ACTIVITY 10

COFFEE PRODUCTION AND CONSUMPTION SYSTEMS

HOW CAN BIOLOGICAL MATERIALS 'CASCADING' GENERATE VALUE CREATION AND DISTRIBUTION OPPORTUNITIES AS WELL AS REGENERATING CAPITALS?

CONTEXT FOR THE ACTIVITY

The circular economy in the biological cycle is about creating, capturing and distributing value alongside the regeneration of natural and social capital. It can do this through biological materials cascading and approaches such as business 'enterprise stacking'. This workshop activity uses the coffee production and consumption system as a context to explore Idriss Aberkane's (2016) notion of Knowledge+ (biological) Waste = Asset (multiple assets through 'cascading'). The main emphasis of the discussion in this session is on coffee **production** at the farm level but includes extension work around coffee **consumption** and coffee 'waste' cascading within cities.

RESOURCES AVAILABLE

- 10:R1a Intro PPT slide
- 10:R1 PPT Slides of introductory data on coffee and Task 2 briefing illustrations
- 10:R2a-e Introductory data on sun-grown and shade-grown coffee (graphs, photos, tabular data)
- 10:R3 Spider diagrams illustrating some differences between shade-grown and sun-grown coffee production systems
- 10:R4 Task 2 handout/brief/'prompt drawings'
- 10:R5 Efficiency versus effectiveness graph by Sally Goerner

ORGANISATION

- Small groups with plenary session. Potential use of PPT to introduce background on coffee production
- Small groups work at tables with large sheets of flipchart paper - requires scissors, pens and paper glue for applying 'prompt diagrams', annotation work etc.

TASK(S) AND RUNNING ORDER

1) Small group discussion to introduce sun-grown and shade-grown coffee production systems
2) Small groups develop 'circular value' system diagrams to visualise a large farm that includes shade-grown coffee (through a circular economy lens using regenerative design principles)
3) Plenary on the small group discussions - everyone gathers around a gallery of the small group systems diagrams
4) Plenary debrief to reflect on why shade-grown coffee systems are not yet at scale

TIMINGS

Overall approximately 90 minutes. Task 1: 15 mins; Task 2: 40-45 mins; Task 3: 15 mins; Task 4: 15 mins.

AIM OF THE ACTIVITY

Through a coffee production and consumption context, to give an introduction to the idea that, in the biological cycle, the circular economy is about value creation/distribution and regeneration of natural and social capital through biological materials cascading and approaches such as business 'enterprise stacking'. Illustrate the lost opportunities and implications of our current approach to food production. Consider the opportunities for innovation to build economic, environmental and social capital by shifting to a restorative approach to food production.

TASK 1

Invite small groups to briefly consider global coffee production trends for the two coffee species of commercial value, *Coffea arabica* and *Coffea canephora* (robusta). What would you need to know to explain the coffee production trends? What do you already know?

Introduce to the groups the data from R2 (photographs and graphs about sun-grown and shade-grown coffee).

Groups can ask for information in a step-by-step process (e.g. show R2a, then R2b etc.) and then get some feedback from groups (quite brisk). Note: the first photograph on R2a shows the picking of coffee 'cherries', the second photograph shows a monoculture coffee plantation; the images on R2b show the coffee beans and cherries, including the processing where the outer skin and pulp of the coffee cherry is removed.

Establish task 1 as a first activity, not the main one. This task is mainly a brief run-through of the international coffee market that encourages participants to start to consider how we produce coffee and the production trends.

Next introduce the table of data on R2e that indicates differences between shade-grown and sun-grown coffee systems. Then ask the groups "do the trends have consequences, what are they?"

Note that for larger groups in a workshop, for logistical reasons and management of feedback it may be preferable to introduce all the data in R2 at the start of the task.

In a short plenary debrief for this task note how:

- the trend for coffee growing is big business particularly the 'speciality coffee' market

- recognising the waste involved in the current coffee production system, in recent years there has been a growing interest in the commercialisation of coffee 'waste' streams and the associated 'coffee chemistry'

- globally, shade-grown coffee is shrinking and sun-grown coffee is increasing as a proportion of the land committed to coffee production

Paradox: total global production of shade-grown coffee has increased since 1996, but the area of land used for sun-grown coffee has increased at a much faster rate, resulting in shade-grown coffee falling from 43% of total cultivated area to 24%.

As recent research at the University of Texas at Austin demonstrates (Airhart, 2014 and Jha et al., 2014), despite growth in speciality coffee and growth in public awareness of where coffee comes from and the different ways to manage it for biodiversity, shade-grown coffee only seems to be grown in a few regions. Interestingly, although the global area cultivated for both sun- and shade-grown coffee decreased to 10.2 million hectares between 1990 and 2010 (the year with the most recent comprehensive data), production still climbed 36%, which is evidence of an overall intensification in several key countries (e.g. Brazil and Colombia).

Trend consequences: the sun versus shade-coffee table of data on R2 reveals some of the consequences of the trend towards using land for sun-grown coffee e.g. high yields from sun-grown coffee production systems but with various associated environmental downsides (pollution etc.).

End the task 1 plenary by asking the groups to consider R3 which uses 'spider diagrams' to further compare and contrast sun-grown and shade-grown coffee systems. Use the spider diagrams 'Crop Production' estimate lines and the quote on R3 to enable groups to reflect on the differences between 'efficient' and 'effective' agricultural production systems.

Briefly mention the work of Sally Goerner (2015) from the Capital Institute that considers effectiveness, fragility and resilience in complex dynamic systems. R5 (with graph) is included as a supplementary resource and may be useful as a background resource.

Note that this whole discussion is around system boundaries and the notion of effective versus efficient systems. In general a system has to be effective if it is feedback-rich and has longevity - it has homeostasis, and form and function combine. An efficient system need not; instead it is suited to throughput, its emphasis is on the part, maximising production of one variable, in this case coffee, but it may not be able to maintain or enrich natural and social capital or optimise the whole system. And, as Sally Goerner argues, a highly efficient system can have a tendency towards brittleness and fragility e.g. in the case of sun-grown coffee monocultures in Brazil, over recent decades there has been an increasing risk of coffee crop failures and reduced outputs due to frost, drought and other unpredictable environmental factors. The differing frameworks for thinking are clear: optimise the whole or just the part?

In the next task move the same small groups on to investigate shade-grown coffee production systems in more detail.

TASK 2

Ask the small groups to develop effective 'circular value' system diagrams to visualise a farm that includes shade-grown coffee. Invite groups to consider this through a circular economy lens - using regenerative design principles.

Ask the groups to address the question "If a circular economy regenerates natural capital – could this be done profitably so it includes coffee production? How?"

Ask groups to use handout R4 as the brief for this task. Note that this handout provides an illustrated briefing on some of the important circular economy and regenerative design principles that groups should consider in this task ('waste=food' etc.). Depending on participants' background knowledge and familiarity with such principles, the facilitator may wish to provide an introductory briefing to the task using PowerPoint R1 where relevant illustrations from R4 have been reproduced.

Each of the groups needs to work around a table with large sheets of flipchart paper – groups require scissors, pens, paper glue for applying the 'prompt drawings', their own sketches, annotation work etc.

TASK 3

After completing the large diagrams with the flipchart sheets on the tables invite the whole group to gather around a gallery of the different farm illustrations. In this plenary, invite each small group to feedback to the whole group and summarise how their illustration addressed the question "If a circular economy regenerates natural capital – could this be done profitably so it includes coffee production? How?"

In this plenary debrief ask the whole group to reflect on:

-whether or not their illustrations of the farms display biomimetic principles. Do they mimic the surrounding tropical forest ecosystem in terms of structure and materials/nutrients, energy and information flows. If so, how?

- whether the farms illustrated on the tables are 'regenerative by design'.... So how do they regenerate 'natural capital'? Did the groups get to consider soil regeneration on their farm? This is critical to sustained output and crop resilience.

- to what extent do their farm illustrations illustrate material cascading and enterprise stacking? e.g. in relation to coffee or pineapple plants. Did any groups for example, use the pineapple prompt graphic to think about/research the potential for value creation utilising 'waste' pineapple leaf fibre? (see link in References and Further Reading for recent research about this).

- to what extent do the illustrations demonstrate 'effective' rather than 'efficient' production systems? If so, describe why.

TASK 4

Finally, invite participants in this plenary to reflect on why regenerative farming systems, like the ones they have been working on, may not yet be occurring at scale.

Disabling factors include:

-Land ownership: farms with shade-grown coffee may be more appropriate for farmers who are owners of the land and can benefit from the other cash flows on the farm. It's not easy to develop such systems on larger farms which are leased

-Other assets are important for optimal livelihood: participation in a cooperative or other local association and access to land, water, loans, houses, and equipment

-Capital is needed to invest in a changed system

-Infrastructure: reverse cycles on and around farms are not in place and are expensive to set up

-No developed markets for additional produce e.g. small-scale egg production versus established large-scale commercial egg farm operations

-Learning/skills opportunities are not available relating to management of complex dynamic agricultural production systems e.g. systems thinking skills

While cheap (ish) fertilisers and simplified systems predominate (they have a comparatively low

knowledge threshold), while costs are externalised and perhaps also while subsidiary markets for the other products from such regenerative farming systems are underdeveloped, the obvious question is "why bother with regenerative agriculture?" As Frederick Kirschenmann (2003) points out, these highly productive, redesigned farming systems that mimic complex dynamic living ecosystems (in this case, tropical forest ecosystems) are most compatible with smaller scale, independently owned farms. Such complex systems do not seem to lend themselves well to large-scale centralised operations where farmers are not usually involved with the complex ecology of their farms. But see the film about Leotino Balbo's organic sugar cane farm in Brazil as to how regenerative agricultural systems might be achieved profitably at large scale (References and Further Reading).

Some final points that could be covered in the task 4 debrief:

It's not just about coffee, it's about multiple cash flows and reimagining them on the farm and beyond the farm, and what can be done with underutilised resources (often viewed as 'wastes') on the farm and if this material leaves the farm.

The complete biological system/entity needs to be considered.

A holistic cascade-based relationship with coffee would consider the entire fruit and the whole coffee growing protocol. The entire shrub in its context also need integrating; as a shade-loving plant it can be positioned adjacent to other trees. It's important that the biological material on the farmland goes through the cascades not to bypass them e.g. by going from tree to furnace forgoes the value that could be harnessed via staged decomposition through successive material cascades.

In the biological cycle of the circular economy it's all about biological decomposition - material is broken down in stages by microorganisms like bacteria and fungi that extract energy and nutrients from the carbohydrates, fats and proteins found in the material. Contrast this with the technical cycle in a circular economy where the material molecules are maintained at high value in the inner loops (not decomposed).

Maybe it's time that we stopped seeing coffee as a drink and similar agricultural products as simply crops - but rather as a whole value building system?

POSSIBLE EXTENSION ACTIVITY

For a discussion around coffee **consumption** and coffee 'waste' cascading within cities the facilitator could invite the same small groups to return to their tables and their regenerative farm illustrations. Invite groups to next think beyond the coffee production system on the farm to the wider coffee system - use the large illustration entitled *The coffee system and biological cycle of the circular economy* on R4 to prompt the urban coffee consumption context.

Invite groups to reflect on the accumulation of coffee grinds in urban areas. A discussion on coffee grinds value creation opportunities could introduce the work of Gunter Pauli. His recent TEDx Tokyo film includes a short presentation on the business and innovation opportunities with coffee grinds: growing mushrooms and the production of biochemicals to absorb body odours and protect our skin from UV rays. The social enterprise Rotterzwam, in the Netherlands, is a good example of a business growing mushrooms on coffee grinds (see links in References and Further Reading). Valuable work has been carried out at the University of York in the United Kingdom on the green chemistry of coffee/ coffee grinds – 'the coffee biorefinery' (Dugmore, 2014).

Emphasise to groups the need to consider the complete coffee production and consumption system and remind them that the early work in this activity focused on the farm production side - so now encourage groups to focus on urban coffee consumption by reflecting on questions such as:

What are the systemic opportunities and challenges for value creation and distribution utilising coffee grinds that accumulate in urban areas?

Who benefits from the value creation opportunities generated by cascading of coffee grinds in urban areas? What about value distribution?

The following quote from the renowned urbanist Jane Jacobs might also be a useful prompt for discussion:

"Cities ... need all kinds of diversity, intricately mingled in mutual support. They need this so city life can work decently and constructively, and so the people of cities can sustain ... their society and civilization. ... I think that the science of city planning ... must become the science and art of catalyzing and nourishing diverse, close-grained working relationships that support each other economically and socially".
Jane Jacobs, *Cities and the Wealth of Nations, 1984*

Cities are huge accumulations of people, and materials and flows of information and ideas. Are there opportunities here for innovation and job creation using coffee 'waste'? Flows of material waste to peri-urban farming/urban farming? Rebuilding natural capital through localised composting for soil regeneration? Then redistributing the valuable food grown to those who need it? What about the matter of value distribution?

Of course the discussions could move beyond just coffee grinds in cities....what about solutions to address, at scale, the massive flows of other food-based waste in urban areas? Just one example: in South Africa, the company Agri-Protein uses fly maggots to digest large volumes of urban food waste at scale (see link in References and Further Reading).

What about digital as enabler? Innovative entrepreneurs in particular are using the growing ICT capabilities to address urban food waste streams using mobile apps to locate available resources (Cole, 2017).

SUPPLEMENTARY RESOURCES

Sally Goerner effectiveness versus efficiency graph R5

A circular value system diagram for Higueras Village, Mexico. The diagram shows how the stakeholders and participants in linear production chains can be circularized, creating networks of knowledge and residue sharing beyond that of industrial symbiosis through upcycling/cradle to cradle processes and technologies.

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Gunter Pauli introduction to value creation opportunities with coffee grinds TEDx video. Relevant clip at 5.16 – 8.07 minutes
https://www.themanufacturer.com/videos/gunter-pauli-on-coffee-tedxtokyo-drink-it-eat-it-wear-it/

Social enterprise rotterzwam grows mushrooms from coffee waste and wants to teach others how. Article available from The Lovepost. Available at:
https://www.thelovepost.global/biotech-change/articles/social-enterprise-rotterzwam-grows-mushrooms-coffee-waste-and-wants-teach

AgriProtein website and film clip with Jason Drew, AgriProtein's CEO
https://agriprotein.com/ and http://www.bbc.co.uk/programmes/p05gq683

Biodiversity International website
https://www.bioversityinternational.org/research-portfolio/fruit-tree-and-tree-crop-diversity/

Biodiversity International works with researchers and farmers on agricultural and agroforestry systems. Includes interesting research on fruit tree and tree crop diversity in different parts of the world.

Leotino Balbo film about a sugar cane farm.
https://www.youtube.com/watch?v=G-pr0cYzuDQ

THUMBNAIL RESOURCES

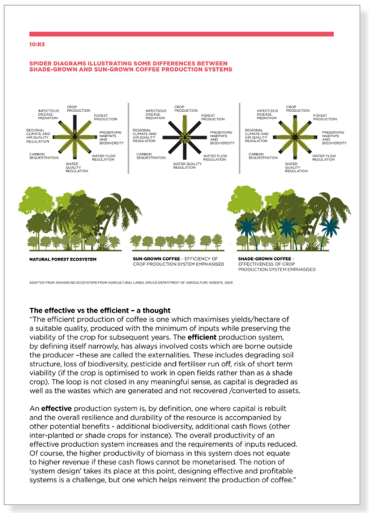
CLICK TO DOWNLOAD HIGH RESOLUTION VERSIONS FROM BELOW

10:R1a Intro PPT slide

10:R1 PPT Slides of introductory data on coffee and Task 2 briefing illustrations

10:R2a-e Introductory data on sun-grown and shade-grown coffee (graphs, photos, tabular data)

10:R3 Spider diagrams illustrating some differences between shade-grown and sun-grown coffee production systems



10:R4 Task 2 handout/brief/'prompt drawings'

10:R5 Efficiency versus effectiveness graph by Sally Goerner