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The Implementation of the Circular Economy in the Coffee Value Chain: Insights from Action Research

Maarten van Keulen
m.vankeulen@students.uu.nl
3853608

Supervisor
dr. Julian Kirchherr
j.kirchherr.uu.nl

Internship Organization
This Side Up Coffees
Lennart Clerkx
lennart@thissideup.coffee

Academic summary

The Circular Economy (CE) promises to provide an alternative to the current take-make-dispose economic model that is the cause of immense waste production, high energy consumption and limited to no usage of disposals. The at least 114 definitions going around are indicative for the vast debate around the subject. There are some examples of CE implementation in literature, but few focus on complex product value chains. This study sets out to do so, and takes the coffee industry as its case study. The leading research question is: how can CE be implemented into the coffee value chain? Action research is used as methodology – enacting and observing initiated change within the system under research. Over a 7-month period, five CE measures were implemented in the value chain of an Amsterdam based specialty coffee importer. Changes were aimed at both the producing and consuming side, with goals on minimizing waste, connecting within and beyond value chains, in order to balance ecological with social and financial sustainability. Results show that successful implementation can be assigned to networking skills; strong value propositions and business cases; taking the on-site implementation situation into account; co-creation with all actors; taking a coordinating role as action researchers; and using simplified images and diagrams. Failure was caused by overestimating a sense of community in a value chain; a too top-down approach; co-creating at a too late stage; connecting value chains too far from each other; and presenting weak business cases. By connecting the findings to existing implementation literature, this study is able to provide a practice-oriented list with "dos and don'ts" for both academics and practitioners, when implementing the CE in a product value chain.

Advice for the Internship Organization

The Amsterdam based coffee importer This Side Up (TSU) expressed the desire to incorporate ecological sustainability next to the already existing social sustainability of the firm. The founder, Lennart Clerkx, struggled finding the overview on where to start, and how to pay for it. This research has implemented the CE, to test if this would be a suitable approach for the firm as a full-fletched sustainability approach, and has found out that it is. The strength and weakness lies both in being the actor in the middle of value chain, which allows an overview and the facilitation of new connections and conversations, but hides the danger of being too top-down, connecting too distanced actors, and overestimating the sense of community. As long as one is aware of this and presents solid value propositions and business cases to all actors involved, both the sustainability performance of TSU as well as the (financial) business relationships with the entire chain can be solidified. Taking a project based approach, tackling one problem at the time and connecting actors from within and without the chain, is something TSU can continue to do, and grow step by step to become a fully circular and sustainable firm.

In agreement in with the master's programme coordinator (dr. Simona Negro), the supervisor (dr. Julian Kirchherr) and the second reader (prof. dr. Marko Hekkert), the master's thesis is written and delivered as a scientific article. After delivering the thesis, the article submission process will start with the assistance of dr. Julian Kirchherr, therefore being referred to as the second author.

sustainability

MDPI

Article

The Implementation of the Circular Economy in the Coffee Value Chain: Insights from Action Research

Maarten van Keulen [1] and Julian Kirchherr [2]

[1] Copernicus Institute of Sustainable Development, Utrecht University, the Netherlands; maartenvankeulen@aol.com

[2] Copernicus Institute of Sustainable Development, Utrecht University, the Netherlands; j.kirchherr@uu.nl

Correspondence: maartenvankeulen@aol.com; Tel.: +31 6 380 78 254

Abstract: The Circular Economy (CE) promises to provide an alternative to the current take-make-dispose economic model that is the cause of immense waste production, high energy consumption and limited to no usage of disposals. The at least 114 definitions going around are indicative for the vast debate around the subject. There are some examples of CE implementation in literature, but few focus on complex product value chains. This study sets out to do so, and takes the coffee industry as its case study. The leading research question is: how can CE be implemented into the coffee value chain? Action research is used as methodology – enacting and observing initiated change within the system under research. Over a 7-month period, five CE measures were implemented in the value chain of an Amsterdam based specialty coffee importer. Changes were aimed at both the producing and consuming side, with goals on minimizing waste, connecting within and beyond value chains, in order to balance ecological with social and financial sustainability. Results show that successful implementation can be assigned to networking skills; strong value propositions and business cases; taking the on-site implementation situation into account; co-creation with all actors; taking a coordinating role as action researchers; and using simplified images and diagrams. Failure was caused by overestimating a sense of community in a value chain; a too top-down approach; co-creating at a too late stage; connecting value chains too far from each other; and presenting weak business cases. By connecting the findings to existing implementation literature, this study is able to provide a practice-oriented list with "dos and don'ts" for both academics and practitioners, when implementing the CE in a product value chain.

Keywords: circular economy, coffee, value chain, specialty coffee, niche, implementation

1. Introduction

In the UK alone, between 500 million and 2,5 billion disposable cups are thrown away every year [1,2]. Global data are unknown, but the UK data may be indicative for the global waste generation caused by disposable cups, where the vast majority ends up in landfills or is being burned for energy generation [3,4]. A product that is only used for ten minutes before disposal is a striking example of the current 'take-make-dispose' model, which is prevalent in most societies today. It has enormous consequences spanning from an immense waste production, high energy consumption and no usage of disposals [5,6]. This system relies heavily on taking in more resources and energy, and improved efficiency will not increase the world's finite resources. The circular economy (CE) promises to provide an alternative to this system, proposing a closed-loop of material flows, and has become trending amongst both scholars and practitioners in recent years [7].

To date, there are several examples of CE implementation in literature, but few respond to the call from researchers for "good CE implementation examples [that] can help sharpen the understanding of the CE concept both among scholar and practitioners", especially in complex systems as product value chains [7,8]. The aim of this study is to fill this gap and to shed light on how to implement the CE in an international value chain, and provide recommendations on how to manage a successful process. The research question that will be answered is: how can CE be implemented into the coffee value chain? We chose the coffee industry as our focus industry since coffee is one of the worlds mostly traded commodities, with a complex and diverse value chain [9]. Specialty coffee actors in particular are under research, as sustainable frontrunners with the opportunity to lead the larger industry players by example.

The paper is organized as follows. Section 2 outlines the CE debate and introduces the current coffee industry. Section 3 explains the methodological approach on how to implement the CE using an action research approach. In section 4, the results are presented following the steps of an action research cycle. The findings are discussed in section 5, comparing with existing CE implementation literature, before concluding the paper in section 6.

2. Theoretical framework and definitions

2.1. Circular Economy

With an increased popularity, a vast increase in the amount of research articles on the topic and more than 100 definitions going around; an easy definition of the CE concept cannot be given [7,10]. Several authors have put the cause of the vagueness to the various antecedents of the CE, deciding the stances and perspectives of different CE researchers and practitioners [6,10–12]. The roots of the CE concept go back as early as 1966, when Boulding described the tension between a *cowboy economy* of constant production, consumption and extraction, versus the *spaceman economy* which focuses on stock maintenance and lessened throughput [13]. The naissance of thermodynamic law in the 1970s with its proof of inevitable material and energy degradation strengthened the perspective against this material and economic infinity, with general system theory and industrial ecology supporting this view [14]. In more recent years, the Ellen MacArthur Foundation has incorporated literature from cradle to cradle, biomimicry and regenerative design to the CE concept [5]. As a result of this, the CE has become an umbrella concept where the CE strategies itself are not new individually, but together form a new cognitive unit [12].

The definition chosen for this study is proposed by Kirchherr et al. [7] and is based on a thorough analysis of 114 CE definitions: "A circular economy describes an economic system that is based on business models which replace the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes, thus operating at the micro level (products, companies, consumers), meso-level (eco-industrial parks) and macro level (city, region, nation and beyond), with the aim to accomplish sustainable development, which implies creating environmental quality, economic prosperity and social equity, to the benefit of the current and future generations."

A main point of criticism on many of the CE perspectives is the lack of a proper balance between all three sustainability pillars (financial, ecological and social), driving a divide between what is sustainable and what is circular [6,10,15]. As Murray et al. [6] put it – "the Circular Economy, however, is virtually silent on the social dimension, concentrating on the redesign of manufacturing and service systems to benefit the biosphere". Especially topics like intra- and intergenerational equity, equality of social opportunities and diversity are too little taken into account [15]. When implementing the CE, practitioners need to be aware of the balance and tension between the three respective pillars.

Several studies have been done on the implementation of the CE in various settings, including papers that provide an overview and compare these initiatives all together [16–18]. Other scholars have identified several barriers and enablers for a successful implementation process. Enablers go

from company culture to governmental support, from establishing new collaborations to technological developments, and from product passports to social awareness [19–22]. Barriers are as diverse as consumer awareness, material compositions, weak policies, high upfront investments, lack of information and technological know-how, and no monitoring of performance [22–27]. Table 1 provides an overview of these barriers and enablers, and has attempted to find common denominators in the multiple studies.

	Enablers	**Barriers**
Cultural	Progressive company culture	Conservative company culture
	Social awareness and education	Lack of public participation and awareness
	Shared vision of all stakeholders	Lack shared vision all stakeholders
Regulatory	Governmental support and policies	No governmental support and policies
	Circular procurement	Administrative burden
Market	Scaling for profitability	Complex material composition
	Strong business case	Weak business case
	Energy, material and economic savings	Lack of reverse logistics and infrastructure
	Product passport and detailed information	Disinterest non-core business practices
Implementation	Short term aims connected to long term goals	Distance between industries
	Systemic and holistic approach	Lack of performance assessment
	Co-creation with all actors	Lack of information
	Practice based experimenting	Unbalanced power between participants

Table 1: CE enablers and barriers identified in literature

Implementers seem not to agree on pursuing either a top-down (governmental) or bottom-up (business) approach, or on how to unite these two approaches. This study will take a bottom-up approach, by focusing on the coffee (business) value chain and the possible impacts one can make from the actor in the middle, the focal firm.

2.2. The coffee value chain

In the year 2017, close to ten million kilos of coffee were produced in the world [28]. Taking the fact that the average espresso needs around 18 grams of roasted ground coffee, the amount of coffee beverages consumed in the world on an annual basis is considerable. In the same year almost 70% of the coffee in the world was consumed in net-importing countries, far away from the so-called 'coffee-belt' in the tropical regions of many developing countries where more than 125 million people depend on it [29,30]. The value chain of the coffee industry is presented in figure 1 and visualizes the different actors at play from the coffee farm to the coffee cup. The dotted line represents the divide between the producing countries in the tropical *coffee belt* and consuming countries mostly in the global North, for example Colombia and the Netherlands. Coffee grows like a fruit on a tree, in red cherries as big as a marble. When processing the cherry through a mill, two beans come out, with their characteristic curved line in the middle. The flesh from the cherry is discarded, and the beans are dried before putting them in 60kg bags for export. After being shipped to the consuming country, the importer sells the bags to the coffee roasters, who roast it to be the brown coffee beans most consumers relate to. It is at this moment the beans go from green to roasted coffee, and are ready for consumption.

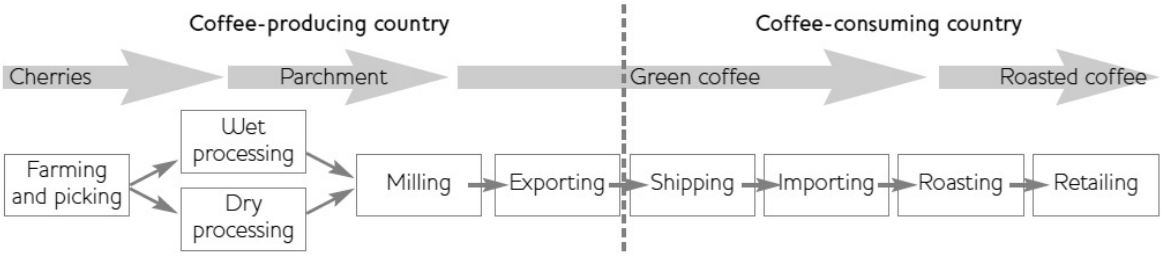

Figure 1: Coffee value chain (Borrella et al., 2015)

An industry of this size and complexity has a big diversity in producing and consuming habits, practices and culture. One way to structure this vast diversity is to put coffee culture in its specific *waves* of development. The first wave of big bulk, low quality commodity coffees and coffee as a "caffeine container" was followed by the second wave, or the "Starbucks period" from the 1990s onward [31–33]. It put coffee education and coffee houses to the forefront, and taught customers about the flavours of coffee. The current Third Wave followed on this development, focusing on high-end coffee qualities and customer education, placing coffee next to beverages like wine and beer [31,34]. Even though authors like Manzo [33] call the waves a "revisionist, imprecise, North-America-focused, and generally unsatisfactory" representation of coffee history and all waves currently co-exist, there seems to be a general acceptance in the coffee industry about the helpfulness of the categorization as it indicates a chronology in the development of coffee culture.

A more historic correct approach would be to look at the consequences of the International Coffee Agreement collapse in July 1989, which started a period of drastic price drops. The year 2000 saw the lowest coffee price in almost a century, and initiated the global coffee crisis that until 2008 lead to hunger, homelessness, migration and damaging farming practices [31,35,36]. The fair trade and organic farming movement – even though being around for many decades – saw a big upsurge and many new product labels were born [37]. Where some authors frame it as just another differentiation of a commodity, others call it for a change from pure market exchange to a system of social and moral relations, or put it together with the ascendance of voluntary product standards [38–41].

This paper finds itself at the end of both developments, in the niche of *specialty coffee*, where the quest for better coffee quality and ethical consciousness meet [34]. Whilst (some) farmers get the opportunity to walk away from producing a low cost bulk commodity, coffee buyers are guaranteed a steady supply of high-end quality coffees and strong marketing options for story telling when they engage more directly with their farmers [32,34,41,42]. As this niche strongly connects product quality to ethical standards, it served as a fertile ground for a more thorough change towards full sustainability (financial, social and ecological) and therewith the implementation of CE principles. The intrinsic demand created a protected area where the diffuse CE idea could be tested in a local and loosely joined system across value chains [43]. It enables the niche to formulate and present the investigated idea in a more stable and concrete way to the world of *big coffee* at a later stage, possibly enacting major changes in the industry as a whole [44–46]. The next section discusses the methodology used when doing research in this respective niche.

3. Methods

3.1. Action research

Action research defines its core intention to develop both conceptual as practical knowledge by doing research *with*, instead of *on* people [47]. It claims to connect science to everyday life, instead of a positivist worldview that separates science from day-to-day lives [48]. The father of Action Research, Kurt Lewin, mentioned already in 1946 the scientific opportunities when putting together practitioners and social scientists in an experimental setting [49]. Lewin claimed that individuals can only understand the system they are in, when they try to change it and push forward change [50,51].

This means that all stakeholders of the organization or system under research are part of the participatory research [51–54].

As Warmington [55] puts it, the points put forward by this approach are not usually associated with scientific research, and have therefore been prone to a threefold criticism; based on the goals, roles and values of the action researcher. Firstly, even though it might seem that the action researcher does all in his power to activate system change, he or she has a dual commitment to both academia as society [56,57]. In other words, the goal is not only to obtain change, but also to obtain scientific results, which include failure of an intended change. Secondly, this acceptance of failed implementations gives the researcher a different role than a consultant [58]. Put differently, a consultant gets paid to do everything is his or her power to facilitate the aspired change, where an action researcher sticks to the methodology, accepting failure and limitations in academia in the case the anticipated change does not happen. It results into a deeper academic understanding of the frameworks used, sticking to the chosen means, instead of amending this to obtain the desired results. As a third point of critique, there lies the risk for the researcher for value adaptation, or going native, and therefore losing scientific objectivity and reflexivity, which should be countered by rigorous documentation and theoretical justifications [56,59,60]. These points of criticism were tackled in our study in the following ways: no guaranteed successes were promised to the actors involved, no payment was received (to state the difference between researcher and consultant), all meetings and discussions were documented rigorously and in detail, and all methodological and academic steps were followed rigidly, allowing failure and possibly not obtaining the change aspired by the client system.

3.2. Research design

The methodology for CE implementation will follow the five-step (cyclical) process designed by Susman and Evered [61] shown below in figure 2. The steps are diagnosing, action planning, action taking, evaluating and specifying learning. This approach is commented on by Baskerville [56] and describes diagnosing as "the identification of the primary problems that are the underlying causes of the organization's desire for change". The action-planning phase refers to the planning of the measures to be implemented; action taking refers to the actual implementation, before doing a thorough evaluation of the outcomes. The final phase, specifying learning, refers to the *dual commitment* as mentioned before and specifies the findings for both academia and the client-system. From here conclusions can be drawn to undertake further steps and start the cyclical process again.

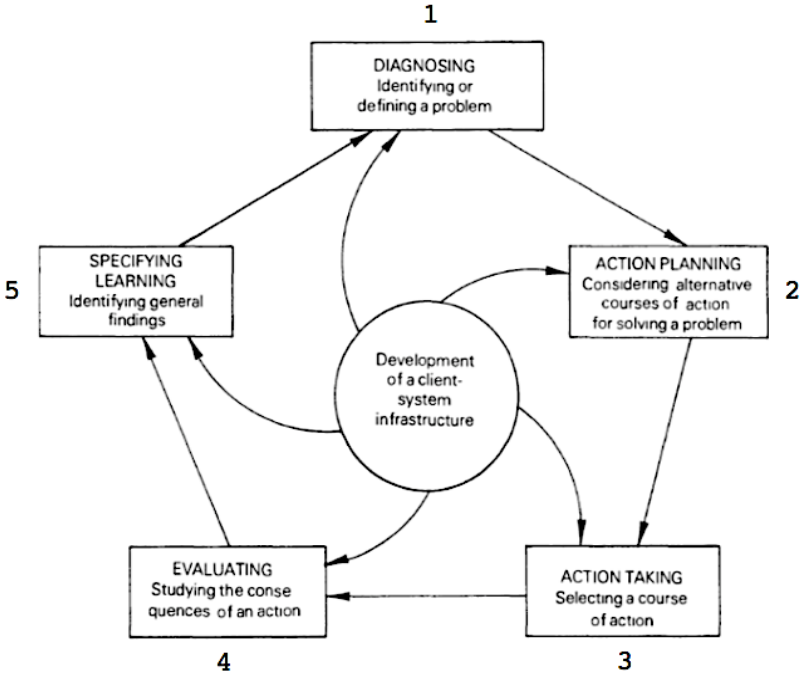

Figure 2: Action Research Cycle (Susman and Evered, 1978).

3.3. Case Study

The so-called client system under research is the value chain of the Amsterdam based specialty coffee importer This Side Up. Being a small firm that celebrated its fifth year anniversary in 2018, it prizes itself by being 100% transparent on all transactions, delivering a cake-diagram of all costs for all 11 producing farms and cooperatives. As the importer is the actor in the middle in the coffee value chain, it provides an excellent overview and touch point for the action researcher to reach out to both farmers as roasters. Focused on social sustainability by paying premiums to the farmers on each kilo of coffee, This Side Up is interested in how to incorporate and balance the ecological pillar in their value chain. With the CE making such promising claims, it provided a solid match.

In order to diagnose the problem in a thorough way and to co-create the solutions with all actors of the value chain, a workshop was organized in November 2017 at the Amsterdam headquarters of This Side Up. 15 people attended the 3-hour workshop, representing all the different nodes within the chain. The value chain was cut in 6 parts: growing and picking; processing; milling; packaging and shipping; roasting; and consuming. The workshop consisted of a general 15-minute presentation about the CE concept, two brainstorm sessions and a group discussion. Looking at the value chain in a circular way, identifying and connecting all value streams, was stimulated.

A total of 23 problems and 61 solutions of CE connected problems in the coffee chain were stuck to the whiteboard, from which a total of 12 problems with connected solutions were put forward in a group discussion. These 12 were chosen by the participants based on their urgency within the specific node, as well as having a balance between social, ecological and financial impact. A week later, the representatives of This Side Up and the action researchers met to select 5 measures that were going to be implemented in the 7-month research period. The selection criteria were based on the CE definition used in this study and consisting of: broad sustainability based on the three pillars; diversification of value chain actors (avoiding implementation at only one node); expected achievability of the measures in 7-month the research period (to be able to observe the whole process); and building forward on the enthusiasm of particular value chain actors on implementing specific measures.

Consequently, the five measures were put in a logical framework approach which allowed "project planners and evaluators to specify the components of their activities and identify the logical linkages between a set of means and a set of ends" [62]. During the implementation process, it gave the action researchers a tool to analysis to come back to, as well as a checkpoint for rigorous documentation [63].

Figure 3: Workshop sub group and whiteboard process in progress

4. Results

The five measures that were implemented are shown in table 2 in an amended logical framework manner highlighting the goals, purposes, inputs and outputs of the measures, and if the

implementation process was successful [62]. It is amended for the reason that this research ran 5 projects simultaneously, and that the classical logical framework was found to be too complex to oversee the progress, hurdles and goals of all on-going projects in an effective manner. Under *goal*, we understand the general overall goal of what a particular project is trying to achieve. The *purpose* is the dilution of the goal, translated to what was expected to be achievable in a 7-month research period. The *inputs* refer to the work done by the action researchers, aimed at obtaining the specific *outputs*. The *success* is directly connected to the purpose. The 5 projects with their implementation steps will be discussed below, following the steps of the action research cycle [61]. Projects 4 and 5, on reusable coffee cups and sustainable farming practices, will be discussed together, as they merged during the implementation process. All 5 projects are related to the same value stream, starting at a coffee farm in the Nariño region of Colombia, to roasters and consumers working with and consuming this particular coffee in the Netherlands. The projects are therefore "focus points" in this respective chain, rather than independent "silos".

	Packaging loops	**Milk alternatives**	**Coffee sludge fertilizer**	**Reusable coffee cups**	**Sustainable farming**
Goal	Increase in sustainable packaging options for coffee transport	Increase use of sustainable options to cow milk and cardboard milk packaging	Repurposing the coffee waste that is left after making a cup of coffee	Motivating and stimulating people to bring own cups and not single use paper cups	Having extra financing for transformation towards ecological friendly farming practices
Purpose	Reduce use of virgin cardboard packaging by 10% of the pilot buyers	Reduce packaging waste by 15% and decrease consumption cow milk by 10%	Repurpose 50% of coffee sludge waste stream of pilot cafés	Develop incentive for customers to bring reusable cup and reduce disposable cups by 1000pcs	Develop finance system for ecological farming transition with annual value of €1000,-
Inputs	Connect actors intra- and inter-supply chain	Initiate direct trade and organize awareness week	Connect actors intra- and inter-supply chain	Organize awareness campaign with vendors	Education of importance and finding financial means
Outputs	Reduced amount virgin packaging materials needed (€ and CO2-eq)	Reusable packaging alternatives and increased consumption plant based milks	Reduced amount of coffee sludge to waste incineration	Increased use of reusable cups and decreased use of disposable cups	Solid and transparent financing system that is available for multiple coffee producers
Success	Yes; 90-100% reduction, *235,20kg CO2-eq, 126,84€ saved*	No; resistance against awareness week, no farmer collab	Yes; 100% repurpose, *2700 litres of sludge*	Partially; strong incentive, aim not reached in research period	Partially; detailed system, aim not reached in research period

Table 2: The 5 implemented measures

4.1. Connecting packaging loops

Diagnosing: At the workshop packaging waste was extensively discussed, spanning from packaging in the producing countries (canvas bags and their internal plastic lining) to a broad span in the consuming countries (paper cups, milk cartons, roasted coffee bags, internal transportation). Most of these materials are disposed after single usage, often landfilled or incinerated. It was expressed that these ecological impacts could be easily avoided, if the industry would decide and collaborate on alternatives.

Action planning: As a result of the diversity within the problem diagnosis, the action researchers and the client system decided to focus on the internal transportation packaging at the end of chain, based on the criteria discussed before, being: broad sustainability based on the three pillars; expected achievability of the measures in 7-month the research period (to be able to observe the whole process); and building forward on the enthusiasm of particular value chain actors on implementing specific measures. This covered the transport off roasted coffee from roasters to coffee shops, which predominantly happened in cardboard boxes where the (250g or 1kg) bags of roasted coffee were stacked. The client system reached out to its network, in order to find connected value chains with a surplus of cardboard boxes, which could be picked up and distributed within the coffee value chain, avoiding the need to buy virgin packaging and waste treatment costs.

Action taking: A test-call for possible donators was done through the social media of the client system, which resulted within several hours in a list of candidates. A watchmaker and retailer in Amsterdam directly volunteered to participate, having a weekly excess of more than 100 cardboard boxes. In the weeks of working out the logistics with the watchmaker, a start-up pioneering in the trade of commercial waste streams joined the process. As the action researchers were looking for a transparent trade system for the boxes, and the start-up was in need for a party to test their new online marketplace, the two parties decided to do the pilot together. During the negotiation process of this pilot, an entrepreneur came forward out of the client system that showed a great interest in the cardboard boxes trade. He proposed to take over the logistics, picking up the cardboard boxes at the watchmaker (saving them waste treatment costs), storing them at a warehouse, and selling them for half the price of new cardboard boxes to actors in the coffee value chain. All parties agreed and the boxes were picked up, stored and sold through the market place.

Evaluating: In the 7-month research period, 5 months were lost to the set-up of the new circular system and working out the legalities regarding the trading waste products. In the final research months, 1375 cardboard boxes were picked up and 302 were sold. This saved the buying parties a value of 126,84 euros and the system was able to provide close to a 100% fulfilment of the cardboard packaging demands of the buying parties, thanks to the wide range of offered boxes. The donating parties were not yet able to reduce the amount of waste bins, but expect to do this relatively soon, herewith saving waste treatment costs. The environmental avoided emissions of not producing virgin cardboard boxes are estimated to be 235,20 kg CO2-eq based on values from earlier research, with an average weight of 330g per box and using them for 3 times [64]. A proper LCA study will need to be done to give exact numbers for the specific case scenario. Connecting this to the aim of reducing the use of virgin by 10% of the pilot buyers, this measure is considered to be successful.

Specifying learning: The networking skills of both the client system and the action researchers were found to be crucial elements to obtain a successful implementation of a new circular system. The value proposition on both financial and environmental assets had to be strong in order to convince actors to participate. Having no waste treatment costs for the donator and no extensive packaging costs for receiver, next to the environmental benefit (no production and waste treatment of virgin cardboard boxes) was found to be strong enough, and was easily communicable to potential participants. This supported the willingness of all participants to co-create a logistics system that would benefit all parties. The time consumed by working out the legalities of waste trading was underestimated and found to be a major hurdle for quick CE implementation. Facilitating clear and good communication between all parties was found to be a crucial role for the action researchers, especially when the legal issues were encountered first.

4.2. Alternatives for milk packaging and cowmilk consumption

Diagnosing: The specialty coffee chain has strong ties with the cow milk supply chain in order to be able to make its cappuccinos, lattes and more. At the workshop, a clear discontent was expressed regarding the current unsustainable milk packaging of plastic-lined cardboard containers and the severe methane production of cows.

Action planning: At the workshop, the participating actors expressed the desire to tackle the problems as a community. The action researchers decided to plan an *awareness week* at the specialty coffee shops. The aim was to raise awareness at the final consumer side of the chain on the pollution of cow milk versus plant-based alternatives, as research shows up to an 80% decrease in negative environmental impacts [65,66]. Next to this, the action researchers set themselves the goal to find reusable milk containers, and to connect the producer to the coffee value chain under research.

Action taking: Talks were organized with a few representing coffee shops to discuss the set-up of an *awareness week*. Fairly soon the action researchers found out that there was only one specific plant-based milk brand that was preferred in the specialty coffee sector. The producer being a social enterprise like the client system under research, it was proposed to connect the value chains and do the *awareness week* together shortly after the Amsterdam Coffee Festival (ACF). During the negotiation period, the action researchers tried to find milk packaging alternatives. The ACF was used as a recruitment and question venue regarding the *awareness week* and the week after that, the promotion materials were distributed at the coffee shops.

Evaluating: The desire expressed by the specialty coffee chain at the workshop regarding reusable milk packaging could not be answered: the possibilities currently available at the Dutch market were insufficient, as was the enthusiasm of local milk producers to create direct trade connections with the coffee shops and to co-create packaging solutions together. Regarding the plant-based milk alternatives, already at the ACF the action researchers and client system noticed great resistance from the specialty coffee shops against a possible *awareness week*. Despite a well-organized tandem with the preferred plant-based milk producer, cafés were unwilling to report their anonymous sales figures to the action researchers. A correlation between an increase in plant-based milk beverages and decrease in cow milk beverages could therefore not be measured, neither the related avoided CO_2-eq.

Specifying learning: The action researchers and the client system overestimated the *sense of community* expressed at the workshop, preferring to protect their business information (even confidentiality and anonymity of data was guaranteed) versus increasing the sales of plant-based milk beverages, learning about the effects of community *awareness weeks* on customers, and possibly reducing the environmental footprint. The value proposition offered by the action researchers to join such a campaign was experienced to be too weak. Possibly too few coffee shops were taken into the process of co-creating the *awareness week*, therefore experiencing it as a *top-down* idea and not something desired by the actors themselves. Regarding the packaging, it was found that the desires of one value chain did not match the realities of another value chain, even though it is often here were business opportunities can be found. In order to preserve the enthusiasm of the client-system on the implementation of the other CE measures, it was decided to abandon the measure when fierce resistance was first observed.

4.3. Using coffee sludge as a fertilizer

Diagnosing: A substantial waste stream in the coffee value chain is that of *coffee sludge*, the in water soaked coffee residue after making a cup of coffee. One of the roasters proposed a *ready-to-go* system at the workshop, where he would pick up the sludge from the coffee shops when delivering fresh coffee beans, and storing it at the roastery, ready to be collected by a third party.

Action planning: With the significance of the waste stream within the coffee value chain, and the enthusiasm of a value chain actor this big, the action researchers planned to find a suitable candidate to pick up the coffee sludge. Once a candidate was found in a different value chain, the action researchers coordinated the logistics with the actors involved. With the strong benefits of the coffee sludge as an agricultural fertilizer, the search started at farms and communal gardens, before moving to different chains [67–72].

Action taking: Co-creating the system with the enthusiastic roaster, the first opportunity was try to close the system of the *indoor food market* where the company resides. The roaster reached out to the neighbouring bakery and the vegetable retailer – combining bread waste and coffee sludge would make a solid basis for compost for the vegetable farmers [67]**.** The action researchers provided simplified diagrams of the proposed collaboration, which would make the explanation of the proposed collaboration easier. First enthusiastic, the approached parties backed off with fears for too complicated logistical systems in their own respective value chains. Action researchers were unable to convince the potential parties to overcome their concerns. The action researchers reached out to several communal gardens in the region, without success. Continuing the search, the action researchers wrote a proposal text to be spread by the social media channels of the roaster, trying to find interested parties in their own specific network. The social media campaign was repeated 3 times, with good responds, but no breakthroughs. Taking a step back to the client system, the coffee importer at This Side Up came forward with a possible candidate: a communal garden in a greenhouse facility 50 kilometres away from the roaster. The facility responded positively to the proposal of the action researchers, but not to the location of the proposed roaster and their weekly waste amount of 50 litres sludge; more was required. A second coffee shop in the client system was approached, with a weekly amount of close to 200 litres of sludge and only 6km from the facility. The two parties were introduced to each other, and a successful collaboration was started. Eventually, the action researchers found a suitable candidate to the initial roaster as well: a start-up that planned to produce ink out of coffee sludge. The efforts of the action researchers got the attention of a third coffee shop in the client system, whom with a little bit of help of the researchers found an enthusiastic communal garden collective nearby.

Evaluating: In the 7-month research period, 4 months were lost to finding suitable candidates in other value chains. During the final 3 months of the research, the collaboration of the bigger coffee shop and the greenhouse communal garden facility prevented 2400 litres of coffee sludge from waste treatment, which was 100% of all sludge produced by the coffee shop. The sludge was being mixed with the soil in the greenhouse facility. *Upcycling* the sludge into mulches is known to increase the water retention qualities of the soil, binds toxic and pesticide residues and increases essential plant nutrients like nitrogen, phosphorus and zinc [67–72]. The coffee shop saved space in the bins and could therefore save money on waste treatment costs, but expressed that other waste quickly filled up the obtained gap, therefore not saving considerable amount of waste treatment costs. The impacts of the newly started collaboration between the ink start-up and the roaster could not be evaluated at the moment of writing. The efforts of the third coffee shop saved 300 litres of coffee sludge from waste treatment, which is 100% coverage of the disposed sludge by the café.

Specifying learning: The time needed to find the right candidates and to do proper *matchmaking* was underestimated. Even though the waste was free with a proven nutritional value for farming, there seemed to be scepticism. The to be connected value chains were possibly too distanced from each other, increasing distrust. Co-creation from the very start was found to increase the success, as actors stayed longer committed to finding solutions and partners, even after several setbacks. The action researchers took a more coordinating role, and took no role in the negotiation process between possible partners, which seemed to increase the willingness for long-term collaboration. As coffee sludge based mulches have clear fertilizing capabilities, the action researchers expected to see a correlation between the coffee sludge use and the decrease of artificial fertilizers, but were unable to prove this within the research period. However, participants seemed cautiously positive about this effect and expected a future decrease of needing artificial additives thanks to the coffee sludge. Connecting our findings to the aim of repurposing 50% of the coffee sludge waste of the pilot cafés, this measure is considered to be successful.

4.4. Stimulating the use of reusable coffee cups and sustainable farming at the coffee plantations

Diagnosing: At the *end of the chain*, disposable cups for to-go coffees end up incinerated or landfilled after only a short usage time, resulting into serious ecological impacts [3,4]**.** At the *start of the chain*, monoculture has negative effects on soils, biodiversity and economic resilience [73]. A transition

to more sustainable farming practices is costly and time intensive, and it was expressed at the workshop that funds are often lacking. The savings made by cafés for not needing to buy disposable cups (when customers bring their own cups) could be invested in sustainable farming practices in the beginning of the chain, creating a circular loop.

Action planning: Already in the research proposal phase of the action researchers and the client system, the connection of the two problems was proposed. During the workshop and the continuing months, the issues were separated as many approached actors found the system too complex. For an increased use of reusable cups, an awareness week was planned, some weeks after the plant-based milk awareness week. As a means of financing the sustainable farming and reforestation, the social premiums on the coffee kilo price at This Side Up were converted to pay for broader sustainability measures, including more ecological friendly farming. How these premiums were exactly to be spent on ecological aims was to be discussed with the farmers in open and equal talks. A 10-day visit to a pilot farm in the Nariño region in Colombia was made in the final stage of the research, to co-create a system on how the sustainable premiums could best be spent.

Action taking: Preparing the awareness week, experiences from the plant-based milk project taught the action researchers some valuable lessons about such an approach, even though the client system initially pitched this idea itself at the workshop. It was decided to abandon the awareness week. Struggling with obtaining significant investments through the premium system on the coffee kilo price to invest in broader sustainability on the other hand, this approach had to be abandoned as well. The original idea of connecting the issues came back to the table. The connection was fairly straightforward: stimulate consumers to bring their own cups and put the saved expenses on paper cups in a fund, which will invest in sustainable farming practices at farms connected to the importer. It thus simultaneously avoided the production and waste treatment of single-use products, and created new ways of financing sustainable farming. The initial concerns of the cafés focused on the complexity of such a system in day-to-day business, which were solved by adding a button on the tablet-payment systems that many cafés use, which would be called *brought own cup* and would show at the end of each month how many times this button was pressed. Multiplying this number by €0,10 (the rough cost of a paper cup with plastic lid) – café owners could easily transfer the total amount to the bank account of the project. Transparency was guaranteed by developing a website, a monitoring system and connecting individual social media accounts of the participating farmers to it, which would allow participants to follow their efforts directly at the farms. An independent non-profit fund with its own board of legal, financial and implementation experts was also set up. Clear aims were set on how many disposable cups had to be avoided within the first year and how many trees should be planted, next to other concrete ecological goals at the participating farms. A two-edged approach was taken, going *bottom-up* by mobilizing small cafés and increasing visibility of the project – and going *top-down* by engaging big firms and banks to apply this system within their companies. The project got the name *Circular Coffee Fund* and shortly before it was launched, got into a collaboration with an NGO focused on farmer support in developing countries. The NGO, with an extensive network in the corporate world, got the goal to acquire all top-down actors, whereas This Side Up was responsible for all bottom-up participants. In return, the NGO brought in coffee farms from their own network, and the two agreed on splitting all incomes 50-50 on the connected farms in their respective networks.

Evaluating: The *Circular Coffee Fund*, with its own website, legal form, bank account, board and workers group was launched in the 7th month of the 7 month research. Results on the amount of reduced disposable cups and funding collected are therefore too limited. The approached parties received the system with enthusiasm, indicating positive results in the months after the research period. The co-creation sessions with the pilot farm in the Nariño region in Colombia showed a blend of enthusiasm for extra financing, but scepticism towards sustainable farming. Perceived as being more expensive, more labour intensive and generating lower yields, it was agreed to spend the first funds to agronomical trainings to be able to discuss concerns and new practices. Especially older generations were found to be hesitant to change habits and traditions, even when the financial and ecological benefits were presented.

Specifying learning: The action researchers found a (latent) desire of actors across the entire value chain to connect more intrinsically to each other, which was used to boost the enthusiasm in co-creating a solid system. Criticism from the client system was initially taken too seriously; abandoning the original idea and later finding out that these concerns could be tackled. Zooming out and taking a systems approach to the CE was found to be beneficial in situations when the action researchers faced problems. Once a proper value position was found, several weeks were lost to translating it into an easy pitch and simple story, to be able to approach different actors convincingly. Supplementing the value proposition with clear diagrams (as shown in figure 4) was found to make the story more compelling, resulting in enthusiasm and pride to join in on the cause. Finding the right balance between having a systems perspective versus zooming into the specific systems at place was found to be crucial, next to balancing space for co-creation and pushing for solutions. At the other side of the chain, the action researchers met resistance to change farming habits, even though the benefits were clear on paper. A careful process of changing these habits is required, and the action researchers realized that results on the implementation of practices like building a water efficient mill, organic fertilizer use or reforestation would therefore be unachievable on the short term. Taking the set goal of developing an incentive for customers to bring reusable cups to their cafés and reducing disposable cups by 1000 pieces in the research period, is perceived as partially fulfilled. The system is designed, but was too time intensive to design and implement leading to exceeding the 7-month research period. This is also the case for the other goal of developing a financial system for the transition towards ecological farming with an annual value of €1000,-. The system is in place, but no quantifiable results can be drawn yet on its results. Taken together, the time it took to set-up a circular system like this was found to be clear barrier for CE implementation processes.

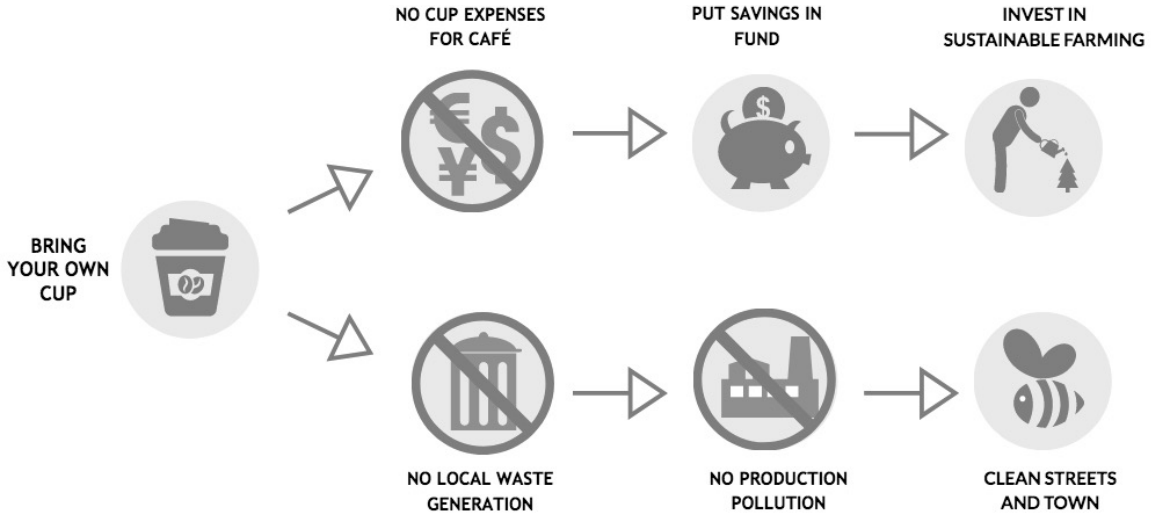

Figure 4: Circular Coffee Fund diagram (by authors)

5. Discussion

5.1. Looking at the projects all together

Approaching a value chain from an actor in the middle (in this case the coffee importer) was found to be of great help to reach as many value chain actors as possible, and enabling uncommon conversations between actors at the both ends of the respective chain. Organizing a workshop on the topic of CE with this broad representation was found to be a good starting point of a CE implementation process: it attracted actors with a general interest and enthusiasm about the topic, which led to willingness towards a procedure of trial-and-error. This co-creation with the client-system from the very start was a crucial element for success, as it created a sense of perseverance to find solutions by the actors involved, even when facing set-backs. Taking a too narrow representation of the client-system translated into a perception of a top-down and forced implementation, whilst

taking a too wide representation leaded to decision-making impairment. Visiting implementation sites, in all parts of the value chain, was found to increase the implementation success as trust towards the CE project and the researchers was increased, supported by taking the local conditions into strong account. Visiting the pilot farm in the Nariño region in Colombia set out to co-create the CE implementation process on site and brought scepticism, intergenerational tensions, and negative perceptions to light, which were not expressed at the initial workshop. However, finding a good representation balance and taking local conditions into account, did not guarantee smooth collaboration towards a broad implementation of CE. It proved to be impossible to implement the CE within a value chain without a strong value proposition with clear financial benefits connected to environmental friendly and social effects. Indirect and long-term financial benefits through marketing efforts were accepted, as long as the direct and short-term financial negative impacts were not too severe. In other words, CE implementation was found to be only successful when a clear-cut business case was presented, though the action researchers heavily underestimated the time to develop and implement such a case.

Even when presenting a strong business case and co-creating the implementation process in thorough ways, CE faces hurdles regarding legislation and innovation. The lack of progressive laws regarding the trading of waste products was found to be a major obstacle that slowed down the CE implementation process drastically. Regarding innovativeness, the coffee value chain expressed a clear desire to use reusable milk containers, but had to accept the fact that the Dutch milk industry could not provide this to date, indicating that some value chains might be more innovative towards the CE than others. This perceived and experienced distance between different to-be-connected value chains was found to be an implementation barrier, and resulted into a sphere of general scepticism towards the other and the CE measure itself. As a consequence, finding committed partners was not easy, possibly because the contacted actors from the different value chain had not gone through the workshop process and were contacted cold. It is in this sphere where a clear mediation role for the action researcher was found to be crucial, assisted by simplified diagrams and easy-to-understand wordings.

The research period consisted of 7 full-time months, though the period needed for going from *action planning* towards proper *action taking* was heavily underestimated. This resulted into not obtaining certain goals like reducing the amount of disposable cups, obtaining a financial value of €1000,- for the ecological fund, and measuring the effects of the ecological farming practices. Future action researchers should be aware of this period and effort it takes to translate a CE idea into a CE business case, co-create it in a bottom-up manner and to build solid intra- and inter- value chain partnerships before actual CE implementation processes can start. On one hand, systems thinking and deeper connections between the different nodes (like farmer to roaster) in the value chain were found to strengthen and accelerate the CE implementation process, where on the other hand a community approach *within* a specific node (coffee shop to coffee shop) was met with resistance. The expressed sense of community was found to be conflicting with the competition element of the independent businesses at times, and lead to resistance to take up action together. The thin line between competition and complementation within a given value chain should therefore be clearly kept in mind when searching for broad support for CE implementation processes.

Maintaining a sustainability balance (financial, social and ecological) through the CE implementation process was found to be challenging to keep in sight at all times. Selecting measures on these criteria in the *problem-diagnosing* phase was found to be very helpful, though it could lead to an overall bias in one direction in case one or more measures failed. This is also the case for finding a proper balance in implementing the CE throughout the entire value chain, from start to end. If all projects on one side had failed, it would have been hard to speak of a proper CE implementation process in a value chain, as this study set out to do. Having a logical framework approach from the very start helped to keep the balance and the individual and overall aims in sight at all times, but could not prevent an eventual bias in the case of implementation failure.

5.2. The barriers and enablers of a successful CE implementation process

Connecting the findings of this study to the CE enablers and barriers found in literature, similarities are found, next to some additions. Similarities in enablers of the CE are: the presentation of a strong value proposition and business case; coordinating from a focal firm; having a progressive company culture; practice based experimentation; taking a systemic and holistic approach; building new networks and partnerships; connecting short-term aims to long-term goals; and co-creation with all actors. Additions to this are the dependence of proper networking skills of both the client system and action researchers in establishing new relationships; taking the on-site implementation situation into account; and using simplified images and diagrams.

Similarities regarding barriers are: having a too weak business case or value proposition; lack of proximity between industries; lack of reverse logistics system and infrastructure; lack of government support and policies; and a too limited co-creation with involved stakeholders. Adding to this, the study found a too top-down approach to be problematic; overestimated a sense of community in the value chain; underestimated the competitiveness amongst some stakeholders involved; and underestimated the time it took to work out legalities. Having a conservative company culture; fearing administrative burdens; and a disinterest in non-core business practices were noted in the course of our study, but no direct relationships can be ascribed to this.

No overlap was found regarding the material composition, quality or quantity. This can be assigned to the fact that the projects chosen started out with materials and propositions that were practical to be reused, instead of trying to solve complex waste streams. This was also the case for high upfront costs, which were avoided in the action-planning phase by the action researchers. All information was provided by the researchers, which helped the respective firms in the implementation process, and neutralized the possible information barrier. This might also be the case regarding the non-alignment of power between participants, which was not encountered. In other words, the use of action research as the methodology tackled some barriers because of the facilitating and assisting role of the action researchers.

Taking these findings together, this study is able to provide a list with seven "dos and don'ts" when implementing the CE in a product value chain, which is shown below in table 3. The list reinforces earlier research (shown in table 1) and adds findings done by our own implementation study.

Do	**Don't**
Present a strong business case and value proposition	Present a weak, not worked out business case
Pick implementers with strong networking capabilities	Connect value chains too far from each other
Co-create with all stakeholders from the start	Co-create at a later stage with few stakeholders
Take on-site implementation situation into account	Overestimate sense of community in value chain
Take coordinating role as action researchers	Underestimate implementation timeframe
Keep triple bottom line in mind	Underestimate competitiveness amongst actors
Use simplified images and diagrams	Take a top-down approach

Table 3: The dos and don'ts when implementing CE

6. Conclusion

This study set out to find out how the CE could be implemented into the coffee value chain and presented action research as a suitable method for CE implementation processes. Its findings are useful for other value chains in the food- and commodity sectors, and can serve as an illustration for *big coffee* actors on how to proceed towards a more sustainable coffee industry. The action research methodology did not provide a proper system to measure the success of particular CE projects, which should be developed in further research. It did provide a framework to identify and test implementation enablers and barriers. Designing projects that make a lasting circular impact takes time – more time than a 7-month research period. Implementing the CE lends itself well for a

longitudinal study, especially regarding its success rates and how to evolve towards full circularity. This study has attempted to do the groundwork for such research, and has provided both academia and practitioners with useful tools for a successful CE implementation process.

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