The Food Papers

Circular Food Systems

For sustainable and healthy diets

Agri Pro Focus

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Circular agriculture: an opportunity for food security

ANALYSIS
At what scale should we close the loop?

SUCCESS STORIES
Circular frontrunners

This is the first edition of 'The Food Papers', a series of magazines highlighting inspiring solutions for current relevant food and nutrition security issues. The magazines are driven by a desire to connect people and knowledge, to promote space for experimenting and learning, and provide visibility for promising ideas and effective practices. The Food Papers thus support the mission of the Netherlands Food Partnership which is to accelerate innovative approaches to sustainable food systems and healthy diets for all.

COLOPHON

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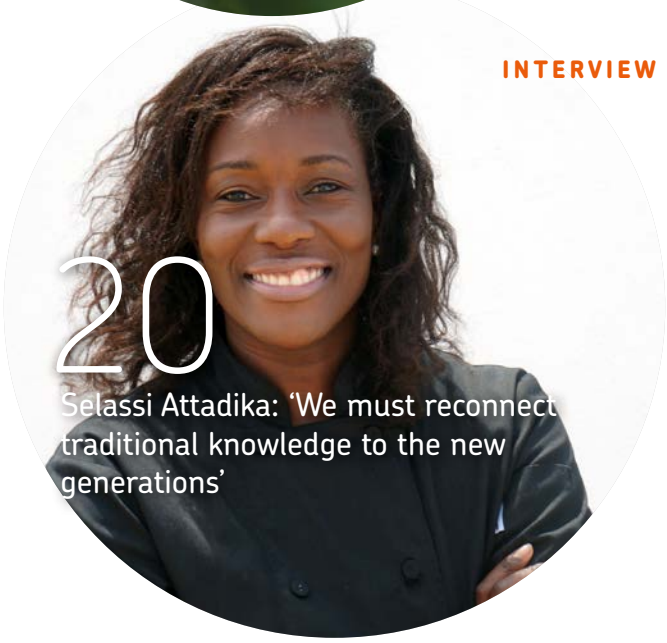


INTRODUCTION

Circular agriculture is in the limelight. The Dutch government, leading agricultural experts and businesses share the opinion that a transition towards circular agriculture is an opportunity to establish an economically, socially and environmentally sustainable food system.

We are at the start of a new exploration. Whereas the vision and goals for circular agriculture are clear, the practical implications and opportunities still need to be worked out for both the Dutch and the international context. Various agribusiness professionals have initiated research and pilot projects for circular concepts, some of which have been further developed into successful business models.

They can build on extensive worldwide knowledge and experience about enhancing the sustainability of food systems. Farmers in various parts of the world have been working with circular production systems for ages, while members of AgriProFocus and other agribusiness professionals have developed solutions to enhance the climate resilience of agriculture, diminish post harvest losses and improve soil fertility. Their combined knowledge will help agribusiness professionals to develop agribusiness models that contribute to circular food systems, comprising all the processes related to food production, consumption and residue streams.

This magazine explores circular agriculture solutions that can contribute to the second Sustainable Development Goal (SDG-2). We will showcase circular models for resource and food streams at different scales and highlight the successes and challenges of circular frontrunners. We hope that the examples we present will serve as an inspiration for agri-professionals and organisations seeking to apply circular agriculture principles. Sharing experiences and insights in this promising domain fits with the ambition to establish a Netherlands Food Partnership, bringing together stakeholders from the Dutch Diamond to boost transformative approaches for sustainable food systems and healthy diets.

'The way in which we produce our food is shifting ever more out of balance. We are taking more than the planet can give, and this is not sustainable.' With these words, Carola Schouten, the Dutch Minister of Agriculture, Nature and Food Quality, calls for a transition to circular agriculture. This article highlights the objectives and principles of this concept and explores how circular business models could contribute to achieving global food security.

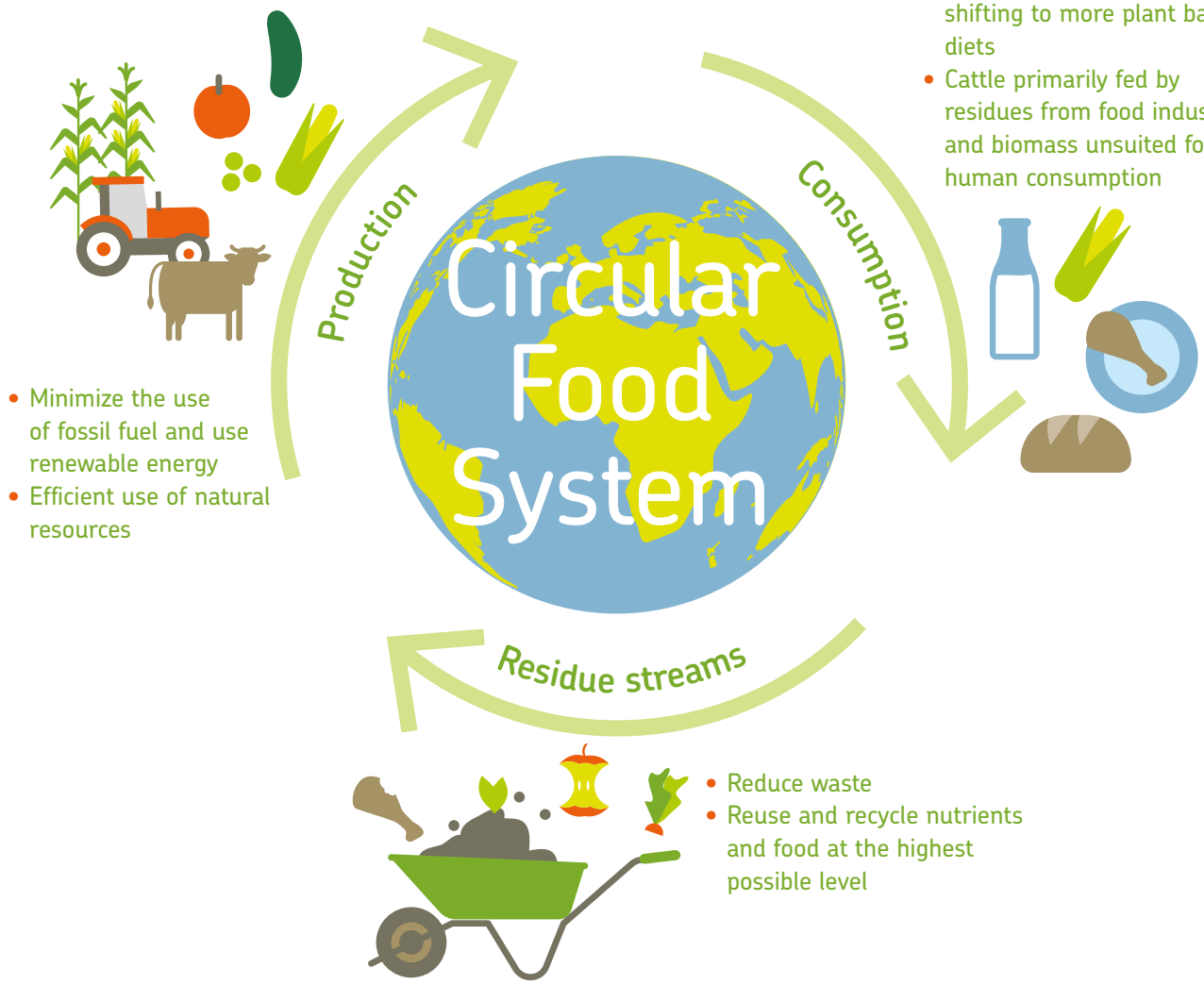
Circular agriculture: an opportunity for food security

The problems of our current food system

Globally, the number of people suffering from chronic hunger and malnutrition is on the rise again after a few years of decline. At the same time, 25 to 30% of the food produced globally is lost or wasted. According to the Food and Agriculture Organisation (FAO), food production has to increase by 50% to feed the growing population. Within the current production system this can only be achieved by exploiting significantly more land and other natural resources.

The global food system has an enormous environmental impact. A recent report by the Intergovernmental Panel on Climate Change (IPCC) has calculated the impact of agriculture, livestock and other forms of land use on climate change. The report concludes that current production systems pose a serious threat to food security. Agriculture is responsible for about a quarter of all greenhouse gases released by human activity. It is the dominant cause of deforestation and loss of biodiversity, uses about 70% of freshwater resources and takes up 40% of the world's ice and desert-free land. Farmers in Low and Middle Income Countries (LMICs) experience the impact of climate change and resource scarcity every day, exploring how to adapt their businesses to the changing circumstances.

PHOTO: DAVIDE BONALDO | ADOBE STOCK



Scientists, policy makers, businesses, civil society organizations and consumers have come to realise that the time to reconsider the current economic model is now. It is time to start exploring ways to build a production system where the social and ecological costs of production are fully integrated.

The objectives and principles of circular food systems

The growing popularity of the circular agriculture concept has led to the emergence of many different definitions and frameworks of principles. These definitions vary widely, depending on the problems being addressed, the audience, or the lens through which the author views the world. Food & Business Knowledge Platform has made an inventory of the ideas and concepts on circular agriculture worldwide, and found the following key elements:

In general the concept of circularity stands in contrast to the linear economic model of 'take-produce-consume-discard' and instead works towards closing the loops in the food system, linking production, consumption and residue streams in order to prevent the loss of natural resources as much as possible. Loops of nutrients and food should be closed at the lowest possible level, and the use of fossil fuels, finite natural resources and artificial fertilizers should be minimized. The main elements of the system are summarized in the infographic.

It is believed that the principles of circular agriculture could help to increase resource and business efficiency, improve ecosystem resilience, preserve biodiversity and reduce emissions of greenhouse gasses. Furthermore, it could contribute to SDG 2 of the United Nation's Sustainable Development Goals, by offering new and better solutions to achieve sustainable agriculture and food security.

The social, economic and environmental aspects of a circular food system

To make a successful transition towards circular agriculture, the social, economic and environmental aspects of the food system should all be considered. Achieving the SDGs calls for a system-wide approach, concludes Wageningen researcher Siemen van Berkum in his report 'Transition to sustainable food systems: the Dutch circular approach providing solutions to global challenges.' 'The food system approach comprises all the processes related to food production, usage and consumption; from growing and harvesting to transportation and waste disposal,' he explains. 'It highlights the importance of the socio-economic context, and helps to clarify the trade-offs between intervention strategies and system outcomes in all three sustainability dimensions.'

THE TIME TO RECONSIDER THE CURRENT ECONOMIC MODEL IS NOW

PHOTO: DAVIDE BONALDO | DREAMSTIME.COM

THE PRINCIPLES OF CIRCULAR AGRICULTURE COULD HELP TO PRESERVE ECOSYSTEM RESILIENCE AND REDUCE THE POTENTIAL IMPACT OF NATURAL DISASTERS AND CLIMATE CHANGE

The vision of the Ministry of Agriculture on circular agriculture is laid out in the document entitled 'Valuable and connected' (a summary can be found on page 8). In it, the Ministry acknowledges the presence of opportunities for business to earn a good income as one of the key requirements to successfully apply circular agriculture. Entrepreneurs currently taking on circular business practices are often unable to even cover the cost of their efforts.

The agricultural cooperative Agrifirm is investing in developing business models for circular agriculture, focusing on healthy soils, the use of circular fertilizers and the valorisation of foodstuffs. 'Using circular materials is currently more expensive than producing according to conventional methods,' says Ruud Tijssens, Director Public and Cooperative affairs. 'Although new concepts are under development, the general business case for circular agriculture is still weak.' Willem Lageweg, founder of the Transitiecoalitie Voedsel, adds that existing circular business models are mainly successful in high end niche markets. He mentions the vegetarian meat substitutes producer De Vegetarische Slager and the quality seedlings breeder Koppert Cress as examples of companies that are on the right track to developing circular business models. 'However, we should start to define the success of circular business models more broadly, as current production methods will lead to loss of productivity and higher costs in the long term.'

Circular solutions for food security

The vision of the Ministry of Agriculture and most of the research into the opportunities for circular production and business models strongly focus on the Western European context, whereas the challenges in LMICs are often very different. According to professor Martin van Ittersum, co-author of the vision paper 'Circularity in agricultural production', the concept of circular agriculture primarily deals with problems related to a system based on highly intensive and efficient production and large concentrations of residue streams such as manure or beet leaves, typical of Western Europe.

In some ways, food systems in LMICs are more circular, with smallholders often applying mixed farming systems and using resources efficiently. Yet these systems are often low in productivity and soils are degrading due to unsustainable farming practices. Together, these factors have a negative impact on food security 'We should first focus on sustainably intensifying production on the current agricultural area,' Van Ittersum points out. 'But in the required intensification of African agriculture, principles of circularity should not be forgotten. They can help to minimize environmental impacts of extra food.' Lageweg adds: 'The principles of circular agriculture could help to preserve ecosystem resilience and reduce the potential impact of natural disasters and climate change, contributing to food security in the long term.'

Apart from increasing agricultural production, there is a world to win in reducing food losses across the value chain due to technological problems, such as poor harvesting procedures, sub-standard storing conditions and inefficient transportation. '40% of the food produced in Sub-Saharan Africa is lost in the value chain, that's more than all humanitarian food aid put together', says former World Food Program director Ertharin Cousin. 'By developing new techniques to reduce post-harvest losses we could almost double the amount of food available for the African continent.'

Van Berkum believes that the circular food systems approach could also offer solutions for LMICs. 'The local manifestations of global challenges might be different, but the model works the same', he explains. 'As long as an intervention takes into account the environmental, economic and social aspects, it could offer a sustainable solution.' He mentions the example of a compost plant in Ghana, which was successfully developed and brought multiple benefits, including new jobs, a cleaner environment, less dependence on imported food and chemical fertilisers – and better human health thanks in part to more nutritious diets. More information about circular solutions contributing to food security can be found in the case studies described in this magazine.

The role of the Netherlands

The Netherlands has taken a first step in developing a new vision on circular food systems, but a lot of work remains to be done in order to translate vision into concrete policies. There is as yet no clear strategy towards applying circular agriculture with international partners. The Ministry of Agriculture maintains its ambition to 'keep our prominent place in the innovation of production methods and be an example to other countries.' The experts interviewed agree that Dutch technology and knowledge could be of use for LMICs when they develop more sustainable agricultural sectors in line with SDG 2. They also mention specific solutions, such as the application of cold chain technology to reduce food losses, sharing knowledge on integrated soil management and processing human food residues into animal feed, solutions for water scarcity, salination and manure surplus. But this is not just one-way traffic. 'Producers in the Netherlands could learn from cattle feeding practices in many LMICs', Van Ittersum points out. 'Chicken and pigs eat food residues from households and ruminants graze on the roadside.'

The experts suggest several policy steps to facilitate the transition towards more circular food systems worldwide. To remove important barriers, EU regulations on food waste and fertilizer use and the Common Agricultural Policy should be reconsidered. In the broader international context, The Netherlands should discuss the implications of a transition to circular food systems for international trade and develop a joint vision on the opportunities such a transition will bring, using international platforms like the World Trade Organization. Furthermore, the government should facilitate a national dialogue about true cost accounting and start to include the 'hidden' costs in taxes. The ministry should also modernise institutions and practices like the Topsectoren (key business sectors that have the Ministry's special attention) and trade missions, by including innovative SMEs and facilitating dialogue with frontrunners from LMICs. Finally, several experts have suggested that the government should develop policies to increase consumer demand for sustainable and nutritious food, by addressing the retail and food service industry and insisting on sustainable procurement policies.

PHOTO: OSKARI HEIMONEN / ALAMY STOCK PHOTO

THE NETHERLANDS SHOULD DISCUSS THE IMPLICATIONS OF A TRANSITION TO CIRCULAR FOOD SYSTEMS FOR INTERNATIONAL TRADE

The Dutch ambition for circular agriculture

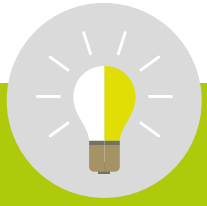
In 2018, the Ministry of Agriculture, Nature and Food Quality presented the vision paper 'Agriculture, nature and food: valuable and connected. The Netherlands as a leader in circular agriculture'. The vision paper gives a broad overview of the ambitions. In 2019, the Ministry outlined the plan to realise its ambitions. It describes the meaning of circular agriculture in practice, the necessary conditions for its application, the opportunities it brings and the proposed policy changes for the short, middle and long term.

The documents are intended to provide guidance for a collective exploration of the opportunities to develop an economically and ecologically vital food system. In the transition towards circular agriculture, farmers, growers and fishermen are uniquely placed to play a leading role in bringing about the necessary changes, whereas they have to shift to new business models. The responsibility for the transition, however, must be shared, not only by all actors in the supply chain but also the government and consumers.
The vision for circular agriculture states that: 'Instead of constantly reducing the cost of products, we need to focus on constantly reducing the use of raw materials through a more efficient use within cycles.' Consequently, the government's goal is for cycles of raw materials and resources to be closed at the lowest possible level, either nationally or internationally by 2030.

The Ministry of Agriculture focusses on the creation of the right conditions in the Netherlands. It is aware that a lot of work needs to be done to arrive at that point. Rules and regulations need to be amended to take away barriers. The Taskforce 'Verdienvermogen' (Capacity to Earn) was set up, to explore possible business cases for circular agriculture. The Ministry has made early policy changes in various sectors, with an agreement for circular horticulture, a national programme for agricultural soils and plans for a more sustainable livestock sector. The Dutch government is also exploring the use of the concept circular agriculture with European and other international partners.

To make the transition towards circular agriculture, the following conditions should be in place:

Create the ability for farmers and fishermen to earn a good income from circular production and to innovate and invest in development



Focus efforts in knowledge and innovation towards realising circular agriculture

Maintain the Netherlands' prominent place in the innovation of production methods and be an example for other countries

Develop strong links between agriculture and nature, where agriculture benefits from nature and farmers are responsible for the quality of nature

Decrease the distance between producer and consumer, which should lead to a reduction in food waste and an increase in consumer appreciation of food

Develop rules and regulations to stimulate the transition towards circular agriculture and create spaces to experiment

ANALYSIS

At what scale should we close the loop?

Circular agriculture in practice

While the objectives and principles of a circular food system are quite clear, the challenge is to realise these in different contexts and at multiple scales. There are key questions related to developing circular food systems that arise from this premise. They include: at what scale should we close the resource loops and what do circular solutions look like in practice?

Circular agriculture aims to close the resource loops at the lowest possible level, but with the rise of global value chains our food system has become incredibly complex. Today, food and nutrients travel across farms, regions and borders with limited return flows or none at all. This results in nutrient accumulation in cities and more developed countries, while agricultural land in many low and medium income countries (LMICs) is increasingly depleted.

In order to transition to more circular food systems, we need a multifaceted approach. We will have to rethink supply chains, markets, and policies. It will involve many different solutions, including simple ones like composting, but also more complex circular systems, such as aquaponics. Moreover, the transition will require entrepreneurship and new collaborations among farmers, producers, food brands, retailers, waste managers, governments and even actors outside the food system.

In this section we will showcase circular initiatives of resource looping: on a farm, at the regional level and on an international scale. First, we introduce aquaponics, a textbook example of a circular farming model. We will discuss its application in LMICs and potential impact on local food security. Second, we show how organic waste and by-products from the city can be converted into an array of valuable products and how these products can help regenerate agricultural land in the city surroundings. Third, we examine the question whether resource loops can and should be closed at the international level. We take one example of organic fertilizer produced from Dutch organic waste and traded around the world, to show how spatial nutrient surpluses and deficits can be balanced.

read our cases

PHOTO: © PXHERE.COM

Aquaponics: a circular solution to food security and malnutrition

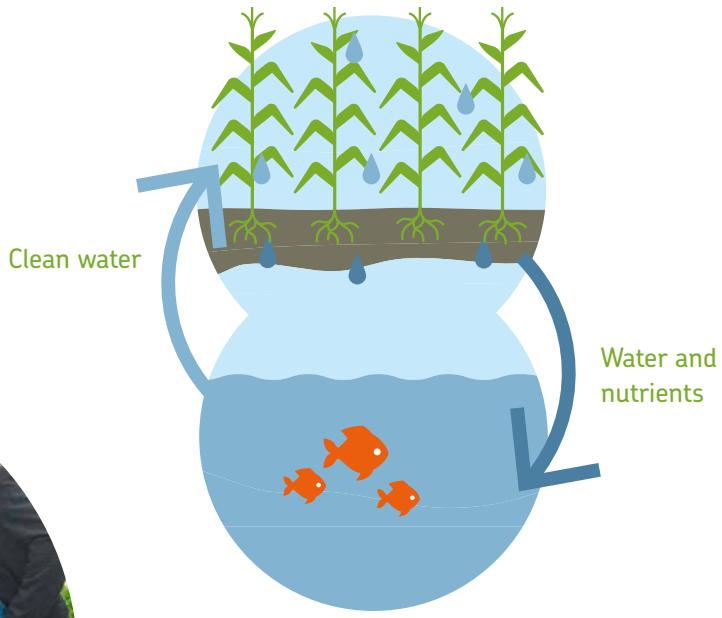
Examples of circular models on farm level

How to feed a growing population, given the diminishing availability of key resources like fresh water and arable land? And how does one provide fresh food to an increasing urban population? To address these questions, agricultural innovators are turning to aquaponics. This is a food production method that involves growing healthy food using limited resources in a fully circular system. To elaborate, an aquaponics system is a combination of hydroponics and aquaculture. Hydroponics means growing plants without soil and aquaculture involves fish farming in a controlled environment. Resource loops are closed as the plants are fed the nutrients-rich wastewater left by the fish, while in return the plants clean the water for the fish.

This innovative closed loop system has various advantages. In terms of farming environments for plants and fish, almost anything goes. Think, for instance, of degraded land, or old buildings in dense urban areas. Because nutrients and water circulate in a closed circuit, the system is highly resource efficient and pests are kept to a minimum as the environment is controlled. Notwithstanding the benefits, some would argue that aquaponics is too expensive and too complicated to operate in LMICs. Projects developed by TGS Business & Developments Initiatives, a consulting firm in Wageningen, give us more insight in the applicability and key success factors of aquaponics in LMICs.

Under the Food & Business Global Challenge Programme, TGS piloted two aquaponics projects in Ethiopia in collaboration with Addis Ababa University, Wageningen University, and the CSO Great Commission Ministry. With a scarcity of arable land and water, Ethiopia would appear to be a suitable location to deploy aquaponics with the goal to improve food and nutrition security.
To test multiple variables, two different sites with

Closing the loop on the farm



BECAUSE NUTRIENTS AND WATER CIRCULATE IN A CLOSED CIRCUIT, THE SYSTEM IS HIGHLY RESOURCE EFFICIENT AND PESTS ARE KEPT TO A MINIMUM AS THE ENVIRONMENT IS CONTROLLED

different target groups were chosen. One project was situated in Shewa Robit and was conducted with female entrepreneurs; the other was located in Hawassa and featured poor entrepreneurial families. In Shewa Robit market conditions seem to have been favourable. There was local knowledge of vegetable farming and a limited availability of fresh vegetables and fish. Conversely, in Hawassa fish was abundantly available, as it is located close to a lake. Here, the project experienced a lack of agronomic knowledge. Location, the choice of entrepreneurs, and the availability of agronomic knowledge were important factors for success. One of the main challenges of the project was the initial €600-700 outlay for the aquaponics system, which rendered it unaffordable for the average Ethiopian household. For local entrepreneurs it seems sometimes one step too far to start producing fish and vegetables at once. Looking back, TGS now says it would have started with a more simple and affordable hydroponics system.

In fact, this was how it was done in a project for food insecure families in Bethlehem, Palestine. Together with the NGO Caritas, TGS developed small-scale hydroponics, producing vegetables for home consumption and selling the surplus at a local market. Because purchase and monthly input costs were less than €50, this model proved to be successful at rooftops and courtyards. Based on this experience, TGS hopes to provide hydroponics systems to refugee families in the Middle East.

Another project that TGS developed was an aquaponics system on a larger scale in Kenya. At the Kikaboni farm they started out with hydroponics and later expanded to using a multi-loop aquaponics technique, in which the nutrients for the fish and plants were managed separately. This meant that they did not have to compromise on what fish and plants preferred. Balancing nutrients in a regular closed loop system, can still be challenging. They also found that a larger scale aquaponics allows for system optimisation and efficiency. Based on his experiences with aquaponics in various settings, Bouke Kappers, Partner at TGS, sees a few key success factors. “Start with hydroponics or aquaculture, based on local demand and availability of inputs, and then expand the system to become fully circular. One of the most important things to do before you invest in an aquaponics system, is to research the local soil, water, and economic conditions, so you can adapt your system to the local context.”
With land degradation and rapid urbanisation continuing in LMICs, hydroponics and aquaponics are interesting innovations to be utilized by small and large scale farmers. Today, aquaponics might still be rather expensive, but innovation is likely to make it cheaper.

Closing the loop using urban waste as a resource

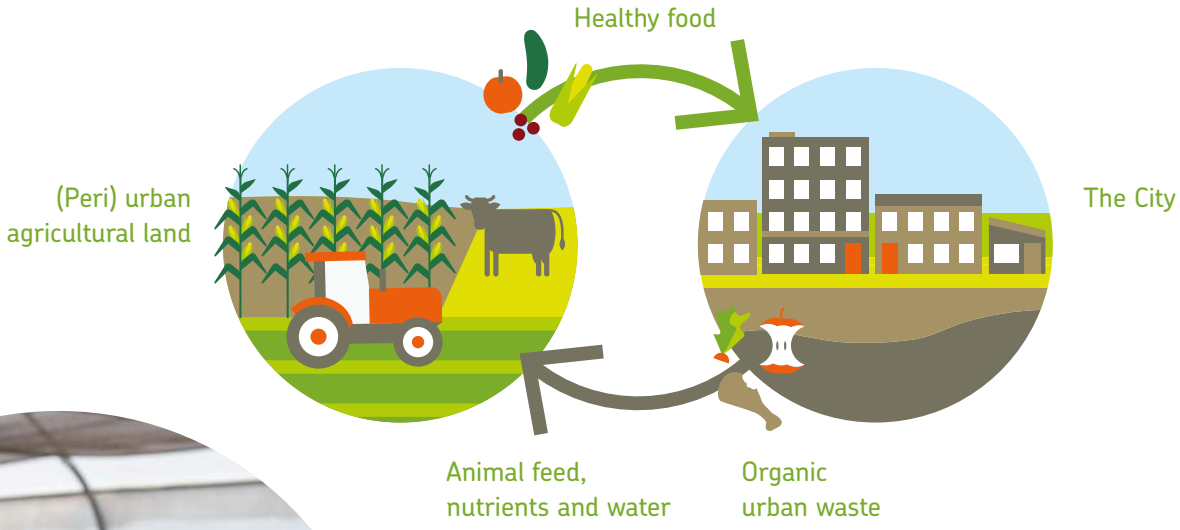
Examples of circular models at regional level

With rapid urbanization across many LMICs, cities face challenges to make sufficient food available and manage the related waste flows. Faeces and urine end up in pits or are flushed away and food waste rots in landfills. This creates pollution and public health issues, but also transforms cities into vast nutrient sinks. Meanwhile, production areas are becoming increasingly nutrient deficient, putting future food supplies at risk. Cities can play a key role in developing more circular food systems that address the interconnected issues of sanitation, pollution, soil nutrient deficiency, and food insecurity.

Various players are developing circular approaches that aim to close the food and nutrient loop by recycling nutrients from food waste and animal and human excreta. One of these examples is Safi Sana in Ghana. Founded in 2010 by Aart van den Beukel, Safi Sana designs, constructs and operates circular waste-to-resource factories for urban slums. With the support of partners like Aqua for All, the Dutch Ministry of Foreign Affairs, the African Development Bank and a group of Dutch and foreign investors, it has successfully constructed its first commercial factor in the town of Ashaiman. Safi Sana collects organic and faecal waste from urban slums and waste from local industrial players, like slaughterhouses. The factory, which uses an anaerobic digestion technology, can treat 40 tonnes of waste per day and generates biogas to produce electricity for the national grid, organic fertilizer and irrigation water (in a pilot phase). The irrigation water and part of the organic fertilizer are used to grow seedlings. With these different revenue streams, Safi Sana can sustain its business and serve 125,000 people with better sanitation and waste collection services, while contributing to local energy and food security.

PHOTOS: © SAFI SANA

Closing the loop at regional level



One advantage of Safi Sana's model is that it is a relatively low cost solution to waste management. Another is that they use replicable technology. Traditional wastewater treatment plants are complex to operate, energy inefficient and too expensive for cities in LMICs. But making Safi Sana's business economically viable has not been without its challenges. Van Beukelen says: "the local government is not supporting the waste collection financially, only our industrial waste suppliers pay for the removal." Sales of their fertilizers have been unpredictable, because demand is variable and moves in tandem with the growing seasons. Besides, distribution networks for fertilizers are poor and farmers have little knowledge of the benefits of organic fertilizers or do not know how to use them effectively. To make their business model more resilient and increase their impact on local food security, Safi Sana is investigating how to fully utilize its irrigation water to benefit nearby farmland and how they can reach more farmers with their organic fertilizer brand 'Asase Gyefo'.

Another notable company that is in the business of converting urban waste to valuable products, is Biobuu in Tanzania's largest city, Dar es Salam. They use the larvae of black soldier flies to eat organic waste. Once they have been dried, the larvae are then used as protein-rich chicken and fish feed, as well as organic compost. One of the environmental benefits of this circular solution, next to solving the waste issue, is that the produced protein can replace protein from soy or fish meal, which has a much higher environmental footprint. Mathew Hayden, CEO of Biobuu, says: 'Larvae enjoy warm environments and our operation is labour intensive. Therefore, this model is perfect for Africa.'

While scouting for new locations to expand their businesses, Van den Beukel and Hayden take away important lessons from their first endeavours. Government support for waste collection is key to make the business case solid. You also need to locate your business where the demand for your products is and allow for flexibility in your model to respond to changes in local market conditions.

CITIES CAN PLAY A KEY ROLE IN DEVELOPING MORE CIRCULAR FOOD SYSTEMS THAT ADDRESS THE INTERCONNECTED ISSUES OF SANITATION, POLLUTION, SOIL NUTRIENT DEFICIENCY, AND FOOD INSECURITY

Cycling nutrients across borders for fertile soils

Examples of a circular model at an international level

The degradation of farmland across the globe has accelerated over the past decade, exacerbating food shortages and destabilizing economies and societies. We need healthy soils to produce nutritious crops for a growing population, protect biodiversity, retain water and mitigate global warming by sequestering carbon. With usage of regenerative practices and close resource cycles, circular agriculture might provide a viable approach to prevent the loss of more arable land and restore degraded land. However, circular agriculture systems are usually discussed at local and regional levels while our food system is becoming increasingly global. For many people it is unthinkable to start the day without coffee and to miss out on a banana or nuts to snack. Food continues to travel across borders with little – if any - return flows, making it challenging to close nutrient loops at a local or regional level.

To illustrate, soy, for instance, is imported from South America to feed livestock in the Netherlands. The output, animal manure, food waste, and human excreta all stay in the Netherlands, leading to high levels of methane, phosphate and nitrogen that pollute the environment. At the same time, low soil fertility is a problem that affects large parts of South America, due to nutrient deficiencies. Recovering the surplus of nutrients from the Netherlands and returning those to nutrient deficient areas in the world, would be one way to develop a more circular food system.

With the production of organic fertilizer, Ferm O Feed, is selling surplus nutrients from the Netherlands around the world. The company is part of the Den Ouden Group and produces about 60,000 tonnes of organic fertilizer from animal and vegetable waste and by-products per year. About 95% of its products are exported to more than 65 countries, including many low and middle income countries (LMICs) in Asia, Africa, and South America. The advantage of organic fertilizers, compared to synthetics, is that they add nutrients, micro-nutrients and organic matter simultaneously. This is very relevant for many smallholders in LMICs, where fields are low in micronutrients and soil organic matter. The latter is critical to enhance the structure and moisture content of the soil.

Closing the loop internationally

WITH THE PRODUCTION OF ORGANIC FERTILIZER, FERM O FEED, IS SELLING SURPLUS NUTRIENTS FROM THE NETHERLANDS AROUND THE WORLD

Some disadvantages of organic fertilizers are that the composition can be highly variable and that they have a low nitrogen to phosphorus ratio. Both can result in a mismatch with regard to the specific requirements of a crop. Ferm O Feed has overcome this challenge by sourcing its input from 20 selected Dutch farmers that are strictly monitored for hygiene, quality and continuity. The company also develops fertilizers with different nutrient ratios, optimised for a large variety of crops, like tomatoes, potatoes, apples, pears, and bananas.

Arguably, Ferm O Feed's products are more complete than standard synthetic nitrogen, phosphorus, and potassium (NPK) fertilizers and this translates into a slightly higher price per kilogram. But farmers do not always have knowledge about this added value. In response, the company has started to provide training about the usage and effects of its products to distributors, extension officers and larger farmers.

One question remains: why not build a production plant close to where their fertilizers are most needed? Peace Quadt, Sales Manager at Ferm O Feed, responds that they have an open mind about these ideas. However, the company is part of the Den Ouden Groep, a Family owned business with its roots in the Netherlands. Also, the production process – and the business viability of the company – require huge amounts of high quality organic waste streams on a continuous basis. In that sense, Helmond is a perfect location for Ferm O Feed, with many professional poultry and livestock farmers around the corner. Other requirements for the factory are infrastructure for transportation, a proper storage facility and a well-enforced health and safety regulation system.

The Ferm O Feed's approach can be part of the efforts to make our food systems more circular at an international level. By improving soil health, their products can make an important contribution to food security. It should be noted, though, that many agricultural experts emphasise that closing resource loops at a local and regional level and that these should be prioritized. The optimal scale at which nutrients should be recycled remains context-specific.

CIRCULAR AGRICULTURE SYSTEMS ARE USUALLY DISCUSSED AT LOCAL AND REGIONAL LEVELS WHILE OUR FOOD SYSTEM IS BECOMING INCREASINGLY GLOBAL

Interview Emma Chow (Ellen MacArthur Foundation)

The Ellen MacArthur Foundation works with business, government and academia to build a framework for an economy that is restorative and regenerative by design. Emma Chow is the Project Lead of the Foundation's Food initiative.

Redesign the act of eating to have a positive impact

How did the *Cities and Circular Economy for Food Initiative* come about?
"The *Food Initiative* was launched in May 2019. It is rooted in the preceding *Cities and Circular Economy for Food* report that was presented at the World Economic Forum in Davos in January 2019. With this initiative, we aim to bring together key actors to stimulate a global shift towards a regenerative food system based on the principles of a circular economy."

Why the specific focus on cities?
"Cities have a unique aspect in that they are major destinations for a lot of our commodities. In 2050, 80% of all our food will be consumed in cities. So if organised well, the huge demand power that is present in the cities can be leveraged to support a more sustainable food system."

"Since May 2019 we have connected London, São Paulo and New York as flagship cities to the initiative, and more than twenty others as participant cities. Our role is to uncover opportunities for these cities, to target action and bring the private and public sector together to design scalable solutions"

What lesson would you share with others who are working towards a more sustainable food system?
"I would ask everyone in any organization to periodically step out of the silo that they're in and to understand their connection to the system. Food is so interconnected throughout industries, no solution can come from one silo. The nature of the problem demands a systemic approach."

"Specifically on the topic of circular food systems: I think it's important that we do not limit the conversation solely to recycling and food waste. This is about shifting to a new system, recognising that we need to grow food in a way that regenerates nature, where waste is designed out altogether. In nature, when an apple falls from the tree it does not become waste, instead, its nutrients and organic material are input back into the soil. We need to find ways to produce food that work within the natural system and can thrive long-term."

"IN NATURE, WHEN AN APPLE FALLS FROM THE TREE IT DOES NOT BECOME WASTE, INSTEAD, ITS NUTRIENTS AND ORGANIC MATERIAL ARE INPUT BACK INTO THE SOIL. WE NEED TO FIND WAYS TO PRODUCE FOOD THAT WORK WITHIN THE NATURAL SYSTEM AND CAN THRIVE LONG-TERM."

PHOTO: RAKSIT | DREAMSTIME.COM

Circular frontrunners

To successfully contribute to global challenges like food and nutrition security, circular agriculture solutions should be economically, socially and environmentally sustainable. This section highlights four inspiring examples that show how smallholders' incomes and livelihoods can be improved while simultaneously moving towards more circular food systems. The focus is on efficient use of natural resources and the re-use and recycling of nutrients and food.

Sauce With a Cause

The Ketchup Project

Over 40% of Kenyan tomatoes are wasted after harvest, due in no small part to the volatility of the market. The price smallholder farmers get for their produce often does not even cover their transportation costs and this leads to large unused surpluses.

Together with farmers in the Kenyan village of Kambu, two Dutch entrepreneurs (Sjoerd Dijkstra and Thomas Sykora) came up with a plan to dry the surplus tomatoes and produce ketchup for the European market. This would result in far less wastage of tomatoes, a better income for the farmers and reduced reliance on the whims of the local market. This plan became The Ketchup Project.

How does it work? The farmers take their tomatoes, which they grow in a cooperative to a newly built drying hub, where they are processed. The dryer works on biomass, mostly agricultural waste such as mango seeds and sisal waste. The dried tomatoes are then ground into a paste and transported to the Netherlands. Herbs, unrefined cane sugar and vinegar are consequently added and the ketchup is bottled and sold online. It is also available in several selected shops and restaurants in the Netherlands.

The price the farmers now get for their produce is consistently higher than the average price on the open market, while the farmers' cooperative keeps a small margin on the tomatoes; this is to save money for new investments in the project and the community (notably education and electricity).

Currently, 18 people are working in the drying hub, a number that is set to double this year. More than one hundred farmers are part of the cooperative; increases are also expected here. The Ketchup Project is exploring collaboration with farmers throughout East Africa. Meanwhile, the hub has started to dry and process mangoes, in addition to tomatoes.

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The Feed Calculator App

Single Spark

This case shows how a simple app can help farmers source animal feed more efficiently with ingredients that are locally available. This is an example of an intervention that creates smaller resource loops in livestock production.

Millions of livestock farmers all over the world have a hard time making a profit. One of their biggest challenges is getting affordable quality feed. According to the FAO, up to 70% of their total farm cost is spent on feeding their animals. It was here that the two founders of Single Spark, Peter Meijer and Sam van Veluw, saw an opportunity to collaborate with farmers across the world in their endeavours towards achieving greater self-reliance and earning better incomes.

Composing the right formula for animal feed needs a lot of knowledge. Nevertheless, reduced to its most basic form, this knowledge is mainly formulas and data. Working with leading Dutch animal nutritionists, software developers and farmers in LMICs, Single Spark developed a Feed Calculator App. It was launched in 2017 and for the first time enabled farmers in low and middle income countries to put together their own tailor-made feed recipes, using locally sourced ingredients.

To test the app, Single Spark carried out a pilot study in Tanzania, Rwanda and Malawi. 22 broiler farmers fed two equal-sized groups of birds simultaneously, the total number of birds involved was 5,000. One group was fed with regular commercial feed; the other group was fed with Feed Calculator feed. The results were impressive: on average the broiler farmers lowered their feed cost by 30% and increased bird weight by 15% at sale point. In all, this resulted in an 80% profit increase.

It works like this: after downloading the app, the farmer selects which animals to feed, then selects all locally available ingredients and the corresponding prices. The app then calculates the most optimised formula.

The app can be downloaded for free. Usage is also free for all smallholder farmers with a maximum of 1.000 birds or 10 pigs. Beyond that, the costs are €50,- per year, an investment that earns itself back within a few weeks.

Two years after its launch, 30,000 farmers from all over the world are using the app. Based on feedback gathered from participants, it is estimated that this app-based method has helped grow the farmers' income by 55%. Most users today come from Nigeria, India, Kenya, and Uganda. Single Spark aims to raise the incomes of one million farmers by 2020.

Preventing post-harvest losses in Indonesian shallot cultivation

BoP Innovation Center

Sanusi is the head of a local farmers group in Bima, Indonesia. He owns fifteen acres of land, where he cultivates shallots three times a year. One harvest takes place during the wet season and like most farmers in this area, Sanusi faces problems in preserving shallots during the wet season, when the air is humid. This is also the time that farmers find it difficult to get a good price from traders, as they struggle to get rid of moisture with their traditional means of on-field drying. This can lead up to a post-harvest loss of 70%.

Under the VegIMPACT NL program in Indonesia, twelve farmers from Bima have joined Base of the Pyramid (BoP) Innovation Center, Wageningen University & Research, Post Harvest Network and AgriProFocus to pilot innovations and best practices to reduce on-farm post-harvest losses.
This strategic partnership is designed to combine locally available technologies

and internationally recognised solutions. The focus will be on increasing the productivity of shallot – for instance by using alternative shallot production systems based on True Shallot Seed (TSS) - and on reducing losses in the post-harvest chain.

Since the beginning of 2019 three solution designs have been identified to reduce the losses: treatment with fungicides during cultivation, improved on-field drying and improved storage rooms. Further testing will take place with three main shallot varieties divided over twelve farmers in Sumbawa, while having control areas in the same plots. The first stage of the pilot has started at the end of July (planting) and last until September/October.

THE STRATEGIC PARTNERSHIP IS DESIGNED TO COMBINE LOCALLY AVAILABLE TECHNOLOGIES WITH INTERNATIONALLY RECOGNISED SOLUTIONS

Locally produced organic fertilizer

Orgaworld Asia

The proudest moments are not necessarily the big orders, says Orgaworld Asia's Managing Director Julius de Jong. He is most satisfied with his work when a Myanmar farmer calls him back to place another order, months after testing with only a one kilo sample bag of their organic fertilizer. 'We have some big ambitions as a company. Over the next few years we want to help raise farmers' incomes, improve soil health and provide local consumers with safe and healthy food. But that does not always translate to the reality of a local farmer who is just trying to get by and improve his yield a little. For that reason it is great to see them coming back to us after small scale trials.'

De Jong first visited Myanmar five years ago. He saw large amounts of organic waste and an agricultural system heavily reliant on synthetic fertilizer and pesticides, often overused leading to health risks for consumers and deprived soil depleted from organic matter and nutrients. He started working on local production of organic fertilizer through the Agile Bio-Converter technology that Orgaworld had developed. Organic waste material and manure of pigs, chickens and goats will be composted in a closed reactor, imitating the natural process but also speeding it up. This process produces high quality organic fertilizer that can compete with synthetic alternatives, especially in terms of price, yet offering more value in terms of micro nutrients, beneficial trace elements and organic matter. This last is precisely what renders it accessible to smallholder farmers.

For the past years this organic fertilizer has been produced in the Netherlands. The first steps on the Myanmar market consisted of acquainting the local farmers with the advantages of organic fertilizer. Today, a local production facility in central Myanmar is under development; production is planned to start in late 2020. The facility will run on solar power and electricity produced by processing organic waste. Excess heat, a byproduct of the Agile Bio-Converter, will be converted into cold for cold-storage to prevent post-harvest loss of locally produced agricultural products.

Orgaworld Asia is planning to build similar facilities producing organic fertilizer with the Agile Bio-Converter technology in China and Indonesia, and ultimately wants to expand the technology throughout Asia.

OVER THE NEXT FEW YEARS WE WANT TO HELP RAISE FARMERS' INCOMES, IMPROVE SOIL HEALTH AND PROVIDE LOCAL CONSUMERS WITH SAFE AND HEALTHY FOOD

Interview chef Selassie Atadika

Chef Selassie Atadika was born and raised in Ghana and the U.S., and spent over a decade working with UNICEF as an emergency specialist before returning to Ghana, where she started working as a chef in 2014. Atadika celebrates Africa's culinary heritage through Midunu – a pioneering, nomadic dining enterprise.

The chef and the shift towards a more sustainable diet

What made you want to become a chef after working as an emergency specialist with UNICEF?
"During my last years working in emergency response I was based in Senegal. That was in support of responses to the Sahelian crisis. Part of my responsibilities included creating a supply of Plumpy'nut [a peanut-based paste for the treatment of children with severe acute malnutrition]. While talking to my colleagues, understanding what Plumpy'nut is, and at the same time looking at this environment where peanuts a.k.a. groundnuts are abundant, I started to think: 'Where did this problem originate? And why are we not solving this problem locally?' That's when I first started looking at our food ways, our cultural, social, and economic practices relating to the production and consumption of food, as solutions."

In your role as a chef, how can you help people shift towards a more sustainable diet?
"Unfortunately, in urban areas in Ghana, eating local is a luxury, because it is more expensive than imported food. Also, aspirations are western, so what is local is often perceived as inferior to something foreign. The Midunu Institute is built around that question: how do we create behavioural change around local ingredients? How were those ingredients used historically, and how do they fit into current, more healthy and sustainable diets? For instance, the recent EAT-Lancet study shows us that most of West African diets are very starch heavy. So how do we get people to eat more vegetables, with meals that are still delicious, and respectful of local culture?"

What do circular food systems mean to you in this context?
"A farmer near Kumasi told me about a traditional sustainable agricultural practice called Proka, a local Twi word meaning: 'Leave it in the ground to rot, and come back.' For me that speaks to the fact that traditional ways have always been circular. When I look at traditional ways of cooking in the village, there is no waste, because all parts of food products are used. But when we bring the same food to the city, we deconstruct our foodways, and this knowledge and intent seems to get lost. We must reconnect the traditional knowledge of the villages to the new generations, so they can help move the food system forward."

"WE MUST RECONNECT THE TRADITIONAL KNOWLEDGE OF THE VILLAGES TO THE NEW GENERATIONS, SO THEY CAN HELP MOVE THE FOOD SYSTEM FORWARD."

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