneurship (SME level-large value chain parties) has been established, some as preliminary Climate KIC partners to become parties in the Metropolitan Food cluster initiative; to engage in the development of the idea within their companies; and/or broaden their scope on this subject towards climate resilient agro food business. In the four cases (Hungary, Brandenburg, London, Southern of the Netherlands), locally organised workshops have been taken place with key actors and key SME's as task force for business development. The realisation of a MFC initiative takes some years, from initiative and prefeasibility, to feasibility studies, network development, design process, investment plan etc. These MFC initiatives are dependent of the continuous collaboration between KENGI partners, in order to proceed and to align in the environment of planning, politics and policies, organizational and spatial conditions and regulations. Participants are more or less engaged, but the CoP should be alive and continuously finding solutions for obstacles and changes but also adequately anticipating on new opportunities to accelerate implementation and realization and finding the optimum. This EU CoP is now alive, in two cases aligned with strong networks and developments, in two cases initiated but not landed where it can stabilise and professionalize.

The overall conclusion of this CoP in Focus pathfinder is that the Community of Practice on MFC within Climate KIC is formed:

- exchange of knowledge, experiences, cultures has taken place.
- a common idea of MFC has been developed.
- a common practice on MFC case development has been developed.
- a community has been formed, in which participants have got to know each other as an important basis for common initiatives on MFC development.
- with the MFC4Climag IP proposal, we have a roadmap and action plan for further activities.
- first alignment has been found within Climate KIC, regional networks.
- commonly a climate benefit overview table for MFC development has been produced
- we have had a really idealtypical rythme of meetings (4), in which the CoP came together, shared new ideas, experiences and progress, and working on the spot, searching for aligment, sharing, reflecting and testing ideas and aspirations which have been developed within the CoP (inner circle) with the outerworld. So continuously progress as well on content as well on social learning processes have have been taken place.
- the participants go home to their positions and regions, where testing, reflecting and discussion took place. In the next meeting they will come back with reflections and new information.
- the CoP can be seen as a Learning community and training infrastructure for entrepreneurs and governmental representatives. The CoP can be divided/split up in regional (MFC Protein Empire and MFC Brandenburg) and thematic (Climate, MFC concept development) sub CoP's.
- in the practice of case development we have really helped each other during meetings, discussions, workshops and excursions to develop common descriptions and analyses of regions on MFC aspects, climate benefits and stakeholder networks.

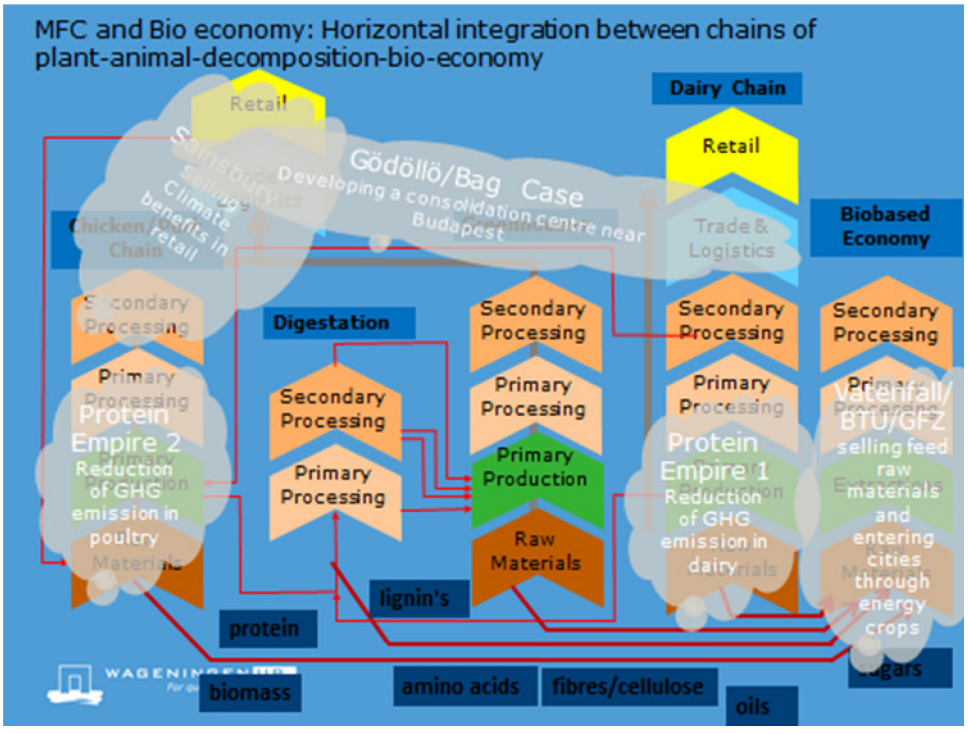
7 Conclusions, reflections and next steps: business plan

7.1 Conclusions

7.1.1 The overall picture

The CoP has been formed by several meetings of the project team. The core of the CoP is the project team, which has been expanded by participation of the regional development agency Oost nv (NL), with interdisciplinary expertise from a scope of specialists on MFC development with the climate perspective (Wageningen UR), with the ambition in transforming the pathfinder into a business driven IP trajectory from perspectives of benchmarks, MFC product and service development for the existing and possibly new development sites. The CoP has grown via interaction within the Climate KIC community; during the processes of the formation of the Challenge platforms, in relations with the objectives of Bio economy and Land and Water engineering. That interaction has led to definition of one of the thematic areas of challenge platform Land &Water, and contributed to the definition of a flagship initiative of smart agriculture.

The pathfinder project has mobilised KENGI partners within the four specific regional innovation processes. More ten 50 people have been informed and committed themselves into the community and more or less engaged in MFC development initiatives during the pathfinder process.



All cases have been working on these issues resulting in:

(1) Climate indicators: we have developed an overview of climate indicators related to the MFC concept /aspects/sectors and parts of the chains, whoich will be elaborated further within a commercial benchmark service.

(2) Case development: we have developed MFC cases in four participating regions and contributed to definitions, planning and progressing the development. The case descriptions have been translated in two business cases for an CKIC Innovation Project.
(3) Network development: we have formed a CoP, an establishment of a network on MFC development on the level of EU, which is willing to be part of the KIC community, as the innovation ecosystem.
(4) MFC-concept: we have enriched the concept of MFC with climate indictors, insights of benefits and routes to realise and optimise performances a group of people, in a regional MFC design and in an inventory of climate benefits, which are applied in some case descriptions, and in the development of new business perspectives.

In this pathfinder we have established four initiatives which are ready for further development within an IP: MFC services (program desk), MFC benchmark and MFC Protein Empire and MFC Brandenburg as exemplars/demonstration sites. The MFC Bag and MFC London are not ready for further development within an IP.

NL: enrichment business case from Climate	Yes	
G: new concept development: from agroforestry to Bio economy cluster	Yes	
UK: business case Sainsbury's	No	
Pathfinder commercialisation of benchmark	Yes	
KPI-3.1 Development of regional innovation projects	MFC Brandenburg (Ge)	New opportunities dicovered to be elaborated in IP
	MFC Protein Empire	To be transformed into demonstation site
	MFC Bergerden (NL)	New potential case development originated from new engagement of Oost nv within CoP

7.1.2 Results Education

MFC development demands new forms of knowledge development. MFC development can be seen as a complex problem (wicked problem of sustainable food security and food safety) which needs to be developed in interaction between research, market and public sector (triple helix). Also interaction with Society (quadruple helix) is necessary. So new knowledge and competencies on all domains are needed, which could be seen as part of an education strategy.

CoP is a concept of social learning, which takes place in interaction and co-creation between Kengi-partners. CoP represents the concept of social learning, parallel to the well- established forms of Education in BSc, MSc and PhD context. In the CoP in Focus pathfinder, conditions for learning and development have been created to inform about the opportunities of MFC's, as well from the abstractions of the concept and good practices elsewhere, as within a specific context of a partner region and a concrete initiative or opportunity. Next to explanations of the concept, the innovation strategies have been discovered, which should practitioners give tools and techniques set up their own MFC development. Further the CoP has been to functioned as an environment in which interaction and co-creation between KENGI-partners, within cases, between cases, between disciplines and domains of research, business and government, is enhanced and stimulated.

Results Education:
- Facilitation of the social learning process: multi stakeholders discussions, learning by doing, learning as experience, cross cultural exchange as well on level of project team as in regional MFC case developments.
- Lectures on MFC in all regions, and at Szent István University in Hungary to a group of 40 students.
- Cross learning with pathfinders Admit, Sustland.
- Innovation Project MFC4Climag in which education is one of the pillars.

7.1.3 Results Entrepreneurship

Many Dutch initiatives, which have been set up in research-business interaction and organised by means of the Ministry of economic affairs, have provided demonstration to the CoP in Focus project group. They have been mobilised to present and show their initiatives, to discuss with the CoP in Focus project team, focussing on MFC development in general and on climate benefits, in terms of GHG reduced and and contributions to resilience. Those entrepreneurial exemplars and initiatives seemed to be very beneficial for all partipants in the Dutch CoP meeting. The regional case of Protein Empire has led to engaged entrepreneurs and a supporting environment of different levels of government and various disciplines of research. The entrepreneurs are willing to invest in an Innovation project on new stable development. Early indications on climate benefits can only be estimated. The ultimate objective which has been set by the group of intiators is, to diminish methan emission with 100%. In the CoP in Focus trajectory, we found committed partners who are willing to implement mitigation measures integrated in business strategies. The regional development Agency, Oost nv, has signed the knowledge transfer agreement. They have learned about MFC development, as well theoretically as in practice, which has led to new ambitions and initiatives in the East of the Netherlands.

The German research project contributes in knowledge transfer in order to be able to select the most promising functionalities and value strategies for MFC development, in terms of added value and climate benefits (Greenhouse gas reductiuon and contributions to resilience). Leading perspectives have been the characteristics of the Brandenburg area and the needs of the urban population ands industies of the capital of Berlin. So ideas and potential business cases of new possible functionalities(dairy) and values (energy, feed and food) from agroforestry, which could be added or newly developed, have been shown up, and led to concrete business development process, which should take place within the follow up MFC4Climag.

In Hungary the investment of the project developer in a consolidation centre in which collection of agricultural products, some processing, agro logistics and distribution is optimized for the city of Budapest, but also for Hungary as a hub in the European Agro and Food logistics, has been done in order to achieve a state of the art MFC development which leads to new products and services, new employees and a reduction transport and handling steps within the food production chain, beneficial to climate. The conceptual knowledge and the MFC experiences from other initiatives is beneficial for first steps in orientation towards and design of Metropolitan Food Cluster development in Hungary.

In the UK, the complementary activities focussing on measurements and benchmarks of climate benefits have been contributed to new service and product development: the commercialisation of a benchmark business, which leads to employability and enhanced applications on benefits on climate and economics from MFC developments, which will take place in Climate KIC IP context.

KPI-2.2 Contribution to entrepreneurship	HU: enrichment business case from MFC concept	Yes
	NL: enrichment business case from Climate perspective	Yes
	GE: new concept development: from agroforestry to Bio-economy cluster	Yes
	UK: business case Sainsbury's Pathfinder Commercialisation of benchmark (Possible branding)	No yes

7.2 Reflection

All cases have led to the formation of a group of engaged participants, who are willing to co-operate in MFC business design and planning processes. The CoP in Focus trajectory has added the the context of ambitious climate benefits objectives to the Metropolitan Food Cluster business ambition.

The MFC concept has grown, as it has been developing in the climate perspective. Distinctions can be made between parts of the production chain, between countries and cultures, between sectors involved. New insights have been formed in order to roll out the concepts in the EU food production as value strategy development with concrete location oriented value propositions.

In the case of dairy production in Protein Empire the proposed innovation of a completely closed stable that would be able to deal with methane emissions, shows the way for high productive dairy production in regions throughout the world, where this has not been possible due to high humidity and high temperature. Many of these regions have fast growing urban populations and rely on growing dairy imports, such as Southeast Asia, South China, large parts of India and Africa.

In the Case Brandenburg, where the original focus was on the mutual benefits of spatially integrated arable farming and forestry, the concept of Metropolitan Food Clusters, in which vertical and horizontal integration in the food production chains has been integrated. This will contribute to a more productive agriculture and food production and to enhancement of sustainability in the food production systems as well towards food security. The focus here is now on the integration of the Metropolitan Food Cluster concept with approaches for sustainable land use management and cultivation methods. The project resulted in new ideas for the integration of the value chains of livestock farming and bioenergy crops. Several regional partners are to be involved in follow-up projects due to the activities of CoP in Focus.

Participants are more or less engaged, but the CoP should be alive and continuously find solutions for obstacles and changes and also adequately anticipate on new opportunities to accelerate implementation and realization and finding the optimum. This EU CoP is being set up, in two cases aligned with strong networks and developments. In the two other cases MFC has been initiated but not landed in a way that it can stabilise and professionalize. This is why the logical next step, following the pathfinder CoP in Focus trajectory, builds on the two cases of Brandenburg and Protein Empire. The aspired benefits in adaptation and mitigation of climate change have been made explicit in the pathfinder and partners in future regional Communities of Practice have been identified, and are in some case already involved, and have started thinking on inventions from their own perspective that could further support the case.

The innovation principles that are the basis for the development of Metropoltan Food Clusters (resource use efficiency, vertical and horizontal integration, agrologistics and the integrated design of hardware, orgware and software) are more and more finding there way in a number of projects that are being executed globally. They are targeting metropolitan regions worldwide. Protein Empire and Brandenburg are focussing on the primary production part of the vertical chain but they both need significant changes in the way the general public is accepting these high productive, industrial ways of livestock production. Both the cases are contributing to the development of metropolitan food clusters in a regional specific way.

The protein empire case can build on all the efforts that modern agriculture in the delta metropolis of Northwestern Europe (covering the area between Lille, Amsterdam and Cologne) is continuously making to improve its performance, and because of this, it can focus on the system innovations of reduced methane emission dairy and insect fed poultry, without having to consider too much the development of the Metropolitan Food Cluster as a whole. The dairy case is targeting a system innovation in one of the heartlands of dairy production globally: The European region covering the land between Ireland and North Poland and the challenge is that this region is one of the few globally that could maintain high productive dairy production in open systems (New Zeeland is the other). Here the climate argument is really the driving force for innovation. The dairy case could, if succesfull, be applied in other metropoles in this region (Dublin, Mid England, London, Hamburg). But, as argued above, it would also enable an innovative way of high productive dairy production in the high temperature and humidity areas around the world.

In the case of Brandenburg the establishment of the aspired system innovation would build the first Metropolitan Food Cluster for Berlin, providing part of its food and part of its energy. The integration

of forestry and arable farming enables this region to keep playing its role in a productive agriculture while the regional specific suitability for high productive agriculture is rather low.

We have developed the CoP in Focus in close interaction with pathfinder trajectory Admit. This trajectory has led to new insights in bio based aspects of MFC development. MFC has a focus on food production and on strategic coupling from waste between plant and animal production, as well decomposition. In the pathfinder trajectory also new forms of capturing values and optimization strategies have been introduced. Especially in the Brandenburg case, agroforestry production finds new and higher values in energy. In the Protein Empire case, the introduction of algae production in combination with dairy production as well as feeding insects on organic matter that normally is no part of the human food chain, both look promising. So the MFC business cases seem to have opportunities to augment and to add all kind of new production processes in order to optimize production, processing and adding value to biomassa and waste materials. New forms and sizes of agro production and processing units will come up, which show higher benefits on climate and business wise, and will give regions and producers new perspectives.

- The CoP in Focus project has been succesfull in delivering and preparing two concrete cases that now can be further elaborted in an IP proposal for Climate KIC:They provide demonstration cases – the regions in which KENGi parties have committed themselves to a MFC business case, which will be executed to realization, in close cooperation between CKIC, project team MFC4Climag and the regional network, to be seen as a complex problem of optimization of resources, investment, space, energy and interactions.
- They build on and further development of the network, the CoP: in which the promising concept of Metropolitan Food Cluster will be spread. They enhance the influence of MFC on smart agriculture initiatives in Europe and outside and development of new business cases.
- They will be helpfull to further case development, commercialization of MFC services functionality within a front office: advice, design techniques, business case consulting, benchmarking, masterplanning, market research etc., and they identify real measurements of climate benefits, in order to communicate with neighbours, governments and consumers. They will deliver building blocks for new Licence to operate, and develop of new standards and indices.

For the Climate KIC initiative itself, the continuation of the pathfinder CoP in Focus project into an integrated project would identify and elaborate key areas for climate smart agriculture as well as deliver showcases for these innovations to be feasible. Moreover it would integrate the Climate KIC objectives with the innovation principles of Metropolitan Food Clusters and use these innovation principles as a vehicle for global implementation.
The focus on two cases enables the team that would like to continue in an IP trajectory, to concentrate more on, and to expand with the detailed knowledge to build the cases, not only regarding the hardware aspects but also with focus on orgware (how to better involve government and how to overcome barriers in permits and legislation, how to build business cases) and software (dealing with the way in which public opinion and the general public (in their role of citizens as well as consumers) are dealing with these system innovations.

7.3 Business planning - Innovation Project MFC4Climag

With the CoP in Focus partners we have developed a process of continuation the innovation pathway within the Innovation Project proposal MFC4Climag. The MFC4ClimAg-project aims at developing the MFC-related business opportunities by developing 1) climate related benchmarks that can be used to provide MFC businesses with climate labels/certificates, 2) business models and plans on Inventions that deliver Adaptation to and/or Mitigation of Climate Change (IAMCC), and that can be implemented in the Metropolitan Food Cluster concept, and as such can help create innovative ways of making money, and 3) an IAMCC-MFC Front Office at EU level that can stimulate the development of MFCs in Europe. These activities are fed by inputs of data and experiences from case studies in actual MFCs, where contacts were built during the pathfinder-project, CoP-In Focus, and by quantifying the resource use efficiency.

7.3.1 Continuation and growth of the network, the CoP

Within this work package the CoP working will be continued, focussed on strengthening the alignment of the CoP:

- Within the Climate KI Community, get connected to other platforms as Making transitions happen, industrial symbiosis and Bio-economy, and connect to RIC's.
- Connecting the KENGi networks between the two demonstration regions. Creating an environment for exchange of experiences and creating communality within the CoP.
- Mobilization, growth, engagement and alignment of the regional networks.
- We search for new MFC initiatives with climate benefits within and outside CKIC.
- We search alignment in the EU arena, for example with the EU platform on research efficiency which is looking for international synergies.

7.3.2 Demonstration sites

The MFC4CLIMAG project features two case studies of actual Metropolitan Food Clusters, one in the Netherlands and one in Germany.

Demonstration site: MFC Protein Empire (NL)
Protein Empire is the co-operation between entrepreneurs in meat, egg and milk production and processing, their suppliers, the local and regional government of the municipality of Venray and the province of Limburg and a number of knowledge institutions. Their co-operation is aimed at a broad range of system innovations to improve their different forms of protein production, including resource use efficiency, vertical and horizontal integration and better use of space.
The MFC propositions are:

Methane reduction in dairy farms: Through their production of methane, ruminants play a very important role in GHG emissions. Protein Empire partners will address these emissions. A large scale dairy farmer, a stable construction firm, an enterprise specialized in air conditioning systems for livestock farms, together with knowledge institutes will design and eventually construct a closed stable system in which the methane in the atmosphere can be captured and removed. Results of already on going innovation trajectories that focus on reduction of methane emissions through improved manure handling and improved feeding will be integrated in the design.

Insect based feeding of poultry production: The share of poultry based proteins (meat and eggs) in the global food provision will keep on rising. Within poultry chains the production and transport of feeds and concentrates (corn, soy and other cereals) causes more than half of the total of GHG emissions. Introduction of insects as source for poultry feed will significantly reduce these emissions. They can be grown locally on the basis of waste, rest and by products in the human food chain, thus reducing the inputs that come with the production of plant based feed and also reducing transport. Poultry producers, feed producers and knowledge institutes will co-operate in the design and set up of these innovative poultry chains in Protein Empire. Input from governmental organisations is especially important because feeding insects to chicken will require change of law.

What the MFC4CLIMAG project aims for in this case:

By regional linking of land-based (arable farms) and land-less agriculture (pig and poultry farms) increases in resource use efficiency (RUE) can be achieved. This asks for Regional mixed farming (horizontal integration) including arable farms where vegetables and other crops for human consumption are grow, but also forage and feed for grazing animals and dairy farming by cooperation of specialised entrepreneurs within the region at various levels of integration. Intensive pig and poultry farms could further contribute to an increase in RUE by an optimal use of the products and residuals from the regional mixed farms, such as organic residues for co-digesting of manure and feed/concentrates and vice versa by use of produced manure and energy (horizontal integration). Vertical integration in the landless systems will be included through integrating of the breeding, rearing, slaughter and food processing chain, whereas animal welfare is aimed to be improved by reared animals in closed, animal friendly and low emission stables.

Calculations about resource use efficiency and economics will be made for various scenarios, such as:

1. Current situation: Dairy and arable farming system (scaling up according to trend & use of concentrates from feed factory) & Pig and poultry farming system (all concentrates are imported, products are exported and processed outside the region, manure is partly applied regionally and partly exported.
2. Intermediate implementation MFC: Regional mixed dairy and arable farming (Regional feed centre buying crops from dairy farmers and arable farmers, processing with local concentrates and selling to dairy/animal farms, optimization of crops on regional level).
   Pig and poultry farming system (System focusing on closing nutrient cycles within the region: concentrates partly produced in the region, animals and eggs are produced and processed in the region; finished goods are exported and residues are optimally re-used in the region, manure is partly applied in the region, excess manure is fully processed by e.g. co-fermentation and nutrients recovered as 'fertilizer'.
3. Full implementation MFC: Regional mixed farming: Regional nutrient centre (feed, manure, biomass), optimisation of crops, manure and biomass on regional level instead of farm level & Pig and poultry farming system has a nearly closed nutrient cycle within the region according to the principles described under 2.

The consequences of regional centres for feed, upgrading manure and waste will be shown for the dairy farmers, the nutrient centre (feed, manure and organic residues), arable farmers and pigs and poultry farmers. The difference of optimizing crop rotation and use of manure and residues on a regional level will be compared with optimizing on farm level. The tool to be developed will be based on an existing LCA tool for Dutch farming systems and a regional model for Dutch agriculture including impacts of measures on all nutrient and greenhouse gas fluxes to air and/or water. This will be adapted to a fully integrated regional level evaluation tool.

Demonstration site: MFC Brandenburg (D)

The Brandenburg region has been subject to intensive and large-scale open-cast mining. The reclamation of soils and restoration of landscapes of former mining areas are the main challenges with regard to the re-establishment of sustainable forms of land use. These conditions offer a unique opportunity to test the resilience of agricultural systems with regard to climate and nutrient stress. Agroforestry systems, such as alley-cropping systems with trees appear potentially suitable for both the reclamation of such post-mining landscapes and the management of agricultural set-aside areas and marginal land. New aspects with regard to the overall MFC concept include a clearer focus on the "food part" of agroforestry value chains instead of solely focussing on the utilisation of the "Fuel part", a stronger emphasis on generating new sources of income for farmers and land owners and an inclusion of producers cooperatives and SMEs as addressees of future activities alongside larger companies (such as Vattenfall).

MFC Brandenburg proposition:

- Fuel provision by wood from agroforestry.
- Processing of rest products connected to Vattenfall power plants.
- Livestock development - farmers consuming fodder from agroforestry.
- Concepts for using biochar as a means of soil fertilisation and carbon sequestration.

What the MFC4CLIMAG project aims for in this case:

Alternative cultivation systems such as agroforestry may serve as building blocks in the formation of multifunctional landscapes that allow for the harmonisation of different societal needs such as food provision and energy supply with low GHG emission. They are able to produce higher revenue even in case of lower yields due to the reduced use of fertilizer and pesticides, increased soil carbon stocks, improved soil moisture regimes and product diversification. Agroforestry has even been recognized as having the greatest potential for C sequestration of all land use forms analysed in the Land-Use, Land-Use Change and Forestry report of the IPCC (Smith et al., 2008). In order to implement the most effective schemes and methods and to achieve maximum value for money it is crucial to quantify or estimate the effect of production method chains in the context of their environmental impacts. Technological developments and applications such as on-site monitoring systems as well as spatial

analyses of the components of the MF*C and the establishment of regional cooperation will help in achieving minimal environmental impact while maintaining economic viability.

The Berlin-Brandenburg region has been subject to extensive open pit mining of lignite. The MF*C Berlin presents an agroforestry constellation that seems highly suitable for both the reclamation of such post-mining landscapes and the agricultural use of such marginal lands.

We will develop methods for in-situ benchmarking of the respective management and production schemes. These will be integrated into a decision support tool providing farmers with reliable numbers for emission reporting and management planning. Existing instruments such as the "Cool Farm Tool" (Hillier et al., 2011) can serve as the methodical backbone for implementing such a solution. A selection of indicators that will be evaluated this way will include:

- A set of 'spatial indicators' based on a GIS-based analysis and optimisation of the spatial layout of the components in the MF*C Berlin-Brandenburg (e.g. landscape metrics for assessing the spatial composition and configuration).
- The water footprint of differently managed plots (m3 per year, per hectare or per product unit).
- GHG emissions on the respective sites (in CO2 eq per hectare, related to energy input and management intensity).
- Soil moisture in agricultural production system(matrix potential, kPa; assessed by application of GNSS reflectometry as a practical monitoring tool).
- Qualitative spatial and management-related factors determining the GHG emissions on agriculturally used plots.
- Nutrient use efficiencies in terms of e.g. use of nutrients N and P (kg N or P) as RUE-indicators for the benefits achieved from an integration of the value chains of food, fodder and bioenergy crops.
- Economic benefits: the indicator "land equivalent ratio" (LER), defined here as the ratio of the area under 'standard' management to the area under 'alternative' management (agroforestry) needed to give equal amounts of yield at the same management level will be used to assess the economic implications of different management practices; the soil carbon pools will be integrated as an additional parameter into these calculations to account for climate effects.

7.3.3 Benchmarks: quantifying the RUE of MFCs

The rationale behind the climate mitigation effects of MFCs originates from the idea that optimal organization of the logistics of all resources (water, energy, nutrients) leads to minimal use of resources, re-use of waste streams (circular economy), and minimized emissions of GHG to the atmosphere and nutrients to soil and water. This conceptual rationale needs to be backed up by quantitative information on the efficiency gained with respect to the resources used in specific MFCs. The two MFC exemplars run and analysed in WP1 and used for quantifying RUE in WP2, are cases in point. We will use them in this project to gather data on the efficiency improvement in production of the MFC-style organisation. These quantitative results will be used in WP3 to generate a set of benchmarks for the climate performance of actual MFCs with regard to, among other things, carbon sequestration, water use efficiency, methane emission reduction, and insects as a protein base for animal feed.

7.3.4 Business models: how to make money with the MFC concept

Climate innovations like agro-production in resource efficient MFCs will only really be adopted when they are commercially promising; therefore they must generate added value. In this project we will prototype and test various business models pertaining to Inventions that deliver Adaptation to and/or Mitigation of Climate Change (IAMCC) for MFCs and develop the most promising ones into draft business plans. The business models tested will be of a wide variety: e.g. specialized products or services needed to resolve barriers in MFCs, issuing (or advising on) certificates on the climate performance of MFC-products, and consultancy regarding the implementation of the MFC concept.

7.3.5 IAMCC MFC Front Office: a consultancy that will accelerate the development of MFCs

A supporting and enabling consultancy type of business will be developed into an operating business in the first period of this project based on the experiences and recommendations from the pathfinder project, CoP-In Focus, and from experiences in living lab MFC business case development. It will be realised in the form of an innovation desk called the IAMCC MFC Front Office.

The IAMCC MFC Front Office will stimulate the development of MFCs by 1) identifying and communicating MFC innovation storylines, 2) marketing and institutionalizing the MFC concept at EU level, and 3) implementing the consultancy business case by providing consultancy services to (new) MFCs. The first two activities aim to familiarize all partners – from policymakers, to investors, to entrepreneurs – with the MFC concept and the promises it holds for sustainable food provisioning of an urbanizing world. The third activity truly engages in the establishment of MFCs in Europe by developing services based on the experiences, data, business models and benchmarks obtained from the WPs 1 to 4, thus accelerating the transition to climate-conscious, resource efficient, sustainable agro-production.

7.3.6 Connecting to the Climate KIC community

The MFC4ClimAg-project fits a number of strategic challenges identified within KIC Climate. It especially fits the platform Land and Water Engineering for Adaptation, which is concerned with the challenges of 'increasing the resilience to climate change through adaptive land, agriculture, and water engineering'. This is what the MFC concept is all about. The MFC concept is also about 'valorising underutilized resource flows' as this is one of the main principles behind it; making it contribute to the Industrial Symbiosis platform. Finally the project contributes to the Sustainable City Systems platform as it 'alters the connection patterns between cities and their environment to enhance resource efficiency', and to the platform that aims at Making Transitions Happen because the IAMCC-MFC-Front Office is also specifically 'addressing the non-technical barriers of social, institutional, financial, and regulatory nature and developing products aimed at deploying and up-scaling/ the MFC innovation.

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Annex 1 Core Team CoP in Focus: expertise and expectations

Name: Gábor Bujáki (Hun).
Institute/university: Gödölő - Szent István University (SZIE).
Expertise: -
Expectations: good partnership, useable idea's from you.

Name: Sebastian Hoechstetter (Ger).
Institute/university: German Research Centre for Geosciences (GFZ).
Expertise: Institute; Earth sciences, Remote sensing, Geoinformatics, Seismology, Physics of Solid Earth Bioeconomy, Landscape Evolution, Climate Science, Hydrology. Personal; Landscape ecology, GIS, Climate adaption, Geo-ecology, Agroforesty.
Expectations: Establishing a link between CoP in Focus and Sustland. Introduce the idea of sustainable land use concepts to MFC's. Learn more about MFC's and participating regions. Establish "land use" as a key topic in Climate KIC. Connect food security + energy supply.

Name: Arturo Castillo (UK).
Institute/university: Imperial College London (ICL).
Expertise: Biological & Thermal waste-to-energy and materials, Bioenergy chains, Renewable energy policy.
Expectations: To understand how our case study can be harmonised with the other two. What criteria should be fulfilled. What to do if limited data from industrial partner. Explore even more collaboration.

Name: Nicole Kalas (UK).
Institute/university: Imperial College London (ICL).
Expertise: Bioenergy and bio-renewables research, LCA and techno-economic analysis. Bio-economy. Integration of food, energy and biomaterials supply chains. Case study Sainsbury's – established partnership between ICL and SSL.
Expectations: Develop conceptual understanding of MFC implementation at regional level – challenges, opportunities. Learn from each other's experiences. Understand content and format requirements of position paper. Integration / cross-over of ADMIT Bio-renewables – collaborative approach.

Name: Remco Kranendonk (Nl).
Institute/university: Alterra – Wageningen University and Research centre.
Expertise: Researcher regional development, account manager. Partner in Dutch regional food clusters, Bio-Based Clusters. Public administration and steering strategies / innovation. Community of Practice.
Expectations; Forming an Community of Practice at EU level. Helpful in concept development and case development MFC.

Name: Madeleine van Mansfeld (Nl).
Institute/university: Alterra – Wageningen University and Research centre.
Expertise: Landscape ecology, Metropolitan Food clusters, Process management "wicked problems". Studied landscape ecology, now MFC, process management.
Expectations: Cooperation on theme MFC based on key knowledge participants. Growing EU community on sustainable development with new forms of agriculture.

Name: Mátyás Cserháti (Hun).
Institute/university: Gödölő - Szent István University (SZIE), Department of Environmental Protection and Environmental Safety.
Expertise: Ecological Farming, Environmental microbiology, Mycotoxic cases.

Expectations: Some ideas about good farming practicing in arid regions.

Name: Atilla Gurabi (Hun).
Institute/university: freelance consultant.

Name: Jolanda Dirksen (Nl).
Institute/university: Alterra – Wageningen University and Research centre.
Expertise: Landscape ecology, planning and organizing, finance and administration.
Expectation: Getting to know each other and working together.

Name: Alwin Gerritsen (Nl).
Institute/university: Alterra – Wageningen University and Research centre.
Expertise: Governance & regional development, knowledge & innovation, green growth.
Expectations: Getting to know the projects, the cases and the persons involved. Needed for Friday and Saturday session and for CBP Bag case.

Name: Katalin Posta (Hun).
Institute/university: Gödölő - Szent István University (SZIE), Faculty of Agricultural and Environmental Sciences.
Expertise: developing agricultural technology □ improved quality of life □ evaluating nutrition (production of healthy food). Management of climate change.
Expectations: Sorry, I'm not well informed about the activities of this project. But our faculty would like to take part in that. Making good partnership and to be well informed.

Annex 2 2 CoP network

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Alterra Wageningen UR is the research institute for our green living environment. We offer a combination of practical and scientific research in a multitude of disciplines related to the green world around us and the sustainable use of our living environment, such as flora and fauna, soil, water, the environment, geo-information and remote sensing, landscape and spatial planning, man and society.

The mission of Wageningen UR (University & Research centre) is 'To explore the potential of nature to improve the quality of life'. Within Wageningen UR, nine specialised research institutes of the DLO Foundation have joined forces with Wageningen University to help answer the most important questions in the domain of healthy food and living environment. With approximately 30 locations, 6,000 members of staff and 9,000 students, Wageningen UR is one of the leading organisations in its domain worldwide. The integral approach to problems and the cooperation between the various disciplines are at the heart of the unique Wageningen Approach.

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

Alterra Wageningen UR
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Alterra Wageningen UR is the research institute for our green living environment. We offer a combination of practical and scientific research in a multitude of disciplines related to the green world around us and the sustainable use of our living environment, such as flora and fauna, soil, water, the environment, geo-information and remote sensing, landscape and spatial planning, man and society.

The mission of Wageningen UR (University & Research centre) is 'To explore the potential of nature to improve the quality of life'. Within Wageningen UR, nine specialised research institutes of the DLO Foundation have joined forces with Wageningen University to help answer the most important questions in the domain of healthy food and living environment. With approximately 30 locations, 6,000 members of staff and 9,000 students, Wageningen UR is one of the leading organisations in its domain worldwide. The integral approach to problems and the cooperation between the various disciplines are at the heart of the unique Wageningen Approach.