Food & Business Knowledge Platform

Circular Agriculture in Low and Middle Income Countries

Introduction

Online version study bit.ly/circularLMICS

Circular Agriculture is rather new concept with many different definitions in use as it is applied by a diverse group of researchers and professionals. Though the concept may not be crystal clear, many Dutch and international actors recognize the potential of the concept to develop sustainable food systems. In the Netherlands, the Minister for Agriculture, Nature and Food Quality, Carola Schouten, has embraced circular agriculture as a concept that should be further developed. First implementation steps are taken to make the Dutch food system more circular, but little attention has been focused on the potential of circular agriculture to contribute to SDG 2 in the international context: Achieving food security, improving nutrition and promoting sustainable agriculture. To fill this gap, the Food & Business Knowledge Platform has commissioned this study. The aim of this study is to discuss the definitions and main principles of circular agriculture in the context of low and middle income countries (LMICs). We explore what the opportunities and challenges are for circular food systems in LMICs and look at the circular models at various spatial scales: farm, regional and international. In the final part we present recommendations to transition to circular food systems in LMICs.

Core principles

The concept of circular agriculture can mean different things to different people. In an effort to extract the key principles of circular agriculture, we mapped various terms used in over 20 publications. After interpreting and grouping these various terms, four core principles emerged that explain the working of circular agriculture.

1. Cycling and designing out waste - Circular agriculture emulates natural systems that are closed-loop and waste-free.
2. Using renewable energy - Circular agriculture is built on the use of renewable resources and thus avoids the use of non-renewable resources such as fossil fuel where possible.
3. Optimum use of resources - Natural resources (including soil, water, nutrients, and biodiversity) should be effectively used and managed in order to conserve them. We have to optimize our resource use in a way that adds the most value to the food system and the economy and causes the least damage to the environment.
4. Diversity: Core principles of circular agriculture are to preserve and enhance (bio)diversity and complexity.

Circular agriculture could be applicable...

... to various scales. The concept of circular agriculture can be applied to the local and regional level, this has several benefits, including the avoidance of long-distance transport, the stimulation of local cooperation, and the improvement of the self-sufficiency in the region. Though, it can also be applied to the international level, which has the advantage that the best agroecological and socioeconomic circumstances can be selected for a crop.

... by various stakeholders. As the concept can be applied to various scales, a broad range of actors is using the concept.

... to the food system. To improve food system outcomes and tackle global challenges, researchers urge to use a food system lens when setting up and carrying out circular agricultural initiatives.

Circular agriculture in practice

Moving beyond theory, find below a set of case studies from different parts of the world that show interesting aspects of circular agriculture. We have selected cases of circular business models that are implemented at different spatial scales: farm, regional and international level. *(Note: full report includes more cases.)*

Farm level

Circular pig breeding enterprise, China: In China's Jiangxi province, in Pingxiang City, there is a pig breeding enterprise. Established in 2004, the farm covers approximately 365 ha. The enterprise originally followed the traditional model of linear production but as the farmer was facing several challenges he decided, in 2015, to re-design the entire one-way flow of linear production (resources–products-waste) and build a circular organic production system (pig–biogas–feed for pigs/fish or pig–biogas-bamboo). The new production system takes biogas

production as its central point. Biogas, a high-methane fuel, and biogas slurry, an organic fertilizer, are products of the pig manure anaerobic digestion.

Biobuu Limited, transforming organic waste into insect-based proteins, Tanzania: Starting in 2014, a recycling company called The Recycler and its spin off Biobuu Limited started offering waste management and collection of recyclable material in Dar es Salaam, Tanzania. One of the services Biobuu Limited offers is to collect and process organic waste and transform it into insect-derived proteins and organic compost. This is done by a native insect called the black soldier fly (BSF). The BSF can consume 70% of its own body weight in waste every day. For every kilogramme of organic waste it consumes the insect produces nearly 50 g of protein, which can be used as a feed supplement for fish or chicken feed. After the decomposition process the leftover product can be used as organic compost.

Ferm O Feed: Organic fertilizer distribution, worldwide: Ferm O Feed is of one of the biggest manufacturers of organic fertilizers in Europe, with a factory located in Helmond, the Netherlands. The company produces 70,000 tons of organic fertilizer per year. Animal and vegetable by-products are purchased from 20 selected Dutch farms, strictly monitored for hygiene, quality and continuity. The company then sells its products to more than 65 countries. The quality and quantity of the fertilizer is consistent, as the farmers are feeding their livestock according to a known and constant diet.

Opportunities and challenges

The table below presents some of the economic, environmental and social benefits and challenges of the concept. We want to emphasize that many of the outcomes are either expected or based on the preliminary findings of the limited number of cases in LMICs. Circular agricultural practices are still very much in development and we hope that within a few years more opportunities are capitalized and challenges overcome in order for circular agriculture to significantly contribute to the SDGs.

	Benefits	Challenges
Economic aspect	Resource efficiency (from waste to value), business model diversification (increased resilience)	Access to finance, true pricing, financial compensation for e.g. waste management, marketing an unfamiliar product
Environmental aspect	Reduced waste and pollution, efficient natural resource use, improved soil fertility, reduced climate impact, reduced dependency on fossil fuels	Safety and quality management (recycling toxic materials and pathogens)
Social aspect	Social cohesion, improved living conditions, public health, job creation, enhanced food and nutrition security	Food safety, in-depth knowledge and skills required, need for a broad network, consumption patterns, underlying paradigms and social norms and values
Overarching issues	Concrete examples in LMICs present	Conversation often miss food system angel, quantification is missing, need for rules and regulations, international transport, relative impact (addressing system symptoms not root causes)

What is needed for the transition to (more) circularity in agrifood systems?

1) Entrepreneurship & sound business models, 2) Supportive policy framework & financial instruments, 3) Generating, sharing and using knowledge, 4) Collaboration Dutch Diamond actors and local stakeholders, 5) Leveraging technology, 6) A shift in the diet of animals and people, 7) Measure what matters.

Conclusion and recommendations

Circular agriculture is a concept which could potentially contribute to solving various economic, environmental and social challenges in LMICs. We need the involvement of all Dutch Diamond actors to connect, innovate and scale circular agriculture initiatives.

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