MSc Thesis

Investigating barriers towards transition into a circular economy: Exploring how online platforms facilitate a global circular economy transition

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1. Abstract

The concept of circular economy shows potentials for changing the current linear economy system into a system in which economic growth will be decoupled from material consumption. Stakeholders involved in circular economy transitions however, face several barriers that first need to be overcome in order to fully facilitate a circular economy transition. Suggestions in circular economy literature to overcome these current barriers include several IT-enabled tools and technologies that can enable collaboration through information sharing and increased market transparency. The enabling tools and technologies mentioned in literature include the use of social media, crowdfunding, crowdsourcing, but also match maker mechanisms like online trading and auction. There are already several online platforms that try to facilitate a circular transition. Even though some authors recognize the existence of circular economy platforms, it seems that they have neglected the opportunity to build grounded knowledge on the specific interface of circular economy and the use of online platforms. Therefore, this exploratory research was done by investigating a sample of 12 circular economy platforms with the goal of theory building. A comparative overview of the offered features and platform characteristics was produced which helped to indicate the current strong and weak points of the circular economy platforms in the research sample. Subsequently, several suggested improvements are discussed, based on a selection of some exemplary platform examples. The overview of the features and characteristics of the circular economy platforms in the sample, helped to identify some distinctive patterns and correlations. Based on these patterns and correlations several propositions where created, together with a suggested circular economy platform typology. This exploratory research on the topic of circular economy platforms can help form the basis for future research towards a more elaborate body of knowledge on the topic of circular economy platforms.

Keywords: circular economy, multi-sided platforms, case studies, theory building

2. Introduction

In the current linear economy system, resources do not move in a closed loop, but go through a material and energy intensive one-way journey of taking, making, disposing of products and resources (Ellen Macarthur, 2013). This linear production system is causing losses of value by underutilizing products and resources, overconsuming energy, and incentivizing planned obsolescence of products (Ellen Macarthur, 2012; 2014). By using the right combination of materials, product designs, and business models, the concept of a circular economy is the exact opposite of a linear economy from several perspectives. A circular economy maximizes the conservation of value of products and resources, and uses renewable energy sources (Ellen MacArthur, 2012; 2013; 2014). The circular economy concept paints a promising picture of decoupling economic growth from material consumption and environmental depletion (Ellen MacArthur, 2012; 2014). Governments (De groene zaak, 2015) and several sustainable businesses are already trying to apply the principles of circular economy (Ellen MacArthur, 2012; 2013; 2014). Despite these efforts, most consumers (Ellen MacArthur, 2012) and small and medium sized businesses (Bastein et al., 2013; Rizos et al., 2015) are still not aware of the circular economy, or do not understand the concept (Rizos et al., 2015). Businesses that actually started to adopt circular economy principles are facing several barriers that are currently inhibiting a circular economy transition (Ellen MacArthur, 2012; 2013; 2014; Bastein et al., 2013; Raksit, 2014).

Based on an extensive literature review in this research a broad range of categories, typologies and formulations of barriers have been taken into consideration. Particularly the literature findings have resulted in grouping of circular economy barriers in six categories which can be summarized as follows:

- (1) education and awareness;
- (2) policies and legislation;
- (3) markets and transparency;
- (4) consumer behaviour;
- (5) finance and risk;
- (6) collaboration and infrastructure

The category of education and awareness is all about making businesses, consumers, (Ellen MacArthur, 2012; 2014) researchers and educators (Bastein et al., 2013) aware of the concepts and value of the circular economy and educating them on how to apply the principles. Policies and legislation are about the need to adapt current policies and legislations in order to start promoting and incentivizing the circular economy instead of favoring and subsidizing sub-optimal practices (Ellen MacArthur, 2012; Bastein et al., 2013; Edie.net, 2015; 1). Markets and transparency includes the sharing of information about supply and demand of resources, innovations, and knowledge. Markets could play an essential role in creating more transparency on for example resources and sustainable products (Ellen MacArthur, 2012; Bastein et al., 2013; ING, 2015). The barriers of consumer behaviour is all about nudging consumers to consume more sustainable, which will often include changing thoroughly ingrained beliefs and habits (Bastein et al., 2013; Ellen MacArthur, 2014; ING, 2015). Finance and risk is all about the ability to raise sufficient capital for the investments that are necessary to shift production methods and business models (ING, 2015; Raksit, 2014). Innovative investments often go hand in hand with higher risk, which should somehow be shared among the value chain instead of one business in the chain (Rizos et al., 2015). Collaboration and infrastructure deals with orchestrating all the puzzle pieces to efficiently collaborate by sharing information and resources, often by using new forms of infrastructures (Ellen MacArthur, 2012; Raksit, 2014). These barriers will be explained and discussed further later on in this chapter (page 7-9).

Besides grouping different barriers to transition, the literature review on circular economy provides a number of suggestions specifically related to the use of online platform technologies in order to overcome the barrier categories mentioned above. Suggestions include IT-enabled transparency and information sharing, using social media, match maker mechanisms (Ellen MacArthur, 2012), trading or auction (ING, 2015; Bourguignon, 2015), crowdfunding (ING, 2015) or crowdsourcing (Ellen MacArthur, 2014) platforms to overcome currently existing barriers. These suggestions for online facilitators have in common that they all fall into the category of on online platforms, in literature better known as multi-sided platforms (Lett, 2015).

Although literature clearly assigns to online platform technologies a key role in facilitating a circular transition, they have never been researched before. This is in contrast with the existence of a broad range of research on offline case studies dealing with circular economy projects, at both company (e.g. Ellen MacArthur 2012;2013;2014) and regional level (Geng et al., 2009; Mathews and Tan, 2011). As a result, a multiple case research, which studies online circular economy projects in the form of online platforms seems to fill an existing knowledge gap in literature.

Mapping the existing circular economy online platforms, and their features and functions, is the chosen method for starting the research on this highly relevant branch of circular economy facilitators. The fact that limited theory exists yet on circular economy platforms asks for theory building instead of testing. The decision to do a multiple case study follows the approach suggested by Eisenhardt and Graebner (2007) who state that theory build from multiple cases is generally more robust, generalizable and testable compared to single case studies. Because of the newness of this research topic and the fact that all the elements and challenges of circular economy are interconnected, the decision has been made to go for breadth instead of depth in order to provide a starting point from which more in depth research can be done. The multiple case study will result in an overview of barriers that are currently already (partially) being tackled by circular economy barriers identified in literature and the platform features and functions currently being offered. A research on the state-of-the-art of multi-sided platform literature and several exemplary non-circular platform case studies may result in reflections on additional circular economy platform features that may help to overcome one or several circular economy barriers that are currently barriers that are currently not - or only partly overcome by circular economy platforms.

Theory building asks for a broad range of literature in order to compare the emergent concepts, theories or hypothesis with existing literature (Eisenhardt, 1989). Therefore, the remainder of chapter 2 will provide an introductory overview of the two relevant literature topics that will be covered in this research, namely circular economy and multi-sided platforms. Chapter 3 will combine the insights from the literature overview into the description of the research objective and the respective research questions. The research design will be provided in chapter 4. Chapter 5 will provide a description of the empirical strategy in which the selection of the research sample is explained, followed by the analysis of the sample in chapter 6. The results of the research can be found in chapter 7, followed by the discussion and conclusion in chapter 8 and 9.

2.1 Literature review: the circular economy

As already briefly explained in the introduction, the concept of a circular economy has the goal of decoupling growth and revenue from the demand of resources (Ellen MacArthur, 2012; 2014). The Ellen MacArthur Foundation (2014) has formulated the following definition of a circular economy; 'A circular economy is an industrial system that is restorative or regenerative by intention and design. It replaces the 'end-of-life' concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse and return to the biosphere, and aims for the elimination of waste through the superior design of materials, products, systems and business models'. The Ellen MacArthur Foundation (2012) and the Dutch ING bank (2015) describe the circular economy as an irreversible trend. This statement is exemplified by the Circular Economy Package¹ which has been published in the beginning of 2016 by the EU, in order to promote circular economy practices from a legislative and policy point of view. Furthermore, figure 8 (later in this report) showing the steeply increasing number of Google searches, clearly shows that there is also an increased interest and relevance outside politics and academics. A multitude of facts, projections and estimations about population growth and resources, show us that a shift in how we deal with waste, resources and consumption is not only desirable, but inescapable. The remainder of this paragraph will start with showing the high circular economy urgency with facts and figures about resource consumption and population growth. This will be followed by facts and figures showing the relevance and potential of the circular economy concept. Thereafter, the main elements and workings of the circular economy will be explained, followed by an overview of the main barriers and challenges.

¹ http://www.europarl.europa.eu/RegData/etudes/BRIE/2016/573899/EPRS_BRI(2016)573899_EN.pdf

Population and resource urgency

The turn of the millennium, introduced a steep increase in the market prices of food and resources (Ellen MacArthur, 2012) (see figure 1). This increase of resource prices is caused by increased demand, exhaustion of easy-to-access reserves, and innovation in financial markets and products (Ellen MacArthur 2012; 2013). These factors increased the commodity prices with almost a 150% between 2002 and 2010, thereby completely erasing the price decline of the previous century (Ellen MacArthur 2014). Even the most conservative estimates project an increase in demand for natural resources of at least a third in the coming decade, with 90% of that increase coming from emerging markets (Ellen MacArthur, 2012). A realistic prediction of longer term global material consumption is that it will have been tripled by 2050, thus during the coming 35 years (Bastein et al., 2013). Professor James Clark (Hunt, 2013) has





Source: Macrobond. Figure 1, Price development of raw materials and resources. Source ING (2015)

analyzed the use and recycling rates of elements from the periodic table and came to a dark conclusion. Clark states that elements like, gold, silver, indium, iridium and tungsten, may be depleted within 5 to 50 years (Ellen MacArthur, 2014).

The current global population is estimated at 7.7 billion, of which only 1.8 billion currently living in middle class (ING, 2015). 15 years from now, in 2030, the middle class is projected to be risen from 1.8 billion towards 4.9 billion (Ellen MacArthur, 2013; ING, 2015). These 3 billion new middle class consumers will all have more money to spend, and will thus want more food and luxury items. The fact that the current global consumption levels already needs 1,5 earths to sustain itself (ING, 2015) explains why the World Bank has described the coming upsurge in consumer demand as a 'potential time bomb' (Ellen MacArthur, 2014). In order to prevent massive shortages, sky-high resource prices, and increasing depletion of natural resources, action needs to be taken better sooner than later. The circular economy concept seems to be the best way to solve, or at least mitigate our current and future problems related to resource demand and environmental degradation.

Circular economy potential

Previous research on circular economy shows that the concept not only shows the promise of more sustainable production and consumption, but also that of real financial benefits, for consumers, businesses (Ellen MacArthur, 2012) and countries as a whole (Bastein et al., 2013). The Dutch Research Centre TNO calculated that expanding the circular economy in the Netherlands will have a positive impact of 7.3 billion euro's, involving 54.000 jobs (Bastein et al., 2013). For the European Union, the material savings will be 380 billion dollar in a transition period, which can increase towards 630 billion dollar in a fully adoption scenario (Ellen MacArthur, 2013). The worldwide material savings potential is projected at over a trillion dollars a year (Ellen MacArthur, 2014). Circular economy business models do not only create financial benefits in the form of material saving, it also show great potential benefits for both consumers and businesses. An exemplary case example is that of a washing machine case described in Ellen MacArthur (2012; 2014). They describe that a low end (2.000 cycle) washing machine costs 27 cents per washing cycle, while a more durable high end (10.000 cycle) washing machine costs only 12 cents per washing cycle. By leasing the washing machine to the consumer, the consumers' barrier of high-up front costs is solved, while the five 2.000 cycle washing machines can be replaced with only one 10.000 cycle machine. This results in 180 kg's of steel savings and 2.5 tonnes of CO2 savings (Ellen Macarthur, 2012). To make the direct benefits more concrete, a circular economy approach of producing and consumer a washing machine would save customers roughly

a third per washing cycle, while manufacturers will earn approximately a third more in profits (Ellen MacArthur, 2014).

The main principles of circular economy

A circular economy distinguishes two separate types of nutrient streams that each have to be managed in a different way. There are the biological (or biotic) nutrients and the technical (abiotic) nutrients (Ellen MacArthur, 2012; 2013; 2014) (see figure 2 below).



Figure 2, The biological and technical nutrient streams of a circular economy (Source: Ellen MacArthur, 2014)

The biological nutrients stream is based upon renewable nutrients that are re-used as often as possible in order to extract maximum value. This chain of re-using a biological nutrients is often referred to as cascading (Ellen MacArthur, 2012; 2013; 2014). After having cascaded a renewable nutrient as often as possible, the goal is to create additional value via the creation of gas and soil nutrients through the process of anaerobic digestion and/or composting (Ellen MacArthur, 2013; 2014; Bastein et al., 2013). The biogas resulting from anaerobic digestion can then be used as a renewable energy source (Bastein et al., 2013) while the remaining substance can be used as input for new natural products in the form of all natural fertilizer for soils or as feed for livestock (Ellen MacArthur, 2012; Bastein et al., 2013). Because of the natural and renewable nature of this resource stream, leakage into the environment is not a problem, and even done deliberately (Bastein et al., 2013).

Technical nutrients consist of non-renewable resources, therefore leakages into the environment should be avoided at all cost (Ellen MacArthur, 2014). The main goal of technical nutrients is to reuse them as often and as long as possible (Bastein et al., 2013). In order to optimize the reuse of products and its technical nutrients it is essential that the decisions about material use and product design are made with the end-of-life of the product in mind (Ellen MacArthur, 2014; ING, 2015). This can be done by designing a product in such a way that it is easy and cost-effective to maintain, repair, refurbish and remanufacture the product (Ellen MacArthur, 2014; Joustra et al, 2014). For optimal recycling potential of pure resources at the end of

all these stages, it is important to not mix resources in such a way that they cannot be separated again (Ellen MacArthur, 2012). This is because the mixing of technical nutrients results in what Braungart and McDonough (2007) call 'monstrous hybrids'. These mixed nutrients result in lower quality resources that have less applicability options and therefore produce lower value, resulting in down-cycling (Ellen MacArthur, 2012) by the public often confused with the more familiar concept of re-cycling. In order to give manufacturers the incentive to actually re-design their products for durability, and re-use the resources included in those products, new business models are needed (Ellen MacArthur, 2013). When manufacturers stay the owners of the product, they will be better able to re-use the precious value and resources imbedded in the product (Ellen MacArthur, 2012). The fact that the producer stays the owner and thus the party responsible for the service delivery of the product, incentivizes the elimination of planned obsolescence of products (Ellen MacArthur, 2012).

The circular economy principles around four distinctive sources of value creation (Ellen MacArthur, 2012; Bastein et al., 2013). These four sources are (Ellen MacArthur, 2012; 2013; 2014):

- 'the power of the inner circle',
- 'the power of circling longer',
- 'the power of cascaded use',
- and 'the power of pure cycles'.

The **power of the inner circle** refers to the fact that the shorter the circle (see right side, figure 2) the more value (in the form of energy, man- and machine hours, and complexity) stays inside the product (Ellen MacArthur, 2012; Ellen Macarthur, 2014). The **power of circling longer** refers to de-incentivizing planned obsolescence and a situation in which products are repaired, maintained, refurbished and re-sold second hand in order to maintain and extend value (Ellen MacArthur, 2012; Ellen Macarthur, 2014). The **power of cascaded use** refers to the biological nutrient cycle in which for example clothing gets repaired, resold second hand, followed by the re-use of the cotton fibers (Ellen MacArthur, 2014) and the final resource destination as material used as insulation in walls or as stuffing for chairs (Ellen MacArthur, 2012). The **power of pure cycles** refers to avoiding the mixing of materials in order to keep resources in their purest and thus most valuable form. All those four principles help to maintain the product and resource value, thereby lowering the need for extraction of non-renewable resources (Ellen MacArthur, 2014; Joustra et al., 2013). There are several barriers that first have to be overcome in order to be able to fully apply the four sources of value creation.

Main barriers and challenges

The road towards a circular economy comes with several challenges as already shortly mentioned in the introduction. Because of the absence of a ready-made categorization of circular economy barriers, the challenges have been divided into six categories, based on the reading of literature and scanning of relevant documents. The six barrier categorization consists of; (1) 'education and awareness', (2) 'policies and legislation', (3) 'markets and transparency', (4) 'consumer behaviour', (5) 'finance and risk', and (6) 'collaboration and infrastructure'. Although slightly arbitrary, the barriers are presented in chronological order, the sequence thus says nothing about the importance of the individual barriers mentioned below.

Education and awareness

Education is essential for both the increase of general awareness about the circular economy among the public and businesses, but also in order to create skills that are necessary to drive circular innovation (Ellen MacArthur, 2012; 2014). Universities and design schools need to incorporate circular economy into their curriculum (Bastein et al., 2013) to build awareness and create a skill base for circular innovations (Ellen MacArthur, 2012). Ellen MacArthur (2012) states that social media networks have the potential of mobilizing millions of users around a new idea simultaneously, and can thus create consumer awareness and concrete action. Besides the topic of creation of knowledge and awareness about the circular economy, the government also seems to have room for improvement on the topic of taxation policies and legislations since they often seem to still favor the linear system as is described in the next section.

Policies and legislation

The fact that changing the policies and incentives in favor of the circular economy is not as easy as people might think can be seen in a recent example at the European Union level. Although the European Union recently came up with a proposal for the Circular Economy Package, it was scrapped in December 2014, because it did not address the whole circle (Bourguignon, 2015). The EU even asked the public to participate in the generation of ideas for the improvement of the Circular Economy Package (Edie.net, 2015; 2) thereby already applying the Ellen MacArthur (2014) suggestion of crowdsourcing. A new circular economy action plan is planned to be put forward by the end of 2015 (Bourguignon, 2015; Edie.net, 2015; 2; Rizos et al., 2015). Meanwhile, authors are suggesting countless legislative and policy improvements. An example is the suggestion to rebalance the tax burden from taxing labor towards taxing materials and energy usage (Ellen MacArthur, 2012; Edie.net, 2015; 1). This will make the labor intensive recycling and refurbishing practices more cost efficient while at the same time discouraging excessive material and energy usage. A simpler alternative could be to lower the tax rate on circular services such as repairs and re-using of components (Bastein et al., 2013). Some even suggest to tax lost value instead of added value (Bastein et al., 2013). By forcing the publishing of CO2 embeddedness in products, consumers might become more aware of their buying decisions (Edie, 2015; 1). Lower tax rates on low carbon products and pricing all externalities into the price of a product might be another solution to trigger changes in consumer behavior (Preston, 2012).

Not only taxes need to change, there is also a need to change legislation that is currently blocking circular developments. The Dutch Environmental Management Act, chapter 10 from March 2011 has already made some steps forward by not applying waste regulations on some agricultural and forestry wastes (Bastein et al., 2013). There are however still many laws on food security (Bastein et al., 2013; ING, 2015), bio-based products, and minerals that are currently obstructing the effective use of raw materials (Bastein et al., 2013). The government should 'change the rules of the game' by among others, stopping the subsidies on incineration, applying appropriate landfill fees, and minimum return and collection quotas, and by phasing out the use of toxic materials that impair recycling (Bastein et al., 2013). Although not mentioned in circular economy literature, an online platform application to overcome policy and legislation barriers might be the concept of e-governance, in which governments involve consumers and businesses in policy and decision making through the use of internet technology (Nam, 2014). Not only the change of laws and legislation will support the circular economy transition, higher market transparency might be an even more powerful mechanism.

Markets and transparency

Many businesses do not know the exact origin or composition of the raw materials they use in their production process (Bastein et al., 2013). In order to unleash the 'power of pure circles' as mentioned earlier,

suppliers need to become more transparent about the composition and ingredients of their materials (Bastein et al., 2013). Another promising angle of market transparency is that of clear insights into supply and demand. A clear increase in transparency at the consumer market came with the creation of markets like eBay, Craigslist, and Amazon who led the way to an increasing amount of second-hand goods traded online (Ellen MacArthur, 2012; Bastein et al., 2013). Although consumers are very used to online second hand markets, many businesses are not aware that they could reduce their waste or even earn money with it by working together with other businesses in the chain (Bastein et al., 2013; Ellen MacArthur, 2014). A closer look at the circular economy literature identifies several statements about the potential of matching supply and demand through the use of platforms, auctions, intermediaries (ING, 2015; page 41), and match maker mechanisms (Ellen MacArthur, 2012; page 58) that are suggested for higher market transparency and making use of arbitrage opportunities (Ellen MacArthur, 2012; page 82). For a total transition from consuming a product towards consuming a service, consumers will have to change their behaviour.

Consumer behaviour

All articles on the circular economy describe the fact that there will be a shift from owning and consuming a product, towards the consumption of a service (Bastein et al., 2013; Ellen MacArthur, 2014; ING, 2015). Although most consumers are not yet actively aware that they are moving towards more circular behaviour, many recent developments show that consumers are becoming more circular. The emergence of lively second-hand markets like eBay and Marktplaats.nl show that consumers are more willing and able to re-use products (Bastein et al., 2013). The high growth figures of the sharing economy, which concept has been introduced by platforms like Uber and Airbnb shows that consumers will change their behaviour if the right incentives are provided. Current millennials (aged 21-34) show the highest participation in the sharing economy according to ING (2015). This is in line with the statements of Ellen MacArthur (2014) and Bastein et al. (2013) that the younger 'generation Y' is less preoccupied with possessions and are displaying a preference of access over ownership. In order to quickly shift towards real circular consumption however, some changes need to take place. Consumers for example still tend to look only at the upfront price of a product, and tend to ignore the lifecycle costs (Bastein et al., 2014; Ellen MacArthur, 2014). Within a circular economy, consumer leasing contracts will become more common and familiar to consumers (Bastein et al., 2013; Ellen MacArthur, 2014). The shift towards leasing instead of owning will help to solve the barrier of high up-front costs for better quality products (Ellen MacArthur, 2012).

The presence of consumers on social platforms provides the ability to mobilize millions of users around a new idea simultaneously (Ellen MacArthur, 2012). On both a social media, and personal level, consumers can advocate responsible products and practices and thereby incentivize manufacturers to produce in a more circular way (Ellen MacArthur, 2012). When consumers will increasingly make use of products as a service, this will result in higher risk and up-front costs for the businesses that provide those leased product

Finance and risk

An important part of a circular business model is that consumers are consuming a service instead of buying a product (Bastein et al., 2013; Ellen MacArthur, 2014). The positive elements of this new way of consumption is that the producer remains the owner of the product and the resources inside it (Ellen MacArthur, 2012; 2014). When consumers do not buy the product anymore, but pay small monthly payments instead, this has massive influence on the financial situation of a company (ING, 2015). The need to prefinance the costs of the products that are leased to consumers, leads to increased capital needs (ING, 2015; Raksit, 2014). A shift towards leasing instead of selling increases the risk for businesses. In order to reduce the bankruptcy risk of clients, businesses can use differentiation of risk premium based on personal financial situations, ask for a deposit, and spread their customer portfolio (ING, 2015). Financing needs of circular economy businesses will ask for different forms of financing. Equity will for example be more appropriate for unproven and risky technologies, while crowd funding (Rizos et al., 2015) might be suitable if there is a strong community aspect (ING, 2015). Figure 3 (source: ING, 2015, page 44) shows that the Dutch ING bank has the idea of an online platform to facilitate businesses in their circular economy financing needs.



Figure 3, Circular Economy Financing Platform According to the ING Bank (Source: ING, 2015)

While banks like ING bank are seeking collaboration with crowdfunding platforms, collaboration between businesses and supply chains in general will be an essential element for the creation of a successful circular economy transition.

Collaboration and infrastructure

In order to create a circular economy there is a need for cross-chain (Ellen MacArthur, 2012; 2014), and cross-sector collaboration (Ellen MacArthur, 2012; Raksit, 2014). For this cross-chain and sector collaboration to work, it is important that businesses and sectors collaborate on the creation of product standards and guidelines (Ellen MacArthur, 2012; Raksit, 2014). New circular economy business models, create the need for the reverse logistics of products and resources (Ellen MacArthur, 2012; 2014). To make the reverse logistics possible, and to benefit from economies of scale, large scale collection are necessary (Ellen MacArthur, 2012; 2013; 2014). New material tracing technologies seem promising facilitators to this problem (Ellen MacArthur, 2012; 2013; 2014). There will be a need for a centralized track and tracing technology that enables consumers to easily return their products and at the same time helps businesses to return the products that they produced by storing all the bar-, or RFID codes of the products and materials made. It makes sense to store this information for example in a secure cloud-based platform, on which all stakeholders can monitor their in and out flow of products and resources.

After having investigated the state of the art on circular economy literature, the next section of this chapter will investigate the state of the art on multi-sided platform literature. The chapter will end with an overview of the commonalities between circular economy literature and multi-sided platforms literature.

2.2 Multi-sided platforms

Just as the concept of circular economy, online platforms are also a relatively recent development and field of study (Evans, 2011). In previous sections it has already showed that online platform technologies can provide solutions towards overcoming several of the barriers identified so far but have not been researched in the context of facilitating a circular economy transition. But what actually entails a (multi-sided) platform?

Hagiu and Wright (2015, p.4) rightfully mention that 'existing definitions of MSPs [multi-sided platforms] suffer from excessive specificity, over-inclusiveness, or being too vague to be of use'. For this reason we would describe platforms as an online interface where several stakeholder or user groups can find each other and interact. An online platform is almost inherently multi-sided, since most platforms have multiple distinctive user groups, most of which revolves around supply and demand. Therefore, literature tends to define online platforms as two-, or multi-sided, depending on the number of users on the platform. These 'sides' refer to the users or stakeholders that are using the platform. Facebook for example, is a multi-sided platform, since it has at least four user groups, namely; (1) people posting, (2) people reading other ones posts, (3) advertisers trying to sell through Facebook adds, and (4) websites using the Facebook interface for example for easy sign up. This paragraph about multi-sided platforms will provide a broad view on multi-sided platforms, thereby following the case study advice of Eisenhardt (1989). The creation of a broader view on online platform literature will start by introducing the state-of-the-art definitions, elements and issues about multi-sided platforms (from now on abbreviated as MSP's) in order to lay the foundation for the multiple case study research. At the end of this paragraph we will have paved the road for more clarity and insight on the broad scope of MSP literature. This broad base of knowledge and insights on MSP's might later on prove helpful in identifying solutions towards overcoming some circular economy barriers. First of all, the term MSP, will be defined based on definitions, followed by some common MSP elements. Thereafter, the most important issue of MSP's will be provided.

Definition

There are three main definitions of multi-sided platforms (Lett, 2015). (i) The **existence of cross-network externalities** is the first definition and is stated by Evans (2003). (ii) Rochet and Tirole (2003) base their definition on **the ability of the platform to influence the volume of interactions by changing the pricing** structure. Later, a useful addition to the two previous definitions was made by Hagiu and Wright (2011). They state that multi-sided platform primarily create value through (iii) the enabling of direct interactions between two or more distinct types of customers who are all affiliated with the **platform**. This third definition clearly rules out the reseller format of for example supermarkets (Lett, 2015). Thus, MSP's use cross-network externalities, are able to influence interaction volume through the use of pricing mechanisms, and facilitate direct interactions between sides that are directly affiliated with the platform. Possible unclear terms will be explained in more detail during the remainder of this paragraph.

Some common elements

Literature study shows several elements that are unanimously agreed upon as important MSP features. First of all, MSP's fulfill an intermediary role (Evans, 2003; Eisenmann and Hagiu, 2008; Thomas et al., 2014) by connecting two or more distinct (Evans, 2008; Hagiu and Wright, 2015; Staykova and Damsgaard, 2015), and interdependent sides (Muzellec et al., 2015) who are all affiliated with the platform. Because of their intermediary role, MSP's have no ownership over the products or services that are traded (Thomas et al., 2014). Secondly, MSP's tend to minimize the transaction- (Piezunka, 2011), coordination- (Evans, 2003), and searching costs (Hagiu, 2014) by enhancing market efficiency (Thomas et al., 2014), enabling matching (Evans, 2008; Piezunka, 2011) and providing direct- and indirect network effects (Evans, 2008; Hagiu, 2014). MSP's also tend to have a certain infrastructure, consisting of rules and facilities that enhance effectiveness and promote fair behaviour (Eisenmann and Hagiu, 2008; Thomas et al., 2014).

Getting all sides on board

Before MSP's can provide all the efficiency benefits as mentioned above, they tend to face several problems related to attracting and growing the different user groups of the platform ecosystem. This most mentioned problem of MSP's is called the chicken-and-egg problem (Evans, 2003; Hagiu, 2014; Muzellec et al., 2015).

Some authors also refer to this problem as the catch-22 problem (Hagiu and Wright, 2013; Eisenmann and Hagiu, 2008). Simply put, this most common and important problem is about getting both sides on board. The one side of a platform tends to only benefit from the platform in the existence of the other sides, and vice versa. This positive interdependency on 'the other side' is called the indirect- (Evans, 2008; Piezunka, 2011; Hagiu and Wright, 2015) or cross network effect/externalities (Staykova and Damsgaard, 2015; Hagiu, 2014) of platforms. When more people on 'the same side' however add value (e.g. with faxing machines), this is called a direct network effect or same side effect (Evans, 2008; Staykova and Damsgaard, 2015). Since MSP's connect two or more sides, the positive interdependency of the other side(s) has the highest relevance. In order to create self-perpetuating network effects on a platform - meaning that more and more people will join both sides – a tipping point or 'critical mass' has to be reached quickly (Evans, 2008; Muzellec et al., 2015) where the platform 'ignites' so to say (Evans, 2013). The question remains how the chicken-and-egg problem can be solved.

Solving the chicken-and-egg problem

The chicken-and-egg problem of MSP's can be tackled with a successful combination of two strategic angles, namely the pricing (Evans, 2003; Hagiu, 2014; Staykova and Damsgaard, 2015) and entry strategy (Evans, 2003, 2008, 2013; Piezunka, 2011). The most often mentioned strategy in overcoming the problem of an 'implosion' of the platform because of lack of 'another side' is to 'subsidize' one side of the platform (Evans, 2003; Parker and Alstyne, 2005; Hagiu, 2014). Facebook and Google used this strategy of offering a free service and thereby build a huge audience which attracted the 'other side' in the form of advertisers (Holzmann et al., 2014). Amazon however, started with buying and selling books to prove the concept and eliminate the risk for the book publishers. Only after building a customer base - thereby proving the concept – transferred Amazon most of the risks and responsibilities back to the publishers (e.g. Hagiu and Wright, 2013). The subsidizing and vertical integration strategy are most common. Other less common entry strategies are among others, one sided, or two sided pre-commitment, using a single or double marquee, simultaneous entry or becoming a vendor/merchant (Evans, 2008). These strategies will however not be discussed in detail, since that does not serve the function of this thesis. There are some other important MSP problems, which will now be described shortly.

Other problems and issues

Other issues that often occur at MSP's have to do with multi-homing, balancing interests, and governance issues. Multi-homing means that users are using several competing platforms at the same time (Evans, 2003). Solutions to users at competing platforms could be vertical integration or exclusivity contracts (Eisenmann and Hagiu, 2008). When one side of the market exclusively engages at a single platform, that platform becomes the industry bottleneck (Evans, 2013; Piezunka, 2011) which increases pricing power and the ability to attract customers (Piezunka, 2011).

The problem of the balancing of interests might be that there is a power imbalance between stakeholders (Keijzer-Broers et al., 2015) or supply and demand (Evans, 2003; Hagiu and Wright, 2013). Short term profit maximization might lead to a decrease on one side of the platform (e.g. too much advertisements) (Evans, 2008; 2013; Hagiu, 2014).

Governance issues revolve around rules about access, interactions, preventing negative externalities and creating trust. Access and interactions is about who is allowed to join and what are the different sides allowed to do (Staykova and Damsgaard, 2015). Governing certain rules can cause high technological or operational costs, outsourcing to the users (e.g. Airbnb and eBay) might therefore be a solution (Hagiu, 2014). Negative externalities include congestion on one side of the platform, too much competition on the platform, or bad behaviour from users. Uncertainty about the reliability and quality of the other side might lead to low levels

of trust. A feedback or rating mechanism (e.g. eBay, Airbnb, and Uber) can help to increase and enforce trustworthiness, thereby overcoming the problem of trust (Hagiu and Wright, 2015). MSP's create value and profit by managing and solving these problems (Evans, 2013).

Multi-sided platform categories

After having investigated the relevant literature on multi-sided platforms it is also relevant to know the state of the art on multi-sided platform categorization. Thereafter, the MSP (multi-sided platform) categories that are relevant to circular economy platforms will be identified. Based on literature study, four main MSP categories have been identified. These four categories are described in table 1 below.

Multi-sided	Category description
platform categories	
Hard- and software	Hardware can be game consoles (e.g. Xbox) at which the producer of the console needs
	to arrange the supply of a sufficient number of games often years before the game or
	new console will be launched. Software can be Android for mobile devices who need
	to incentivize app builders to build apps to serve future customers (Lett, 2015).
Transaction systems	The most well-known transaction system is a credit card. A consumer will only use a
	credit card if it is an accepted paying method at a large number of businesses.
	Businesses however, only want to invest into the credit card system and infrastructure
	if there are enough consumers using it (Lett, 2015).
Audience makers	These are search engines who bring together two parties by providing the customer
	with search results including the third party advertisements. The same principle works
	for content and social media platforms (Evans, 2003; Lett, 2015).
Market makers	These are trading and auction platforms that have to solve the chicken and egg problem
	of creating a critical mass on both the supply and demand side of the platform. If one
	of the two sides is too small, the platform will collapse because of the absence of
	indirect network effects. (Evans, 2003; Lett, 2015).

Table 1: Multi-sided platform categories

Source: based on authors filed literature study

The balancing act between simultaneously creating supply and demand in order to reach a critical mass can be seen as the common denominator between the circular economy and MSP's. Consumers will not use circular products and services when companies do not produce them yet, and companies will not transform towards working according to the circular economy concept unless consumers are asking for it. From the perspective of barriers towards a circular economy, it can be reasoned that the market maker-, and audience maker platforms seem to have high practical relevance because they provide marketplaces and more transparency and have the potential of informing and educating people and businesses which covers most of the topic of the barriers currently identified in the previous section. Since circular economy literature does not show evidence of a need for a change in hard- or software or the way monetary transactions take place, the focus of the MSP case studies will be on exemplary cases from the audience- and market maker category.

Table 2 presents an overview of the common elements between circular economy literature and multi-sided platform literature. Three common categories have been created, namely the concepts of (i) 'supply and demand', (ii) 'increasing scale', and (iii) 'community and networks'.

Table 2: Literature commonalities between circular economy and multi-sided platforms

Commo	Circular Economy literature	Multi-sided platform literature
nalities	2	•
Supply	Valorizing supply chain waste by selling it	'Multisided market platforms alleviate
and	to others'. (Raksit, 2014)	bottlenecks for buyers and sellers by
demand		facilitating their transactions with one
	build matchmaker businesses and profit	another and generate value for buyers and
	from arbitrage' (Ellen MacArthur, 2012; page	sellers through enhanced market
	82)	efficiency' (Thomas et al., 2014)
	Find transparent ways to match supply and	Platforms solve a transaction-cost
	demand for example through online	problem that makes it difficult or
	platforms, auctions or intermediaries'.	impossible for agents in different groups to
	(ING, 2015)	get together' (Staykova and Damsgaard,
		2015)
	The move towards a circular economy	
	represents an additional transitional step that	'Successful MSPs create enormous value by
	requires chain optimization at the source.	reducing search costs or transaction
	There are notably few examples of this	costs (or both) for participants' (Hagiu,
	optimization, which is in part attributable to	2014)
	the complex value chains that characterize	
·	our global economy (Bastein et al., 2013).	
Increasi	One of the 8 challenges towards a circular	Once a platform achieves critical mass,
ng scale	economy is building a critical mass (Raksit,	to grow by attracting more members. That
	2014).	is once a platform reaches critical mass it
	leading by example and driving scale up	'ignites' in the sense that it is propelled
	fast' (Ellen MacArthur 2012)	forward by its own momentum from
		positive-feedback effects. (Evans, 2013).
	'Scale really matters in the reverse loop,	
	improving the marginal cost position for	'Many, but not all, MSPs also exhibit
	collection and remanufacturing operations	economies of scale – their average cost of
	and fetching better prices for sales of larger	serving a customer (on a given side) or of
	quantities' (Ellen MacArthur, 2012).	enabling an individual transaction declines
		with the total number of customers that
	The key is to tame materials complexity by	participate or transactions that are enabled
	defining and using a set of pure materials	(Hagiu, 2014)
Commu	TT enabled transparency and	Firms use the internet to provide
nity and	information sharing match maker	information to provide connectivity and
network	mechanisms awareness raising in general	community to allow transactions and to
s	public and business community' (Ellen	share cost reductions' (Muzellec et al.
-	MacArthur, 2012; page 58)	2015).
		,
	'there are social networks now that can	Facebook (Staykova and Damsgaard, 2015;
	mobilize millions of users around a new idea	Holzmann et al., 2014; Hagiu, 2014; Pallis
	simultaneously – from motivating	et al., 2011; Evans, 2008; Piezunka, 2011;
	consumer awareness to facilitating	Evans, 2013)
	concrete action' (Ellen MacArthur, 2012).	
	Information technologies (IT) play a key	
	role in enabling the transition towards	
	circular business models. E.g. tracing	
	materials and products, organize reverse	
	logistics and accelerating innovation	
	(crowdsourcing and information sharing)	
	to mining big data' (Ellen Macarthur, 2014).	

Many companies have adopted access-over-ownership business models to appeal to the new consumer mindset and profit from using idle capacity in the economy. Among the best known are Airbnb, Lyft, Zipcar' (Ellen Macarthur, 2014).	Airbnb (Hagiu, 2014; Hagiu and Wright, 2015)
"a lively second-hand market (the success of sites such as eBay and Marktplaats.nl being prime examples) show that society is capable of moving towards a more circular economy" (Bastein et al., 2013).	Ebay (Hagiu and Wright, 2013; Holzmann et al., 2014; Hagiu, 2014; Hagiu and Wright, 2015; Evans, 2003; Lett, 2015; Piezunka, 2011; Evans, 2013)
'A fundamental driver of this changing economy is technology' . (Raksit, 2014).	

Source: based on authors filed literature study

It can be concluded that there are several barriers towards the circular economy on the category of supply and demand. There is a clear need for the creation of markets, for example to valorize waste materials. This can be done by the creation of matchmaker mechanisms that can profit from current arbitrage opportunities in the marketplace. There is also a strong need to solve the complexity in value chains. All these circular economy problems can be solved by multi-sided platforms, because they can increase market efficiency (better matching of supply and demand). MSP's can also alleviate bottlenecks and reduce search costs, which will lower complexity in the market and will therefore make it easier for different parties to get in contact with each other.

The need for the creation of scale is one of the challenges towards the success and cost-effectiveness of a circular economy. Multi-sided platforms have the same need for the creation of a critical mass in order to 'ignite' and move towards the needed economies of scale in order to compete in the market. The fact that these two literature topics both acknowledge the importance of increasing scale and reaching critical mass, makes it interesting to see if there are certain literature findings that can complement each towards the creation of a circular economy with the help of multi-sided platforms.

The circular economy literature has high expectations of the use of IT, social networks, access over ownership, and online markets in order to create more transparency, awareness, and a changing consumer mindset. The MSP literature also confirms that platforms can create more connectivity and community. The main examples that are mentioned in MSP literature are Facebook (social network), Airbnb (access over ownership) and Ebay (online marketplace). These three examples perfectly fit into the circular economy description of social networks, new business models, and online markets.

3. Research Objective

The literature review shows that the concept of the circular economy seems to be a highly promising perspective for solving the environmental, social and economic challenges that our world is facing today. The way towards a circular economy transition however, seems to be paved with several barriers that are slowing down the progress towards real sustainable value. Although the circular economy literature proposes several online platform solutions, it is not clear if circular economy platforms are actually applying all the proposed platform solutions as mentioned in the introduction. The four proposed platform solutions were (1) IT-enabled transparency and information sharing, (2) the use of social media to create awareness and create communities, (3) match maker- or trading or auction mechanisms in order to connect supply and demand, and (4) using crowds for financing and wisdom in the form of crowdfunding and crowdsourcing.

Besides that, it is not clear to which degree circular economy platforms can follow principles derived by research and best practices of online platforms. This lack of knowledge and conceptualization suggest that there is a clear research gap that needs to be filled. Because circular economy platforms have received limited attention in literature so far, there is no clear overview of the currently existing platforms and their functions. The fact that no prior research is available on the topic of circular economy platforms resulted in the decision to go for breadth instead of depth, thereby providing a starting point from which more in depth research can be done in the future. Therefore, the research objective was to start a process of analysis and critical reflection on circular economy platforms by creating an extensive list of existing circular economy platforms and their features and functions. This list will then help to understand whether circular economy barriers can be overcome by principles and functions of existing circular economy platforms, or that other online platforms might provide possible solutions. Figure 4 shows a schematic description of the research and its identifiable phases.



Figure 4, Schematic overview of the research phases

Phase 1 shows a literature research on both circular economy and multi-sided platforms. Both literature studies result in platform lists. The circular economy literature also identifies circular economy barriers. The goal of phase 2 is to compare the features and functions of the circular economy platforms from the list, to the barriers and suggestions identified in literature. When the gaps between the barriers and suggestions in literature and circular economy platform in practice are identified, phase 3 will use other non-circular platform cases for reflections on which features and functions might help to overcome the identified gap. Based on the schematic description, the following research objective has been formulated as follows:

Investigating the barriers towards a circular economy, and building an extensive list of circular economy platforms with their current contribution(s) towards overcoming the identified barriers. Comparing the contributions of circular economy platforms with the barriers identified, and reflecting on overcoming possible gaps by using state-of-the-art online platform technologies identified from relevant case studies.

The first research question has the aim of identifying the circular economy barriers, and identifying which circular economy platforms exist and how they contribute towards overcoming these barriers.

Research question 1. What are the main barriers towards a circular economy transition and how are current circular economy platforms contributing to overcome these barriers?

Sub question 1.1 What is circular economy and what are the main barriers towards its transition?

Sub question 1.2 Which online circular economy platforms do currently exist and how do they contribute to overcome barriers to transition?

The second research question tries to identify how existing knowledge on online platform features related to exemplary non-circular case studies can be used to tackle circular economy barriers to transition.

Research question 2. How can exemplary non-circular platform cases be used to facilitate the circular economy transition?

Sub question 2.1 Which exemplary platform cases may provide solutions to translate circular economy principles into practice?

Sub question 2.2 How can exemplary online platform features and functions be used to improve the effectiveness of circular economy platforms?

The next chapter will describe the methods that will be used in order to answer the research questions mentioned above.

4. Research design

This chapter on methodology will describe the rationale for the chosen research strategy, which will be followed by an explanation of the research framework, the research methods, and the research analysis.

Research strategy

The objective is to analyze circular economy platforms from the perspectives of circular economy barriers that are identified in literature. This approach will reveal to what extent the desired theoretical solutions compare with the reality of the solutions that circular economy platforms are currently offering. Case study research to build theory is best applied in the early stages of research on a certain topic (Eisenhardt, 1989). The creation of theory using case studies is especially well-suited for new topic areas since it does not rely on prior literature or evidence (Eisenhardt, 1989). Since this research has the goal of creating a broader view of the phenomenon of circular economy platforms instead of an in-depth view, multiple case comparison is more appropriate than single case research (Cunningham, 1997; Eisenhardt, and Graebner 2007). Multiple case research also tends to be more robust and generalizable compared to single case studies (Eisenhardt and Graebner, 2007) and is therefore more suited to function as theory to base future research on. The exploratory nature of theory building from case research provides - and even necessitates - freedom to make adjustments during the research (Eisenhardt, 1989; Cunningham, 1997). Constructs, definitions and measurements tend to often emerge from the analysis process itself, rather than specified in advance (Eisenhardt, 1989). This results in the fact that theory building research from cases has a frequent overlap between the collection and analysis of the data (Eisenhardt, 1989). Despite these variable theory building features, the research framework below shows the initial research framework.

Research framework

Comparison of a broad range of related topics is essential for the process of theory building (Eisenhardt, 1989). Therefore, the research will start by analyzing the state of the art literature on circular economy and multi-sided platforms. This literature research will have two main results. First of all, an overview of all the current barriers of a circular economy according to literature, including several platform suggestions. The second result will be an initial list of circular economy platforms mentioned in literature. In order not to miss important circular economy platforms, the platform list will be extended by asking for additional circular economy platform suggestions from circular economy experts. Analyses of the online circular economy platforms from the list will result in a tabulation of several platform aspects that will emerge as relevant and appropriate during the investigation. The overview of the several aspects, concepts and constructs from these platforms will provide common and unique platforms elements which might already provide relevant insight into this virgin research topic.



By comparing the barriers identified from literature with the functions that circular economy platforms provide in practice, possible gaps might be identified. This identification of one or more gaps will result in case studies on non-circular economy platforms with the goal of finding extension features for circular economy platforms. The resulting findings and reflections will be discussed with circular economy experts and platform owners with the goal of receiving plausible explanations, and increasing or adjusting insights from the study from both an expert and practical point of view.

Research methods

As already mentioned, the research methods will include desk research in the form of a literature study on multi-sided platforms and circular economy. While developing theory, random selection of cases is not necessary, not even preferable (Eisenhardt, 1989). Therefore, the circular economy platform cases will not be selected randomly, but selected based on their features (Eisenhardt and Graebner, 2007). For the analysis of the online circular economy platforms, observations will be used to analyze the individual platforms and its content. Triangulation is an often mentioned tool to improve the strength and robustness of findings (Eisenhardt, 1989; Cunningham, 1997; Verschuuren and Doorewaard, 2010). Triangulation of researchers is one type of triangulation that can enhance confidence in findings, especially when one investigator is immersed in case details and the other one has a more objective eye to the evidence (Eisenhardt, 1989). The fact that the supervisor of this research project contributes to the analysis and interpretation of the case evidence already results in some form of triangulation. Triangulation of methods is another method to provide more confident constructs and hypotheses (Eisenhardt, 1989; Cunningham, 1997). By using literature suggestions for online platform features and combining these with observations of platforms in reality, already some kind of triangulation takes place. By verifying the findings with platform owners, the influence of personal interpretations of the single researcher are at least partly corrected by opinions and viewpoints from other parties. The fact that these parties are platform owners makes the findings on circular economy platforms even more robust and generalizable.

Research analysis

During the analysis of the multiple platform cases, constructs, definitions and measurements will occur which will be translated into clear tables showing the results. During the analysis of each platform case, within-case analysis (Eisenhardt, 1989) will result in descriptions of the individual platforms, which will form a central element for the generation of insight further on in the analysis process. When several cases have been analyzed and relevant constructs, definitions and measurements have been tabulated, the analysis of cross-case patterns (Eisenhardt, 1989) can start (Cunningham, 1997). Cross-case patterns will be found by selecting categories or dimensions and to subsequently look for intergroup similarities and differences (Eisenhardt, 1989). For the analysis, it is essential to know when to stop adding cases and when to decide to stop iterating between theory and data (Eisenhardt, 1989). The addition of cases will stop when all cases have been analyzed or when a clear point of saturation has been reached. Seen the fact that the current list of circular economy platforms counts twelve cases, implies that the end of the list will likely be reached faster than clear saturation will be reached. Iteration between theory and data will stop after saturation has been reached and not much new insight is being added per iteration. The next chapter will provide an overview of the expected results that might result from the saturation of cases and iterations.

Online platforms list

Below is a non-exhaustive overview of online platforms. The platforms fall into the category of market makers, audience makers or a combination of the two. A circular economy platforms circle is added in order to also include circular economy platforms or platforms related to that topic. The size of the platform names depends on how often they are mentioned in the MSP literature. Every mentioning resulted in a fond increase of 2 points. If a platform name is made bold, this means that the name is being mentioned in circular economy literature.

The list of platforms was started by brainstorming about different categories of online platforms. This step was followed by adding all international and Dutch examples that came to mind. The next step was to look at the list of most popular websites that is published on Wikipedia (https://en.wikipedia.org/wiki/List of most popular websites).

This list contains the content of the Alexa traffic rank manager and the Similar Web top websites (both from March 2015). Resulting from this list, extra examples were added. The thirds step was to add the new examples that came up when reading circular economy and online platform literature. Although the creation of the list will be a continuous process (more on that in chapter 5 on methodology), the current selection can be found on the next page.



The table below shows the exploratory case study framework which was adapted from Andersson et al., 2013. The case study framework shows that three phases can be identified in the research process. Phase 1 consists of an exploration of the relevant literature topics of circular economy and multi-sided platforms. Phase 2 consists of the selection and tabulation of circular economy platform cases. The third phase is all about the analysis of the gathered case study data.

Table 3: Exploratory Case Study Framework					
	Phase 1:	Phase 2:	Phase 3:		
	Exploration of	Selection and tabulation of	Pattern analysis of circular		
	circular economy	circular economy platform	platforms and investigation of gaps		
	and multi-sided	cases			
	platform literature				
Purpose	Identifying a broad overview of the two relevant literature topics and identification of current circular economy barriers	Creating an extensive overview of all existing circular economy platforms and identifying and/or creating the right constructs and measurements	Revealing circular economy platform patterns and reflecting on how the gaps between theory and practice can be overcome using non-circular platform examples		
Steps	 Identifying and reading relevant literature on both topics Producing a literature overview for both research topics Identifying and categorizing the identified circular economy barriers 	 Creation of extensive circular platform list based on literature Start analysing platform list cases, thereby start developing constructs and measurements Asking experts for additional platforms and ask feedback on constructs Finalize analysis of additional circular platforms 	 Pattern analysis on the tabulated circular platform list. Identifying gaps between circular economy theory barriers and suggestions and the offerings of circular economy platforms Reflecting on the gaps by providing suggestions from exemplary non-circular platform features and functions. Asking platform owners and experts for their view on the results from the data Adapt conclusion and discussion 		
Data	Scientific literature	Scientific /business literature	Data collected		
sources	Business literature	Platforms	Platform owners		
	Documents	Circular economy experts			
	Web articles				
Output	Understanding of the circular economy barriers and two relevant literature topics	Circular economy platform list with constructs, variables and measurements	Analysis of circular economy platform patterns, gaps between theory and practice and reflections on how to solve these gaps		
	July 2015 -	October 2015 -	February 2016 -		
When	September 2015	February 2016	June 2016		

Source: Adapted from Andersson et al. (2013)

5. Empirical strategy

This chapter about methods gives an overview of the research steps and methods that have been used. It starts with providing an overview of all the steps and methods used in the research process (see table 4). After that, the process of finding and selecting the research sample is described.

Research sample

The 12 circular economy platforms in this research sample have been found using three different selection methods of which the details will be explained later in this paragraph. All the circular economy platforms found were selected into, or rejected from the research sample using three selection criteria on which will be elaborated later. Following to that selection step, a one-page platform description was produced for all of the 12 remaining platforms in order to fully immerse into the topic and content of the research sample. Additionally to those one-page platform descriptions, all the platforms were analyzed and compared on their offered features, and put in a table to easily interpret the individual platforms, as well as the sample as a whole. Based on the table with platform features and a scoring table which couples features with the degree to which they help to overcome certain barriers, an overview was created that shows which of the 6 circular economy barriers are being solved by every individual platform. All these steps just described are outlined in table 4 below. All the research steps mentioned in the table will be explained in the remainder of this report.

Step	Research	What	Method	Detailed
	stage			description
Step 1		Locating circular economy	Using 3 different research	Table 5
	Methods	platforms	methods to locate the platforms	
Step 2		Research sample	Using 3 selection criteria	Table 6
		selection or rejection		
Step 3		Creation of a one page	- Researching the website content	Annex 4
		description of every	- Asking questions and feedback to	
		platform in the research	platform owners	
		sample in order to		
		immerse into the		
	Analysis	research topic		
Step 4		Analysis and comparison	Re-iterative process cycle resulting	Table 10,
		of platform features	in a table that shows the recurring	11 and 12
		offered	features	
Step 5		Creating an overview of	Combining the platform features	Table 13
		the circular economy	table with the barrier solving	
		barriers (not yet) being	criteria table which together	
		solved	results in a table with CE transition	
			scores for each barrier	
Step 6		Formulating circular	Platform propositions and	Table 10,
		economy platform	typology are formulated using the	11 and 12
		propositions and the	platform features and	
	Results	creation of a first	characteristics	
		typology		
Step 7		Providing suggestions for	Using exemplary examples from	Table 16
		the improvement of	platforms that do not fall into the	
		transition barriers that	research sample criteria set for	
		currently have the lowest	the research sample	

Table 4 –	Overview	of	research	steps.	stages	and	method	S
		U,	rescaren	steps,	Juges	anu	methou	5

	CE transition scores (table	
	13)	

Source: Based on author's filed work

Step 1: Locating the circular economy platforms

The platforms in the research sample were gathered in three ways, namely by (1) authors own knowledge, mentioning in literature, or the platform being the (co-)author of a circular economy report, (2) by searching through the top 100 Google search results (first 10 pages) on the search term 'circular economy platform', and (3) by asking the circular economy platforms in the research sample (by e-mail or via the contact form on the website) to add additional potential circular economy platforms to the current list. As can be seen from table 5 below, the research started with a list of five platforms. Google search results added three platforms to the existing sample, while referrals from the current sample added four more circular economy platforms to the final sample, resulting in a final research sample of 12. In order to minimize the personal influence on the Google search results, the search has been done using the 'incognito mode' of Google Chrome. This mode prevents Google from using cookies and other previous searching history to influence the order and content of search results.

Step	Method	Research sample	Details
	Circle-Economy.com		Own knowledge
		Circulaire-economie.info	Own knowledge
1	Own knowledge/	Circulairondernemen.nl	Own knowledge
	Literature / reports	EllenMacArthurfoundation.org	Yearly CE reports
		GreenEcoNet.eu	Opportunities for SME's in the CE
2		Circle-Economy.com	Search result #1
	Google search	EllenMacArthurfoundation.org	Search result #6
		Circularsg.com	Search result #20
		Circulareconomyaustralia.com	Search result #51
		Plan-C.eu	Search result #65
		WRAP.org.uk	Referred by Plan-c.eu and
			EllenMacArthurfoundation.org
3	Platform referrals	Economiecirculaire.org	Referred by Plan-c.eu
		Institut-economie-circulaire.fr	Referred by Plan-c.eu
		Zerowastescotland.org.uk	Referred by Plan-c.eu

Table 5 - Research sample locating methods

Source: Based on author's filed work, Google search, referrals from platform owners.

Step 2: Research sample selection criteria

Not all circular economy platforms that were located have been selected for the final sample. In order to set boundaries to the types of platforms in the sample list, three platform selection requirements were created. Resulting from the absence of literature on the topic of online circular economy platforms, these three requirements had to be created during the research process.

Requirement 1: The platform should have an online presence.

The reason for this first requirement are that no research has been done yet on the online part of circular economy facilitators. Therefore, this research only looks at circular economy platforms with an online presence. Besides that, the online presence makes it easier to find the platform, and therefore provides more generalizability and robustness than a situation where platforms without an online presence would also be included in the research.

Requirement 2: The platform should have a clear focus on facilitating the circular economy transition.

This second requirement exists in order to make sure that all circular economy platforms under study have the facilitation of the circular economy as their main goal. Every platform under study should have the explicit mentioning of circular economy on their platform. This requirement excludes all online platforms that for example publish information or articles, and only have a special page dedicated towards the circular economy.

Requirement 3: The platform should provide actual online value to its users.

An offline platform which solely has a website as an online business card, and therefore does not offer for example; news, events, a cases library, or tools is excluded from the research list.

These three requirements resulted in four of the located online circular economy platforms to be excluded from the research sample. The reasons for each of the four excluded platforms are shown in table 6 below and shortly described in the text below the table.

Locating	Platform excluded	Was referred by	Requirement
method			lacking
	Nudge.nl	Circulairondernemen.nl	2; CE focus
Platform referral	Cirkelstad.nl	Circulaire-economie.info	3; online value
	Becircular.eu	Plan-c.eu	3; online value
Google search	Reloopplatform.eu	Google search (result	3; online value
_		#11)	

Table 6 – List of platforms	excluded from	the research	sample
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Source: Based on author's filed work

Nudge.nl

Although Nudge.nl provides a good way for consumers to start new or join existing sustainability projects, the website has no explicit focus on the circular economy and is therefore excluded from the circular economy platform list.

Cirkelstad.nl

Cirkelstad is Dutch for 'Circlecity' and is an initiative that has an online presence and has a clear focus on the creation of circular cities. However, the website only seems to function as a business card and does not offer particular online value, therefore this platform was excluded from the research sample.

Becircular.com

Becircular.com is a website that currently functions as a business card for a circular economy incubator in Brussels that is planned to be realized in early 2017. Since the incubator is not active yet and the website only provides general information about the circular economy and the future incubator, this platform was excluded from the research sample.

Reloopplatform.eu

Reloopplatform.eu is the only platform so far that focusses on the policy and legislation part of the circular economy. Unfortunately, the platform offers no real online value since it seems to be an offline lobbying platform. Therefore, also this platform was excluded from the research.

The next chapter will describe the process of analyzing the research sample that has been described in this chapter.

6. Analysis

This chapter provides an analysis of the cases included in the final sample and the data gathered during the research process. The chapter starts with a description of the process of creating the one page platform descriptions. That paragraph is followed by an analysis of the representativeness and characteristics of the research sample. The last part of this chapter analyzes the data gathered from the platforms in the form of platform features and characteristics. Furthermore, the creation process of the circular economy transition score table is described.

Step 3: the creation of one page platform descriptions

In order to enhance the readability of this report the 12 pages of platform descriptions have been put in the annex (see annex 4). The one page description pages consists of 3 main elements, namely, a short one paragraph description of the platform, a summary of how the platform scores on each of the six barrier categories identified earlier in this report, and thirdly, a summarizing table that incorporates all the elements, features, and characteristics that might be interesting for the research process. The creation of the table was an iterative cycle during which new table elements where added along the way. In cases where the needed information was not publically available, an e-mail was send to the platforms e-mail address, asking the platform owner if he or she was willing to provide the missing information. Almost all information on the platform sample mentioned below originates from the tables on the one page platform descriptions.

Characteristics and generalizability of the research sample

From the total research sample of 12 circular economy platforms, three platforms are from the Netherlands, three from the UK, two from France, and one from Belgium, Australia and Singapore respectively. The GreenEcoNet.eu platform was started by an international group and can therefore not be originated to a specific country. The majority of circular economy platforms is solely focused on the scope of their own country. The British Ellenmacarthurfoundation.org and the international Greeneconet.eu are the only two platforms that have a worldwide scope. The Dutch Circle-economy.com and Wrap.org.uk from the United Kingdom also seem to have a broad scope, namely on EU level, even though they are still mainly focused on the scope of their own countries.

Platform	Country	Scope
Greeneconet.eu	International	World
Plan-c.eu	Belgium	Belgium
Circle-economy.com	Netherlands	Europe
Ellenmacarthurfoundation.org	UK	World
Circulairondernemen.nl	Netherlands	Netherlands
Circulaire-economie.info	Netherlands	Netherlands
Circularsg.com	Singapore	Singapore
Circulareconomyaustralia.com	Australia	Australia
Econonomiecirculaire.org	France	France
Institut-economie-circulair.fr	France	France
WRAP.org.uk	UK	UK/EU
Zerowastescotland.org.uk	UK	UK

Table 7 –	Platform	scope and	country	of	origin
					()

Source: Based on author's filed work

Geographic representativeness

Google provides an online service called Google Trends, which can be found at <u>https://www.google.nl/trends</u>. As Google states on their page²; 'Google Trends ... allows you to see what others have been searching for with Google. Google Trends graphs how often a term is used over time and where geographically most people are searching for a given term.' Google Trends was used to research the geographical distribution of interest in circular economy in order to verify if the final sample can be compared with worldwide distribution of interest in the topic of circular economy. It was decided to apply the *subject* 'circular economy' instead of the sole *search term*, because the subject incorporates a combination of related search terms in different languages and is therefore expected to provide more valid results. Table 8 compares the number and ranking of countries in the final sample with the search interest of the top 7 countries for the subject of circular economy on the 4th of May, 2016.

	Final platfo	orm sample	Google Trends	
Country	Number of	Rank based	Rank based on	
	platforms in	on sample	worldwide	
	sample		Google searches	
Netherlands	3	1	1	
United Kingdom	3	1	6	
France	2	2	3	
Belgium	1	3	2	
Australia	1	3	n/a	
Singapore	1	3	n/a	
International	1	3	n/a	
Sweden	n/a	n/a	4	
Germany	n/a	n/a	5	
Spain	n/a	n/a	7	

Table 8 –	Geographical	representativeness	of the	final	sample

Source: Based on author's filed work and Google Trends results on the 4th of May 2016

When comparing the countries of origin of the platform sample with the top 7 interest measured in circular economy search terms according to Google Trends, it shows that the top 3 according to Google are all included in the research sample. The United Kingdom is number 6 on the Google list, while it is ranked the on a shared first place in the final sample together with the Netherlands. Google ranks Sweden as 4, Germany as 5, and Spain as 7 while there is no Swedish, German or Spanish circular economy platform present in the research sample. A possible explanation for the absence of the three countries in the final sample is the existence of a language barrier between the researcher and the language used in these three countries.

Chronological order of the platform samples

Table 9 (next page) shows the chronological timeline perspective on the 12 circular economy platforms in the research sample. The 'domain' shows the month and year in which the domain name used by a certain circular economy platform was registered. This registration information has been gathered through using the websites; whois.com, but also sidn.nl (for .nl) and eurid.eu (for .eu). The information on the year of each circular platform 'launch' was gathered by studying the platforms and - if possible - receiving confirmation from the respective platform owners by e-mail.

² http://google.about.com/od/googleproducts/g/trendsdef.htm

Table 9 – Chronological order of the platform samples

Platform	2000	2002	2008	2009	2010	2011	2012	2013	2014	2015
WRAP.org.uk	Domain		Launch							
Zerowastescotland. org.uk		Domain			Launch					
Plan-c.eu			Domain						Launch	
Ellenmacarthurfou ndation.org			Domain	Launch						
Circle- economy.com					Domain			Launch		
Institut-economie- circulair.fr							Domain	Launch		
Circulaire- economie.info								Domain		Launch
Economiecirculaire. org								Domain		Launch
Greeneconet .eu								Domain	Launch	
Circulaironder nemen.nl									Domain	Launch
Circulareconomyau stralia.com									Domain Launch	
Circularsg.com										Domain Launch

Sources: For domain registration (whois.com, sidn.nl, and eurid.eu), for launch year (based on website and/or information provided by platform owners)

When plotting the yearly number of circular economy platform launches from the research sample in a graph (see figure 7) there seems to be a trend of an increasing number of launches. When this trend from the number of launches is compared with the interest in the topic of circular economy according to Google Trends (date: 19th of March 2016) there seems to be a clear increase, starting from the year 2013.





Source: Based on author's filed work

The amount of launches among the final platform sample seems to correlate with the amount of Google searches on the subject of circular economy. This correlation seems to make sense, since an increased interest in the subject will increase the willingness and interest of a possible user base to use or join one or more circular economy platforms.

The first part of this analysis chapter has analyzed the research sample itself, by looking at characteristics like country of origin, and yearly new platform launches. By comparing these characteristics of the final sample with the results form Google search trends, it showed that the top 3 of circular economy platforms in the research sample is identical to the global circular economy subject ranking based on the amount of relevant Google searches per country. The amount of yearly launches in the final sample seems to strongly correlate with the increasing trend of Google searches on circular economy. If we assume that the circular economy interest and chronological trend in Google searches mimics reality, we can imply that the research sample is representative on both a geographical (by country) and chronological (by yearly launches) level. From here, we can now start to go deeper into the platforms themselves by looking into the features they are offering.

Data analysis of platform features offered

Where the previous paragraph analyzed the characteristics of the research sample itself, this paragraph will focus on the analysis of data coming from the features offered by these circular economy platforms. First, two tables provide an overview of the relevant online features that every platform is offering.

Step 4: Analysis and comparison of the platform features

The two tables below provides an overview of the relevant online features that every platform is offering. The features identified in the table are used to systematically analyze to which degree every platform is helping to overcome the specific barriers towards a circular economy transition.

Table 10 shows the platform features that were discovered during a continuous iterative process of analyzing the 12 platforms in the final sample. Through studying the website of each platform and by making notes and comparing the features offered by each individual platform, a comparison table was created. This table 10 shows all the features that occurred at more than one platform. The features were put in the order of occurrence, with the highest number of occurrences on top and the lowest amount of occurrences at the bottom. In order to facilitate the identification of potential trends through time, the platforms were put in order of launch year, with the oldest platform in the far left and the most recently launched platform at the right of the table.

Circular Economy Information

By looking at table 10 it is clear that, with 11 occurrences, the features of 'news' and 'reports' are the most common features among the twelve platforms in the final sample. These two features can be seen as a passive way of providing users with updates about circular economy. The newsletter (8 occurrences) and the tweet stream (3 occurrences) are more pro-active in bringing the information towards the users. The newsletter feature is less popular among the newer circular economy platforms in the sample. Three out of four platforms with a login ability do not provide a newsletter. Of the three occurrences of tweet streams, two streams shows no tweets. This might suggest that the tweet stream is not working properly or that nothing is actually being tweeted. 6 out 12 platforms provide an explanation of the basics of circular economy, the platforms that are offering this feature tend to be older. This might suggest that younger platforms do expect the reader to already know what circular economy is about. Another explanation might be that these younger platforms expect the user to be able to easily find the information somewhere else on the internet. Circular economy lectures (2 occurrences) are only provided by the two circular economy platforms which do not have an online or offline network and do not have businesses as members (see table 10). Therefore it makes sense that these platforms need alternative sources of income in order to be able to sustain their activities.

Education and Action

With 9 occurrences, the features of 'events' and 'solutions' have a more active nature, since they motivate people to join events (most of the physically) about circular economy. The solutions/case studies are also more oriented towards action since it can inspire and motivate others to get in action towards a more circular economy.

Projects and workshops (both 7 occurrences) are perfectly correlated among the final sample of 12 platforms. This seems to make sense, since the workshops can result in tangible projects which will be published on the platform. It is interesting to see that none of the 'online' communities is offering projects or workshops. The online element of these platforms is likely to lead to more intangible or passive results instead of projects. The providing of tools (7 occurrences) also seems to be related to some degree with projects and workshops, which makes sense, since tools can be a useful addition to these two features.

Online versus Offline

Networking (8 occurrences), Log-in ability, and online forum (both 4 occurrences) are correlated in the table. This might be explained by the fact that they are all three related towards the ability of users to communicate with others. For example: without the need/ability to login, it would be hard to control the interactions on the online forum. An interesting trend through time is that networks from older platforms in the sample are offline, while more recent platforms have created online network possibilities. It is also interesting to see that all but one of the five platforms that offer offline networking possibilities are asking membership fees. The online networking platforms tend to be without a membership fee. The only exception to that is platform circulaire-economie.info who is offering both online and offline networking, and therefore also ask a membership fee.

Locating of Resources

The feature of an online map to locate circular economy businesses or projects (4 occurrences) is applied by all three fully 'online' platforms. Since these platforms only have an online network, it makes sense to include an online map that locates all the members in the network. Although not applied often, a list of experts (3 occurrences) is used by some of the younger platforms in the final sample. The locating of resources through the matching of supply and demand is applied by three out twelve platforms. Zero waste Scotland provides a materials brokerage and funding service, while circle-economy.com provides a marketplace for textile materials. Circulaire-economie.info uses the interface of the asset sharing platform Floow2.com to provide the sharing of business assets. The feature of a knowledge map seems to be related to the provision of an actual geographical mapping of businesses and projects.

Free versus fee

As can be seen from table 10 on the next page, circular economy platforms that ask membership fees are all providing additional offline features like networking, workshops or tools. The free circular economy platforms that are offering 'offline' features (plan-c.eu and circulareconomyaustralia.com) tend to also asking money for it.

Table 10 - Overview of relevant platform features

	Occu-	WRAP.o	Zerowas	EllenMac	Circle-	Plan-	Institut-	Circulaire-	Economie	Green	Circulair	Circular	Circularsg
	rence	rg.uk	tescotla	ArthurFo	Economy.	C.eu	economie-	economie	circulaire.	EcoNet.	onder	economy	.com
			nd.org.u	undation.	com		circulaire.fr	.info	org	eu	nemen.nl	Australia.	
			k	org								com	
News	11	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		\checkmark
Reports / Publi-	11	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		\checkmark
cations / library													
-													
Events	9	✓	V		✓ ✓		~	V	V		V	V	√
Solutions / Cases	9	√	✓	√ √	V	V			✓	✓	V	✓ ✓	
Newsletter	8	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark		\checkmark				\checkmark	✓
Network(s)	8			🗸 map	\checkmark		\checkmark	🗸 (online	\checkmark	\checkmark	\checkmark		\checkmark
				(offline)	(offline)		(offline)	/offline)	(online)	(online)	(online)		(offline)
Participation in	7	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark					\checkmark	
Circular projects													
Workshop / master	7	√ (off- /	\checkmark	✓ (off-	\checkmark	\checkmark	\checkmark					\checkmark	
class / courses		online)	(online)	/online)	(offline)	(offline)	(offline)					(offline)	
Tools	7	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark				\checkmark	\checkmark		
				(offline)	(offline)								
CE Basics explained	6		\checkmark	\checkmark		\checkmark	\checkmark		\checkmark			\checkmark	
Log-in ability	4							\checkmark	\checkmark	\checkmark	\checkmark		
Membership fee	4			\checkmark	\checkmark		\checkmark	\checkmark					
Map to locate CE	4			\checkmark					\checkmark	\checkmark	\checkmark		
Online forum	4							\checkmark	\checkmark	\checkmark	\checkmark		
Tweet stream	3						✓ defect	✓ defect		\checkmark			
List of experts	3						\checkmark	\checkmark		\checkmark			
Matching supply /	3		\checkmark		\checkmark			\checkmark					
demand													
CE knowledge map	2			\checkmark							✓		
Presentations /	2	1	1			\checkmark						\checkmark	
lectures						(offline)						(offline)	

Source: Based on author's filed work. (reference links towards the existence of the above features can supplied when asked for)

Social media platform features

Table 11 below serves as a social media impact indicator. The platforms are stated in order of registration of their domain name. The numbers in the table are a representation of the situation on the 11th of May 2016. It was considered to also add two columns showing the amounts of members and partners, but because of the high variation in definitions used by platforms and the difficulty of comparison between different types of members and partners (can you compare an SME with a multinational or a governmental organization for example) it was decided that this information was outside of the scope of this exploratory research and was therefore excluded from the table. The criteria for a social media account to be included in the table was that there has to be link or a button towards the social media account on the platform website.

Platform	LinkedIn	Twitter	Facebook	You	Insta	Login
		followers	likes	Tube	gram	abilit
						у
WRAP.org.uk	2.650	19.712	-	146	-	х
	followers					
Zerowastescotland.org.uk	469	16.329	2.521	-	-	х
	members					
Ellenmacarthurfoundation.org	4.444	18.317	7.871	3.019	-	х
	followers					
Circle-economy.com	1.404	12.639	2.961	-	37	x
	followers				followers	
Plan-c.eu	957	2.447	1.583	-	-	х
	members					
Institut-economie-circulaire.fr	1.726	11.867	4.231	-	-	х
	members					
Circulaire-economie.info	1.480	4.555	-	-	-	✓
	members					
Economiecirculaire.org	-	-	-	-	-	✓
Greeneconet.eu	39	291	127	-	-	\checkmark
	members					
Circulairondernemen.nl	-	-	-	-	-	\checkmark
Circulareconomyaustralia.com	-	-	-	-	-	х
Circularsg.com	219	41	199	-	-	х
_	members					

Table 11 - Social media indicators of the platform samples

Source: Based on data of respective social media accounts on the 11th of May 2016.

From the table above it can be seen that older platforms tend to have higher amounts of followers on social media like LinkedIn, Twitter and Facebook. This can be explained by the fact that these platforms have had more time to build a social media fan base. Of all the social media, Twitter tends to have the highest amount of followers for every circular economy platform. Table 11 also shows that Facebook tends to create a larger fan base compared to LinkedIn. This tendency might be explained by the fact that Facebook engagement is measured in *likes*, while LinkedIn engagement is measured in followers or members. Thus, it could be reasoned that a *like* tends to be more easy and casual compared to following or becoming a member of a LinkedIn group. Using LinkedIn seems to be more in favor by the circular economy platforms in the final sample, since every platform has a LinkedIn page, but four out of twelve do not have a Facebook page. This preference towards LinkedIn can be explained by the fact that most

circular economy platforms are focusing on businesses and/or professionals, and in that case LinkedIn feels to be a better tool compared to Facebook which tends to be of a more informal nature. Although YouTube and an Instagram account are used, they are not very popular among circular economy platforms and also tend to have a lower follower base compared to the big three of LinkedIn, Twitter and Facebook. The ability to login to a platform seems to be negatively correlated to the amount of social media followers and actual presence of social media buttons on circular economy platforms. The fact that two out of the three 'online only' websites (economiccirculaire.org, greeneconet.eu, circulairondernemen.nl) have no social media accounts can be explained by the fact that they have less need for social media accounts to share information or keep their members engaged, since they already have their own online environment on the login area.

Circular Economy platform characteristics

Table 12 below shows four identifying characteristics of circular economy platforms, namely legal form, business model, who can join, and how the information input is arranged. These four identifying characteristics have been selected from the tables on the one page platform descriptions (see annex 4)

A clear pattern that arises from the tabulation of these four platform characteristics is that all platforms (launched after 2012) receiving government funding have an open source platform/log-in ability (see blue blocks). This is in line with the proposed solution by circular economy literature to create IT-enabled transparency and sharing of information. The open source character of these platforms is also according to the proposed solution to use crowdsourcing for knowledge. The circular economy platforms that use the business model of member and partner fees seem to avoid open source information input and thus do not provide a login ability (see green blocks). This tendency might be explained by the fact that these platforms have more money and resources to create the content themselves instead of with the help of users. Additionally, the fact that members of these platforms have to pay might lower their members willingness to put in extra effort in the form of crowdsourcing information. Of the 10 platforms receiving government support and/or member payments, only two combine these two streams of income (see red blocks). This division between government funding and a fee structure can be explained by the fact that governments tend to not fund 'for profit' initiatives. Besides that, governments often want their funding to benefit all people, and since fee based platforms have a closed structure, they inherently (at least partly) exclude nonpaying users.

Peculiarities

Circulareconomyaustralia.com is a volunteer based platform with no own legal form. This platform is also the only one which solely applies the business model of income from activities and projects (see yellow blocks), for this reason no user category can join the platform. Platforms seem to be open to various user groups to join, since 7 out of 12 platforms accept all four identified main user categories. There are however three platforms which focus on only one user group (see orange blocks). Multi-sided platform literature suggests that an increase in the number of user groups exponentially increases complexity since all user groups often have different demands. This might have been the consideration of the three individual user group platforms to narrow their focus to one group. Two of these platforms focus on individuals while one platforms solely allows SME's to join. All three of these specific user group platforms rely on government funds, while the other four government supported platforms accept all user types. There thus not seem to be a middle way in between one use group or all user groups

Table 12 - Circular Economy Platform characteristics

	L	egal form		В	usiness mode	I	Who can join				Information input	
					1			1				
	Limited by Guarantee	Foundation	Other	Government funds/grants	Member/ partner fees	Activities/ projects	SME's	Large businesses	Government bodies	Individuals	Closed	Open source
WRAP.org.uk	\checkmark			✓			✓	\checkmark	\checkmark	\checkmark	\checkmark	
Zerowastescotland. org.uk	 ✓ 			~			~	V	 ✓ 	✓	V	
Plan-c.eu		✓		✓	✓	✓				✓	\checkmark	
Ellenmacarthurfoun dation.org		✓			√		v	√	~	~	~	
Circle-economy.com (×)			✓ cooper ative		~		√	~	v	v	✓	
Institut-economie- circulair.fr			 ✓ associa tion 		√		√	V	√		~	
Circulaire- economie.info		✓		✓	✓ 	~	~	~	✓	✓		~
Economiecirculaire. org (×)			✓ none *	√ *			~	~	✓	✓		~
Greeneconet.eu			✓ none	✓			✓					√
Circulaironder nemen.nl			✓ coa- lition	✓						√		✓
Circulareconomyaus tralia.com			✓ volunte er based			✓					V	
Circularsg.com (×)			✓ none *				\checkmark	 ✓ 	~	~	\checkmark	

Source: Based on one page platform descriptions (* = information could not be confirmed, × = platform did not reply to emailed questions).

7. Results

This results chapter combines all the data and analysis from the previous chapters into an overview which provides insights on how current circular economy platforms are facilitating the circular economy transition. This will be followed by a list of circular economy platform propositions which are based on the current research sample. The propositions are followed by a suggested circular economy platform typology. Finally, some suggestions are made on how the circular economy platforms in the research sample could improve based on reflecting on some exemplary non circular economy platform examples.

Step 5: Current levels of transition facilitation

Every identified platform feature from table 10 was cross compared with the barrier categories identified from the literature research (see annex 1) and given a transition score level from zero to 3 checkmarks (0 no contribution / 3 high contribution). By multiplying these checkmarks with the existence of identified platform features a score materialized. Although the specific scores are not grounded enough to compare on the level of individual platforms, the score of each barrier category provides an indication for the current level of circular economy transition facilitation in general. From the table below it can be seen that education and awareness score relatively high and are therefore rated at a sufficient level. Although transparency, collaboration and policy still have relatively high scores, there is still much room for improvement. Except for a few outliers, the platforms tend to score low on the barrier categories of finance, consumer behaviour, infrastructure, risk and especially markets. Therefore, the contribution towards a circular economy transition is almost nonexistent for these barrier categories.

Transition barriers	Transition	Current level of
	Score	facilitation
Education	132	Sufficient
Awareness	123	Sufficient
Transparency	69	Room for improvement
Collaboration	48	Room for improvement
Policy	44	Room for improvement
Finance	28	Almost nonexistent
Behaviour	27	Almost nonexistent
Infrastructure	21	Almost nonexistent
Risk	18	Almost nonexistent
Markets	14	Almost nonexistent

Table 13 – Circular Economy Transition Barriers

Source: Based on table 18 (see annex 4)

Besides knowledge about the currently offered level of circular economy transition, it is also interesting to know about the workings and types of circular economy platforms. Therefore, the next page will elaborate shortly on the list of circular economy platform propositions that have been formulated based on the current research sample of 12.

Step 6: Circular Economy Platform propositions

Based on the commonalities and peculiarities identified in the circular economy platform sample, a list of circular economy platform propositions has been formulated below (table 14). These propositions can be used as a starting point for future research by trying to disprove them and thereby further improve the body of knowledge on online circular economy platforms. These propositions can be of practical use for

new and existing Circular Economy Platforms in the way that they can be a guide towards conforming or opposing with the status quo.

Situation	Propositions	Research
		sample (n=12)
If a Circular Economy platform	1. Then it is likely there is no online	(4 out of 5)
asks money from its members	environment available	
If a Circular Economy platform is	2. Then it is likely that the platform is either	(5 out of 5)
funded by the government	allowing all four identified user groups or is	
	focusing on one single user group	
If a Circular Economy platform	3. Then they are receiving government	(4 out of 4)
offers an online login	funds	
environment	4. Then they apply open source information	(4 out of 4)
	input	
	5. Then it is likely that they are not asking a	(3 out of 4)
	membership fee	
If a Circular Economy platform	6. Then there are social media buttons on	(7 out of 8)
offers no login ability	the platform	
If a Circular Economy platform	7. Then they are combining this with	(3 out of 3)
applies activities or projects as a	government funds and membership fees	
business model	unless the organization is volunteer based	

Table 14 - Circular Economy Platform propositions

Source: Based on table 10, 11 and 12

Although these propositions are created out of a relatively small sample of 12, it is still possible that several of these propositions will last when tested on a larger sample. In order to enable the creation of propositions for specific platform types, there needs to be a certain circular economy platform typology. The next paragraph is initiating the creation of a circular economy platform typology by grouping the platform sample into specific platform types based on specific characteristics.

Circular Economy Platform typology

Based on specific platform characteristics identified during the research, five platform types have been identified in table 15 on the next page.

Typology characteristics	Platforms from sample
- ability to login to the platform	Circulairondernemen.nl
 no membership fees (government funded) 	Greeneconet.eu
 no offline network of meetings 	Economiecirculaire.org
 having to pay fees to become a member 	Ellenmacarthurfoundation.org
 offering the ability of offline networking 	Circle-economy.com
 no ability to login to the online platform 	Institut-economie-circulair.fr
 earnings from projects and services are 	Circulaire-economie.info
combined with government funding and	Plan-c.eu
sometimes membership fees	
 platform is initiated by the government 	WRAP.org.uk
 platform runs on government funds 	Zerowastescotland.org.uk
 platform provides value for all four 	
identified user groups	
- the only stream of income comes from the	Circulareconomyaustralia.com
delivery of services	
- no ability to become a member	
- offline networking without a fee	Circularsg.com
- founders own circular economy related	
service firms	
	Typology characteristics- ability to login to the platform- no membership fees (government funded)- no offline network of meetings- having to pay fees to become a member- offering the ability of offline networking- no ability to login to the online platform- earnings from projects and services arecombined with government funding andsometimes membership fees- platform is initiated by the government- platform runs on government funds- platform provides value for all fouridentified user groups- the only stream of income comes from thedelivery of services- no ability to become a member- offline networking without a fee- founders own circular economy relatedservice firms

Table 15 – Circular Economy Platform Typology

Source: Based on table 10, 11 and 12

The fully online platforms all provide the ability to login, but do not ask membership fees and also offer no offline network meetings. The offline networking - as the name already suggest – provides offline networking for its members. Contrary to the fully online platforms, these members have to pay a membership fee and are not offered the ability to login to the online platform. The project hybrid category creates part of its earnings from the provision of projects and services, which are combined with government funding and sometimes membership fees. Circulaire-economie.info was a misfit in both earlier mentioned categories, since it offers a login, but also asks a membership fee from its members. The project hybrid however, perfectly fits the platform characteristics. The public interest platform type is initiated and funded by the government and therefore tries to provide value for all earlier identified user groups (SME's, large businesses, government bodies, and individuals). Circulareconomyaustralia.com does not provide the possibility of membership and therefore only receives income from providing services. The platform circularsg.com almost fits into the offline networking type, except for the difference that the members of this platform do not have to pay a membership fee. The two founders of this platform own circular economy related service firms, and are therefore likely to use the offline networking events to prospect for potential clients.

In this results chapter we so far identified on which barrier categories the circular economy platforms are currently lacking. Secondly, 9 circular economy platform propositions were formulated, which was followed by a first attempt to create a circular economy platform typology. The last goal of this chapter is to provide suggestions for improving the current circular economy platforms using the features of some exemplary platform examples.

Step 7: Circular Economy Platform Suggestions

The research on circular economy platform features has identified several circular economy barriers of which the transition is currently not facilitated satisfactorily, resulting from a lack or even non-existence of offered features by online circular economy platforms in the research sample. In order to identify opportunities for the improvement of the transition towards a circular economy, several exemplary non-circular economy platforms have been investigated. The fact that these platforms are called 'non-circular' does not mean that they do not facilitate a circular economy platforms, it only means that they all do not fit one or more of the three requirements for circular economy platforms, formulated earlier in this report. Most of these platforms are focused on the delivery of one specific feature, which directly or indirectly, contributes to a circular economy transition.

Although only two out of the twelve platform in the sample solely focus on individuals, there are many online initiatives that directly or indirectly facilitate a transition towards consumers behaving more circular. These websites are built on the concepts of sharing, usage over ownership, or even new business models. Peerby.com, snappcar.nl and Airbnb.com all provide consumers with the tools to share their possessions, cars or house with others. If more people would share their products, less new products would have to be manufactured, resulting in less resource depletion and less waste. Although sharing initiatives are not as normal for business as it already is for consumers, there is an asset sharing platform for businesses called 'Floow2.com'. This seems to be a good step towards the increased sharing of business assets. Circulaire-economie.info is the only platform in the final sample who has integrated the Floow2 interface into their online environment. It would be good if also other circular economy platforms would integrate the Floow2 asset sharing interface into their platforms in order to facilitate awareness and action on the topic of sharing between businesses.

Ifixit.com is an online and open source platform that guides individuals through the repair of their products. Although some circular economy platforms have developed tools or assessments that help guide businesses with the first steps towards circularity, these tools are always closed off for the public eye and thus only available for paying members. The website 'circulareconomytoolbox.org' is a website that offers businesses a free online assessment to find out where the most circular economy profits are available. Even though this tool is not open source and is thus not improving every day based on open source additions (like ifixit.com), this feature would still be a good interface for free circular economy platforms to integrate or at least link towards on their websites.

Leapp.nl and Bundles.nl both offer innovative ways for consumers to buy or use products in a way that fits better into a circular economy. Leapp allows consumers to buy refurbished Apple products, thereby extending the product life and conserving as much of the value inside the product as possible. Bundles makes it possible for consumers to lease (Miele) household appliances like washing machines or dryers. It would be a good step if more businesses would be able to offer consumers lease contracts. Therefore, there seems to be an opportunity for an online platform that provides an overview of all leasable products and their service providers. Instead of using a products as a service, one could even share this product with others. Besides preservation of resources, the ownership of the products stays at the manufacturer allowing for an even better usage efficiency yield and lower costs for the end user. Zipcar.com is clear example of a sharing service. This Zipcar concept could be extended to other underutilized product categories, which could be facilitated through an online platform.

The reuse of products is already facilitated to a high degree for consumers. Examples of general trading platforms are Ebay.com or Marktplaats.nl (Dutch equivalent of Ebay). An example of a more specialized platform is unitedwardrobe.com which facilitates the online trade in used clothing. These platforms

facilitate an easy and convenient connection between supplier and buyer of used products, and thereby lower the need for additional new products. Some companies already sell used or refurbished products themselves through their own channels, but also here seems to be a business opportunity to create an online platform (feature) which allows businesses to sell their used and/or refurbished products to businesses or consumers.

By the best knowledge of the author, there are not many exemplary platform examples on the topic of policy. Brigade.com is a network for voters which helps voters share their thoughts and support their party of preference. An example specifically focused on circular economy is reloopplatform.eu. This platform was excluded from the platform sample of this research (see table 6) because of a lack of online value. Nonetheless, it seems to be the only platform focusing on improving the policy in favor of circular economy. The question remains however, if the policy towards a circular economy should come from a platform. When looking at recent examples like the Ukraine referendum in the Netherlands, and the recent referendum in England, resulting in Englands exit from the EU, it can be questionable if a platform (of none policy experts) would be the best approach. The EU launched the new circular economy package in January 2016, which should help the EU member states become more circular. Therefore, the need for platform actions towards the topic of policy change seems less relevant and applicable.

On the topic of online trade in used resources or materials, there are already quite some examples. Some Dutch examples are deafvalmarkt.nl, grondstofmarkt.nl and oogstkaart.nl. The American equivalent called materialsmarketplace.org was the winner of the Circulars 2016 (category: Digital disruptor). This price clearly indicates that the trade in used resources and materials can have a very positive influence on a circular economy transition. If one of the material trading platforms would build an interface which could be applied on several currently existing circular economy platforms, this would definitely provide a positive influence on the topic of company awareness and action towards a circular economy.

Circular economy literature often states a lack of finance for circular projects or business models as an important barrier. Crowdfunding platforms like 'oneplanetcrowd.nl' can provide a solution to some circular businesses to raise capital and provide at the same time a good opportunity for individuals or businesses to invest in interesting initiatives. Even though literature suggests the use of crowdfunding, it will probably be a solution that will mainly fit the local or startup initiatives rather than the established businesses. Another crowdfunding platform is fundingcircle.com. Private and business investors can use the Fundingcircle platform to provide loans to SME's (Small- and Medium size Enterprises). Of course, this platform can also be used by SME's wanting to invest in a circular economy projects, thereby lowering the lack of finance barrier towards a circular economy, while at the same time sharing the risk among the crowd.

From these circular economy platform suggestions, it can be concluded that the majority of sustainable platforms in this exemplary sample are focused on serving the consumer (Marktplaats, Peerby, Airbnb, Ifixit, Leapp, Bundles, United Wardrobe). Floow2.com can be seen as the business equivalent of Peerby and is thereby facilitating sharing of assets between businesses. The author identifies several business opportunities, namely, the creation of a sales platform where leasable products and their providers can be found (like beslist.nl for leasing). Another opportunity is the creation of a sales platform where companies can sell their used and/or refurbished products. Thirdly, in order for material trading platforms to reach critical mass, there should be a platform interface which can be easily implemented in several of the existing circular economy platforms. This can help the material trading platform grow faster and reach the needed network effects. Finally, the financing barrier towards a circular economy could be solved (at least partly) through the use of crowdfunding platforms like oneplanetcrowd.com or fundingcircle.com.

For a concluding overview, the circular economy transition barriers, their current level of facilitation by circular economy platforms, and the accompanying exemplary platforms can be found in table 16.

Transition barriers	sition barriers Transition Current level of		Exemplary platforms			
	Score	facilitation				
Education	132	Sufficient				
Awareness	123	Sufficient				
Transparency	69	Room for improvement	Circulareconomytoolkit.org			
			lfixit.com			
Collaboration	48	Room for improvement	Peerby.com			
			Floow2.com			
			Zipcar.com			
			Resource trade platforms			
Policy	44	Room for improvement	(Brigade.com)			
			(Reloopplatform.eu)			
Finance	28	Almost nonexistent	Oneplanetcrowd.com			
			Fundingcircle.com			
Behaviour	27	Almost nonexistent	Peerby.com			
			Floow2.com			
			Leapp.nl			
Infrastructure	21	Almost nonexistent	Bundles.nl			
			Airbnb.com			
			Peerby.com			
			Floow2.com			
Risk	18	Almost nonexistent	Oneplanetcrowd.com			
			Fundingcircle.com			
Markets	14	Almost nonexistent	Leapp.nl			
			Marktplaats.nl			
			Unitedwardrobe.com			
			Resource trade platforms			

Table 16 Transition barriers and their exemplary platforms

Source: Based on authors own knowledge

8. Discussion

The topic of circular economy platforms is a relatively understudied domain, which has limited the author in the ability to use and build on previous research. This limitation has resulted in decisions and assumptions which have influenced the final sample and thus the content and outcome of this report. The three selection criteria for example, had – through a lack of previous research – to be created by the researcher himself in order to limit the scope of possible platforms in the final sample. These selection criteria have definitely influenced the final sample and thus the outcome of the research. Possible future research could repeat the research with a different set of selection criteria in order to investigate the direct effect on the final sample.

The decision to research a relatively large sample of online circular economy platform case studies was made in order to increase the degree of generalizability and robustness of the findings. This decision for breadth instead of depth has resulted in a lack of in depth qualitative research in the form of for example interviews with platform owners. For increased knowledge on specific circular economy platforms, future research could do more in depth research on a smaller sample or maybe even do a case study of a single circular economy platform.

The author created an Excel table to show the hyperlinks that prove the existence of the features for specific platforms as presented in table 10 (this proof table can be provided upon request). It is however hard to proof the non-existence of features. Even though the author has thoroughly studied each platforms website, there is still the possibility that some features are present but overlooked, and therefore not in the features table. Future research could help overcome this problem by having multiple researchers research each platform features, thereby being able to compare the findings and improve the reliability of the findings. Another angle could be to use qualitative interviews with the platform owners in order to identify indirect or overlooked features.

The list of exemplary platform suggestions are based on the authors own knowledge and are not based on a certain selection criteria or method. This enabled the researcher to use the most relevant examples and solved the problem that the identification of exemplary platforms could have been a research project on its own. Nonetheless, this selection method might have influenced the selection of exemplary platform suggestions. Future research could focus on the selection and identification of exemplary (non) circular economy platforms and thereby create grounded knowledge to build on for future research projects on this topic.

The author has come up with this research project on circular economy platforms because of a business idea for the creation of a circular economy platform that offers more and better features for businesses (author owns circulareconomyplatform.com). This business idea might have biased the author during the research and writing of this report. Another potential research bias is caused by the fact that the author is working on the creation of an online marketplace for resources (see CircleSmart.nl). This business idea of an online marketplace for resources might have caused a positive bias towards to usefulness of these online resource markets in the suggestions for improvement. A final point to mention is that the author has invested in both Peerby.com and Oneplanetcrowd.com through crowdfunding in the form of subordinated convertible loans. These investments might have resulted into a positive bias in the writing about these platforms when providing the circular economy platform suggestions.

When reading this research report, it should be taken into consideration that the report is only a snapshot of a probably continuously moving and developing subject of circular economy platforms. Therefore,

future research could repeat the research process in order to spot changes in the current platform features and characteristics over time. This knowledge could add the extra dimension of time towards the propositions, characteristics and typologies and therefore improve the body of knowledge on the subject of circular economy platforms as a whole.

A final discussion point is to consider what the actual function should be of a circular economy platform. The author of this report has started this research from the presumption that circular economy platforms should bring together all circular economy stakeholders, with one platform for all of those user groups (businesses, governments, consumers, universities, etc.) and should thereby be able to solve all identified circular economy barriers. When looking at the success of several exemplary platform examples given in this report (e.g. Peerby, Floow2, and Oneplanetcrowd), the question could be considered if that overarching role is realistic and/or desired. Maybe circular economy platforms should leave the solving of certain transition barrier categories to the platforms that are specialized in solving a specific barrier category. In that case, circular economy platforms could keep their focus on creating awareness and education, and could complementary to that, refer to, or implement, specific specialized platform services on their own platforms. Additionally, future research could focus on the desired role of circular economy platforms in the broader perspective of a worldwide circular economy transition.

9. Conclusion

The topic of circular economy platforms is a relatively understudied domain even though the popularity and relevance of circular economy and its complementary online platforms is on the rise. In terms of the facilitation of a circular economy transition there are several useful findings. Circular economy platforms are generally performing well on the overcoming of the barrier categories of Education and Awareness. Although platforms already have some features and services in place, there is still room for improvement on the barrier topics of Transparency, Collaboration and Policy. The results show that solutions to the barrier categories of Finance, Consumer Behaviour, Infrastructure, Risk and Markets are (almost) nonexistent. This provides an opportunity for current and future platforms to improve their offered features and services and thereby build a large user base. The circular economy platforms that want to be successful in the future will need this large user base in order to create the necessary network effects that make online platforms successful. The research results further show that certain platform features are more popular and often used than others. By studying the platform features and characteristics several clear patterns can be identified between platforms but also in the chronological development of features depending on the age of platforms. Based on these patterns, certain propositions have been formulated that can be improved by future research trying to disprove and refine them. The existence of specific platform characteristics has enabled the creation of a first typology of circular economy platforms. This circular economy platform typology can help form the basis of a more grounded circular economy platform typology in the future. In order to test the validity of the results in this report, future research should try to replicate this research or do more detailed research on specific elements in order to grow the body of knowledge on the topic of circular economy platforms.

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Annex 1. Transition Contribution Interpretation Table

Table 17 – Degree of contribution towards the overcoming of transition barriers

	Education	Awareness	Policy and	Markets	Transparency	Consumer	Finance	Risk	Collaboration	Infrastructure
			legislation			behaviour				
News	✓	$\checkmark\checkmark$			✓					
Reports /	$\checkmark\checkmark\checkmark$	\checkmark	$\checkmark\checkmark$				✓			
Publications / library										
Events	✓	$\checkmark\checkmark$			✓				✓	
Network(s)				\checkmark					✓ ✓ + ✓ online	\checkmark
Solutions / Cases	$\checkmark\checkmark$	$\checkmark\checkmark$	✓		$\checkmark\checkmark$	$\checkmark\checkmark$	✓	✓		
Newsletter		✓								
Projects	✓	$\checkmark \checkmark \checkmark$	$\checkmark\checkmark$		✓	✓		✓		
Workshop / courses	$\checkmark \checkmark \checkmark$						✓			
Tools	$\checkmark \checkmark \checkmark$	✓			✓					
CE Basics explained	$\checkmark\checkmark$	$\checkmark\checkmark$								
Log-in ability									✓	\checkmark
Membership fee					- ✓				- ✓	
Forum					✓				✓	\checkmark
Map to locate CE					$\checkmark\checkmark$				√ √	
List of experts					✓			✓	✓	\checkmark
Tweet stream		\checkmark				\checkmark				
CE Resources map					$\checkmark\checkmark$				√ √	
Matching supply /				$\checkmark\checkmark\checkmark$	$\checkmark\checkmark$		✓		√ √	\checkmark
demand										
Presentations /	\checkmark	$\checkmark \checkmark \checkmark$				\checkmark				
lectures										

Source: The data from the features table 10 is combined with the authors interpretation of the degree towards the overcoming of the identified transition barriers towards a circular economy.

By multiplying every platform feature with the number of checkmarks in table (17) on the previous page, a certain score materializes for every platform on all of the transition barrier categories. These score can be found in table (18) below. For more easy visual identification of scores, the following color scale has been chosen:

0 - 4 points = white

5 - 9 points = grey

10 - 14 points = orange

15 > points = green

It should be noted that the scores in table 17 are the authors own interpretation and that the color scale has no grounding in science. Nonetheless, table 18 can be used for interpreting a certain dynamic among the identified barrier categories, thereby taking into account the influence of the authors own interpretation in the creation of this table.

	Education	Awareness	Policy	Markets	Transparent	Behaviour	Finance	Risk	Collaborate	Infrastructure	
WRAP.org.uk	14	12	5	0	6	3	3	2	1	0	46
Zerowastescotland.org.uk	16	14	5	3	8	3	4	2	3	1	59
Plan-c.be	16	15	5	0	5	4	3	2	0	0	50
EllenMacarthurfoundation.org	15	12	5	1	8	3	3	2	5	1	55
Circle-economy.com	11	12	4	1	2	2	2	1	2	1	38
Institut-economie-circulaire.fr	12	9	4	1	4	1	2	2	3	2	40
Circulaire-economie.info	5	7	2	4	5	1	2	1	7	5	39
Economiecirculaire.org	9	9	3	1	7	2	2	1	7	3	44
Greeneconet.eu	9	6	3	1	8	2	2	2	7	4	44
Circulairondernemen.nl	10	8	3	1	10	2	2	1	9	3	49
Circulareconomyaustralia.com	10	13	3	0	4	4	2	2	1	0	39
Circularsg.com	5	6	2	1	2	0	1	0	3	1	21
	132	123	44	14	69	27	28	18	48	21	

Table 18 – Contribution towards circular economy transition scores

Source: The data from the features table 10 is combined with the contribution towards the overcoming of transition barriers table (17). By counting the number of checkmarks in case of the existence of a certain feature (table 10) the outcome was table (18) above, which provides an indication of the transition scores per barrier.

Annex 2. Login features offered by login platforms

Platform	Login features	Additional information
Circulaire-economie.info	- Place adverts on the sharing market	- only two adverts on own market
	 Access to discussion platform 	- no discussion at all
	- Use our logo as a partner	
Circulairondernemen.nl	- View and register Persons	
	- View and register Businesses	
	- Contributing to the platform with	
	your case, event, etc.	
Greeneconet.eu	- Contributing to the forum	Forum is visible (read only) when
		you are not logged in
	- Writing a blog post	
Economiecirculaire.org	- Create an initiative	
	- Create a community, become a	
	member, or see members of a	
	community	
	- Create a document	

Table 17 – Login features offered by login platforms

Source: based on studying the login platform websites.

Annex 3. Membership features offered by membership platforms

Platform	Membership fee	Membership features
Ellen MacArthur	Undisclosed	- CE 100 Annual Summit
		- Acceleration workshops
		- Collaborative projects
		- Corporate training (6 online spots per member)
		 Access to a valuable network
Circle Economy	Ranging from:	- Entrance to membership events
	Startup€900	- Periodical check-ins with Circle Account Manager
	up to	 Circle membership app (under construction)
	Multinational	 Access to online member community
	€ 15.000	- 5 free tickets to the annual event
		 Use of Circle Economy logo and publicity of own
		company on the Circle Economy website
		- Possibility to use the 12K followers media channel
		- Annual Circle Assessment
		- 30% discount on several products and services
		 Opportunity to participate in programs/projects
Circulaire-economie.info	Startup € 750	- Workshops and meetings
	SME € 1.500	- Monthly CE meetups
	Corporate € 2.250	 Place adverts on the sharing market
	(fees can also be	 Access to discussion platform
	'paid' in kind)	- Use our logo as a partner
Institut-economie-circ.fr	Depending on	- Logo and company description on webpage
	turnover/inhabitants:	- Access to workshops
	ranging from € 250	
	up to € 8.000	

10 m = 10 m	Table 18 – M	Membership	features	offered by	/ membership	platforms
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Source: based on studying the fee based platform websites.

Annex 4. One page platform descriptions

Circular Economy platforms

Greeneconet.eu

The GreenEcoNet platform is funded by the European Union and consists of a consortium of six research networks that are specializing in green economy transitions. GreenEcoNet claims to be the first global platform that supports SME's (small and medium-sized enterprises) in their transition towards a green economy. The platform currently has 90 member of which 59 from the United Kingdom. The four largest represented other countries are the Netherlands (12), Germany (10), Belgium (7) and Greece (7).

Contribution towards a Circular Economy transition

Education and awareness - The platform provides SME's with an overview of relevant tools, solutions, news, blogs and a forum where SME's can ask questions. SME's can add their company profile, solutions, tools, or networks. There is also the possibility to add a news article or write a blog post. All these offerings make that this platform helps in solving the education and awareness barrier.

Policies and legislation - The fact that the platform is funded by the European Union positively influences the likelihood that Greeneconet.eu has some degree of power to influence the policy and legislation decisions on a European Union level. The platforms' FAQ also states clearly that the platform wants to facilitate discussions between stakeholders, researchers and policy makers. In September 2015, the platform actually published a GreenEcoNet Policy Brief.

Markets and transparency - The company solutions list currently offers around 70 solutions, which can be filtered by country, solution type, technological area, or sector. This solutions list does provide more transparency on the existing solutions among businesses. It also provides businesses with the opportunity to market their self by posting the solutions they are currently solving.

Consumer behavior - Since the platform is aimed at facilitating SME's and not directly consumers it is not immediately apparent that consumer behavior is changed by GreenEcoNet.eu.

	Platform name	Greeneconet
	Internet address	Greeneconet.eu
	Main goal	Support SME's in their
		transition towards a green
		economy.
	Started in	Domain: June 2013
		Test: November 2013
		Launch: June 2014
	Legal form / entity	No legal entity
	Initiated by	- Stockholm Environment
		Institute
		- Green Economy Coalition
		- JIN Climate and
		Sustainability
		- Centre for European Policy
		Studies
•		- Ecologic Institute
1		- University of Piraeus
		Research Centre
	Business model	- Funded by the European
y		Commission (Framework 7).
		Funding ends 31 st of May
		2016
		- Also funded by Stockholm
		Environment Institute
		(via Swedish International
		Development Cooperation
		Agency)
	Who can join	- SIVIE's
		- IVIICRO DUSINESSES
	Information in the	- Social enterprises
	Information input	- Crowasourcing
	Country of origin	- United Kingdom
		- Beigium
		- ivetneriands
y		- Greece
	Scala / coore	- Germany
	Scale / scope	
	Languages	40 languages (GOOgle
	Social impact	Linkodin: 20 mombors
		Linkeum: 39 members
	measures	Talebook. 127 likes
		YouTube: p/a
		# ITTELLINGLY: AN ZIVIE 2

Finance and risk - The FAQ page states as one of the benefits of joining the network, that members receive updates on SME green loans. These green loans might help to overcome the finance and risk barrier. It seems however that the platform does not directly match supply and demand of green investment money.

Collaboration and infrastructure - Through the possibility of posting business profiles, networks and green solution, collaboration between green businesses is being facilitated. The offering of a physical infrastructure is however not apparent on this platform.

Plan-c.eu

The non-profit association Plan C, is funded as one of the three pillar of the Flanders' Materials Programme. The platform describes itself as 'the circular economy hub: connecting, challenging and enabling entrepreneurs and organizations to make it happen'. Plan C has set the goal of getting Flanders' in the top 5 of European regions on the topic of sustainable materials usage by 2020. Planc.eu offers a news-blog, infographics, and several publications and tools. Besides this, they also offer several offline activities like a masterclass, participating in projects and they can be booked for a talk or seminar. Although Plan C aims at improving the Flanders' region in Belgium, they also offer their website in English.

Contribution towards a Circular Economy transition

Education and awareness - By offering a news blog, good looking infographics, and several publication and tools, Plan C is definitely helping to overcome the education and awareness barrier. The offline activities of a circular economy masterclass, participation in several projects and the speaking at seminars or talks clearly facilitates awareness building among the topic of circular economy.

Policies and legislation - The Flanders' materials Programme has been initiated by the Flanders' department of environment, nature and agriculture. Besides that, two of the 7 partners of Plan C are the department of entrepreneurship and the department of

Platform name	Plan C
Internet address	Plan-c.eu
Main goal	Connecting, challenging and
	enabling the circular
	economy
Started in	Domain: October 2008
	Activity: April 2012
Legal form / entity	(Autonomous) Non-profit
	association (with no paying
	members)
Initiated by	The Flanders' Materials
	Programme
Business model	- Subsidies (65%) Flanders
	governments
	- Payments from commercial
	strategic partners
	- Earnings from
	projects/events
Who can join	Advising and engaging
	individuals
Country of origin	Belgium
Information input	Plan C
Scale / scope	Belgium
Languages	Dutch / English
Social impact	LinkedIn: 957 members
measures	Facebook: 1.583 likes
	Twitter: 2.447 followers
	# members: 18 businesses /
	1 individual

economics, research and innovation. The fact that these government departments are involved in the Plan C projects increases the likelihood that practical policy and legislation changes will result from this involvement.

Markets and transparency - Apart from creating some transparency by providing knowledge and tools on the circular economy, Plan C does not facilitate supply and demand between businesses.

Consumer behavior - Although the workshops are focused upon educating businesses on the Circular Economy potential, the publications and tools can also be interesting for consumers.

Finance and risk - The platform provides 'econotalks' which is a longread about the economic and financial opportunities and barriers of a circular economy. There are however no concrete tools or contacts on the platform that directly facilitate the decrease of the finance and risk barrier towards a circular economy.

Collaboration and infrastructure - Since the platform does not offer an online member or networking possibility, the contribution towards more collaboration or facilitation of infrastructure is limited. They use their LinkedIn group for specific online discussions.

Circle-economy.com

The Cooperative Circle Economy works together with members and partners on projects on a company, sector or regional level, in order to accelerate the transition towards a Circular Economy. The website provides news, events, tweets, and a library on the Circular Economy. Although the website and its projects are mainly located in the Netherlands, the website is also offered in English. Businesses, knowledge institutes, NGO's, government bodies, but also inspired individuals can become a Circle Economy member. The membership fees for businesses range from € 750 for a startup, to € 50.000 for a multinational. Members get access to various offline networking and knowledge sharing sessions and activities. Circle Economy has also developed several tools like for example the Circle Scan and the Assessing Circular Trade-offs Tool (ACT tool).

Contribution towards a Circular Economy transition *Education and awareness* - The overview offering of news, events, tweets and library items offers some education and awareness. The members only offering of tools and networking events is offering a higher degree of education and awareness to its members.

Platform name	Circle Economy
Internet address	Circle-economy.com
Main goal	Promoting and educating
	about the circular economy
Started in	Domain: December 2010
	Test: ?
	Launch: ?
Legal form / entity	Cooperative
Initiated by	Only Robert-Jan van Ogtrop
Business model	Membership-fees
	range from € 750 for startup
	to € 50.000 for multinational
Who can join	- Businesses
	 Knowledge institutes
	- NGO / Governments
	- Inspired individuals
Information input	- Circle Economy
Country of origin	Netherlands
Scale / scope	Netherlands, some EU?
Languages	Dutch / English
Social impact	LinkedIn: 1.404 followers
measures	Facebook: 2.961 likes
	Twitter: 12.639 followers
	YouTube: n/a
	# members: > 40

Policies and legislation - Circle Economy <u>states</u> to act as an advisor to government programs on the importance of circularity.

Markets and transparency - The networking opportunities for its members might bring some degree of transparency about the circular economy, but since it is for members only, the network scope is limited.

Consumer behavior - Although Circle Economy seems to be mainly focused on businesses, they also invite inspired individuals to join them. Therefore are likely to be changing some behavior, but only for those people which are already known with the concept of circular economy.

Finance and risk - The Circle Economy cooperative does not seem to be offering solutions to overcome the finance and risk barriers towards the circular economy.

Collaboration and infrastructure -

The members get access to networking events which are likely to enhance collaboration. The fact however that these events are members only already lowers the scope, impact and likelihood of successful collaborations between businesses.

Ellenmacarthurfoundation.org

The Ellen MacArthur Foundation has the aim of accelerating the transition towards the <u>circular economy</u>. Ellen MacArthur brought in 500.000 pounds herself, and the five founding partners raised 6 million pounds. The foundation focusses on three areas, being thought leadership, education and business. The website offers news, case studies, yearly publications, and a CE resources- and network map. Although the foundation is started in the United Kingdom, the intended served area is worldwide, which makes this one of the few Circular Economy platform that operates worldwide.

Contribution towards a Circular Economy transition

Education and awareness - With the publication of several books and the yearly circular economy report, the Ellen MacArthur Foundation provides a high degree of education and awareness on the topic of circular economy. The high numbers of followers, likes and subscribers clearly shows that this platform creates much awareness and social impact.

Policies and legislation - The Ellen MacArthur Foundation states to be working with business, government and academia to build a framework for an economy that is restorative and regenerative by design. The fact that this foundation is the worldwide promoter of Circular Economy increases the influence on the lowering of policy and legislation barriers.

Markets and transparency - The website offers a network map of business and their locations that are somehow related to the circular economy. This clearly increases transparency. There is however no online marketplace offered where supply and demand can be matched.

Consumer behavior - The high degree of impact on social media create a strong force of influence with the potential to change consumer behavior. Especially the two YouTube movie clips on circular economy, created by the Ellen MacArthur Foundation have been watched more than 400.000 times.

Finance and risk - The online platform does not state clear solutions for the finance and risk barriers. The yearly circular economy reports however, discuss this barrier and come up with possible solutions.

Platform name	Ellen MacArthur Foundation
Internet address(es)	Ellenmacarthurfoundation.org
Main goal	Accelerating the transition to
	the circular economy
Started in	Domain: November 2008
	Test: -
	Launch: September 2010,
	relaunched September 2015
	Circulatenews.org
	Domain: March 2015
	Launch: April 2015
	Thinkdif.co
	Domain: March 2014
	Launch: autumn 2014
	relaunched March 2015
Legal form / entity	Foundation
Initiated by	- Ellen MacArthur
	- B&Q
	- BT
	- Cisco
	- National Grid
	- Renault
Business model	- CE100 member fees
	- Schmidt Family Foundation
	-> Fellowship program
	- MAVA Foundation ->
Who can join	
who can join	- Corporates
	- Emerging innovators
	- SME's
	- Pioneer Universities
	- Affiliates (experts)
Information input	Fllen MacArthur Foundation
FTE's online part	Approx. 60
Country of origin	United Kingdom
Scale / Scope Area	Worldwide
served	
Languages	English / French / Portuguese
	/ Spanish
Social impact	LinkedIn: 4.444 followers
measures	Facebook: 7.871 likes
	Twitter: 18.317 followers
	YouTube: 3.019 subscribers
	# members: 100 (CE100)

Collaboration and infrastructure - The network map shows a clear overview of all the current businesses that are active on the topic of circular economy. There is however no physical solution or infrastructure offered for problems like reverse supply chains.

Circulairondernemen.nl

Circulairondernemen.nl is a platform where entrepreneurs, employees and those interested, share their projects, events, and experiences. But that is not all; people can find inspiration, information and a network in order to facilitate the steps towards a circular economy. The platform is initiated by the coalition NederlandCirculair! (translated: NetherlandsCircular!). This coalition consists of MVO Nederland, Circle Economy, De Groene Zaak, ClickNL Design, Het Groene Brein and RVO.nl. Together with partners like the Ministry of Infrastructure and Environment, TNO, Acceleratio and ICE-Amsterdam, the platform is working on the realization of an acceleration towards a circular economy'. The website is in Dutch and thus only focusses on reaching the Netherlands. In less than one year, the platform has already over 700 individual members.

Contribution towards a Circular Economy transition *Education and awareness* - The platform does not educate people on the basics of circular economy and thus assumes that users are already familiar with the terms and concepts. Instead of a focus on businesses, this platform focusses on the individual level. The fact that individuals can post cases, events, or library items truly supports the crowdsourcing principle and the wisdom of crowds.

Policies and legislation - Since the platform focusses on cases, events and information, it does not seem to have

Platform name	Circulair ondernemen
Internet address(es)	Circulairondernemen.nl
Main goal	Providing inspiration,
	information and a network in
	order to facilitate steps
	towards a circular economy
Started in	Domain: January 2014
	Test: June 2015
	Launch: September 2015
Legal form / entity	Coalition
Initiated by	Nederland Circulair!
	- MVO Nederland
	- Het Groene Brein
	- De Groene Zaak
	- Circle Economy
	- Click NL
	- Sustainable Finance lab
	- RVO.nl
	- Min. Infra & Environment
Business model	Funding from the Ministry of
	Infra & Environment
Information input	Crowdsourcing
Who can join	Individuals
Country of origin	Netherlands
Scale / scope	Netherlands
Languages	Dutch
Social impact	LinkedIn: n/a
measures	Facebook: n/a
	Twitter: n/a
	YouTube: n/a
	# members: 700

the main goal of changing policy or legislation. The fact however, that the Ministry of Infrastructure and Environment is a partner of the coalition clearly shows that they might be willing to listen to certain wishes or demands from the platform community.

Markets and transparency - The fact that those who have been registered can post news, events or cases clearly improves the transparency of knowledge around the topic of circular economy in the Netherlands. The matching of supply and demand is limited to people's expertise and thus does not include products or services.

Consumer behavior - Circulairondernemen.nl mainly focusses on the individual level instead of the company level. This platform is therefore more suited for consumers to participate in. Since there are more consumers on Facebook then on Twitter, it is peculiar that they do not have a Facebook account.

Finance and risk - Sustainable Finance lab is one of the members of the coalition. Their goal is to bridge the theory and practice of sustainable financing. The platform itself however, does not offer a tool or infrastructure to arrange the matching of supply and demand of sustainable investment money.

Collaboration and infrastructure - Members of the platform can search inside the member library on sector for example or on certain tags. This way they can find the right persons that are also interested or involved in the circular economy.

Circulaire-economie.info

'Stichting Circulaire Economie' (Foundation Circular Economy) has the goal of the creation of a blossoming and futureproof Netherlands by applying the Circular Economy principles. The Foundation does that by showing businesses, governments and educational organisations the opportunities and potential of the circular economy. They want to create more chain cooperation, innovation, more effective use of resources, less waste and smarter use of human talent. Besides the offering of Circular Economy publications, and news and event updates, the platform recently launched the RealiCE ecosystem, which has the goal of connecting knowledge, skills and creativity. Participants of the platform get a login which they can use for the online sharing-, and discussion platform.

Contribution towards a Circular Economy transition

Education and awareness - The publications, news and event updates contribute to more awareness on the topic of Circular Economy. The online discussion platform is likely to educate the participants on the platform.

Policies and legislation - The RealiCE ecosystem states to be connecting entrepreneurs, organizations, governments and research- and educational institutions. If this ecosystem is going to work, it will definitely lower the policy and legislation barriers towards a circular economy.

Platform name	Circulaire Economie
Internet address	Circulaire-economie.info
Main goal	Work on the creation of a
	blossoming and futureproof
	Netherlands from the
	circular way of thinking
Started in	Domain: January 2013
	Test: not applicable
	Launch: October 2015
Legal form / entity	Foundation
Initiated by	Erick Wuestman and Bas
	Luiting. Platform is provided
	by Floow2
Business model	- Subsidies
	- Commercial projects
	- Membership fee\ (financial
	or in kind)
Who can Join	- Every interested individual
	- Businesses: Startup € 7507
	SIVIE € 1.500 / corporates €
Information input	2.250 Crowdsoursing (with shock)
Country of origin	Netherlands
Scale / scone	Netherlands
	Dutch
Social impact	LinkedIn: 1.480 members
measures	Facebook: n/a
	Twitter: 4.555 followers
	YouTube: n/a
	# members: 18 active

Markets and transparency - The online discussion and asset sharing platform, together with the RealiCE ecosystem, are increasing the transparency by matching supply and demand of assets, but also knowledge and contacts. This platform therefore shows the potential of lowering the markets and transparency barriers of the circular economy.

Consumer behavior - The circulair-economie.info platform seems to be mainly focused on connecting businesses and other organizations instead of consumers. Therefore, they do not directly contribute on the topic of the consumer behavior change.

Finance and risk – No finance and risk issues are not addressed by the offerings of the platform. They do however organize a meetup about financing the Circular Economy.

Collaboration and infrastructure - The online infrastructure of the RealiCE ecosystem, together with the asset sharing and discussion platform contribute towards overcoming the barrier of collaboration. The platform however does not offer a solution yet for the inexistence of a current products/materials infrastructure.

Zerowastescotland.org.uk

Zerowastecotland.org.uk is a platform that has been established by WRAP.org.uk, in close cooperation with the Scottish Government. On the 30th of June 2014, the subsidiary company Zero Waste Scotland Ltd. ceased to be a part of the WRAP Group, and is now fully owned by the Scottish Government³.

Contribution towards a Circular Economy transition

Education and awareness - With several projects like 'Love food, hate waste', and 'Love your clothes' Zero Waste Scotland tries to create behavioral changes by establishing awareness and education. One of their projects called 'Resource efficient Scotland' even offers free business support on how to reduce costs and implement resource efficiencies. There is a free online tool called the '<u>Savings finder</u>' which provides business with advice on how to save money and become more sustainable. '<u>Green Champions'</u> and '<u>Green Town</u>' are other free online training tools which allow businesses to learn at their own pace in their own workplace. The website also provides research and case studies related to the Circular Economy.

Policies and legislation - Zero Waste Scotland is owned by the Scottish Government, which increases the potential influence of this Circular Economy platform on

Platform name	Zero Waste Scotland
Internet address	Zerowastescotland.org.uk
Main goal	Providing leadership and
	practical support to
	encourage growth of the
	circular economy in Scotland
Started in	Domain: March 2002
	Test: ?
	Launch: ?
Legal form / entity	Limited by Guarantee
Initiated by	The Scottish Government and
	WRAP?
Business model	Funded by The Scottish
	Government
Who can join	- Individuals
	- Businesses
	- Public sector organizations
	 Resource management org's
	- Re-use organizations
	- Local authorities
Information input	By Zero Waste Scotland
Country of origin	Scotland
Scale / scope	Scotland
Languages	English
Social impact	LinkedIn: 469 followers
measures	Facebook: 2.521 likes
	Twitter: 16.329 followers
	YouTube: n/a
	# members: n/a

the Scottish policies and legislations related to sustainability. The platform provides businesses with online information and guidance on the compliance and industry regulations in Scotland.

Markets and transparency - Zero Waste Scotland provides a <u>materials brokerage service</u> which has the goal of providing local authorities and the public sector to get a better deal for their collected recyclable materials. By combining the suppliers and matching them with the demand from reprocessing plants. The increased scale will provide better deals for the suppliers and more certainty and continuity for the material processors.

Consumer behavior - In their program delivery plan 2015-18, there are five key themes of which one is to encourage sustainable consumer behavior. Their goal is to reduce household food waste with 5% compared with 2015 levels. They want to do this by setting up local community and volunteer networks and by for example promoting the 'good to go' doggy bag scheme to restaurants. Unlike many other Circular Economy platforms, this platform also includes consumers into the tips and tools provided on the website.

Finance and risk - The Zero Waste Scotland platform provides a clear overview of currently available <u>funding</u> <u>possibilities</u> for businesses. The Materials Brokerage Service as mentioned before, seems to be a good step towards reducing the risk by providing certainty of supply for those who wish to invest in a reprocessing plant and certainty of demand for the local authorities

Collaboration and infrastructure – Scotland was the first country to join the Ellen MacArthur CE100 Network. Zero Waste Scotland support a network of 10 SME's which benefit from access to CE100 events and resources.

³ According to the <u>2014-15 annual report</u> from WRAP, page 22.

Wrap.org.uk

WRAP stands for Waste and Resource Action Programme. WRAP was established in 2000 and is thereby the oldest Circular Economy Platform in the research sample of the 12 platform case under study. This UK based organisation does not only receive funding from its own government organisations, but also from the European Union. Its international character is shown by the partnerships with United Nations Environment Programme (UNEP) and the UN's Food and Agriculture Organisation (FAO).

Contribution towards a Circular Economy transition

Education and awareness – WRAP provides many <u>publications</u> and several offline <u>workshops</u>, but also organizes an online webinar on for example Food Waste Recycling. The platform focusses on the four themes of (1) Food waste reduction, (2) Sustainable Electricals, (3) Sustainable textiles, and (4) Waste as a resource.

Policies and legislation – WRAP does not seem to have a clear focus on changing policies and legislations, but the fact that they are funded by several governmental bodies implies that they have

Platform name	Waste and Resources Action
	Programme
Internet address	Wrap.org.uk
Main goal	To accelerate the move to a
	sustainable resource-efficient
	economy
Started in	Domain: June 2000
	Test: ?
	Launch: ?
Legal form / entity	Charity and Company limited
	by Guarantee (non-profit)
Initiated by	UK Government?
Business model	- Many government grants
	(also EU)
	- Business partners funding
	specific projects
Who can join	- governments
	- businesses
	- communities
	- thinkers and individuals
Information input	WRAP
Country of origin	United Kingdom
Scale / scope	United Kingdom/
	International reach?
Languages	English
Social impact	LinkedIn: 2.650 followers
measures	Facebook: n/a
	Twitter: 19.712 followers
	YouTube: 146 subscribers
	# members: ?

the power and influence to improve the policies and legislation in favor of a Circular Economy.

Markets and transparency – The online WRAP platform does not seem to create markets by matching supply and demand online. WRAP itself however is highly transparent by being one of the two CE platforms (besides Plan C) to publish an annual report.

Consumer behavior – WRAP mainly focusses the intended change of consumer behavior on the minimization of waste. They do this through initiatives like 'Love food, hate waste', 'Love your clothes' and 'Recycle now'. The platform also provides informational movie clips, for example on how to best preserve your food.

Finance and risk – The WRAP platform provides a <u>clear overview</u> of possible funds, loans and grants for sustainable communities, businesses or investments.

Collaboration and infrastructure – On their website, WRAP states the following 'we have a unique ability to bring together multiple stakeholders and accelerate change in behavior in ways that neither government nor individual companies can working on their own. A great example of this collaboration facilitation is the design and delivery of grants and loans in close cooperation with funders.

Economiecirculaire.org

Economie Circulaire is an online open source Circular Economy platform on which businesses and individuals can post news, events, articles and where they can create or join (online) communities.

Contribution towards a Circular Economy transition

Education and awareness – The platform provides basic information about the Circular Economy concept, but also enables its members to post relevant news. Through using the tags, users can easily find all the available knowledge and information about a topic that is relevant to them.

Policies and legislation – The regulation tag on the website provides several documents, articles and initiatives related to policies and legislation around Circular Economy. The fact that the relevant French Government department is supporting the platform suggests that EconomieCirculaire.org might have some influence on the French Circular Economy agenda.

Markets and transparency – The fact that the platform is open source creates more transparency in all the available information about Circular Economy topics by using the relevant tags. The list of individuals, businesses and Circular Economy

Platform name	Economie Circulaire
Internet address	Economiecirculaire.org
Main goal	The goal of the collaborative
	platform is to organize
	knowledge on the circular
	economy and to mobilize
	stakeholders at regional,
	national and international
	levels
Started in	Domain: May 2013
	Test: ?
	Launch: ?
Legal form / entity	Charity?
Initiated by	-The Institute of Circular
	Economy
	- CIRIDD
Business model	Support of the ADEME and
	the Ministry of Ecology,
	Enormy2
Who can join	Ellergy:
	entropropours municipalities
	large companies
Information input	Open source
Country of origin	France
Scale / scope	France
Languages	French
Social impact	LinkedIn: xx followers
measures	Facebook: n/a
	Twitter: xx followers
	YouTube: xx subscribers
	# members: 477 individuals /
	407 organizations??

communities on the platform makes it easier to find and connect with the relevant individuals and businesses.

Consumer behavior – The Economie Circulaire platform mainly focusses on businesses and individuals that are already interested in or busy with the Circular Economy. This, together with the fact that there are no social media pages to bring the platform under the attention of the general public shows that the behavior of the general public will not be altered by this particular platform.

Finance and risk – Since there is currently no tag on the topic of financing or risk mitigation, this platform is currently not helping to overcome that particular barrier towards a Circular Economy.

Collaboration and infrastructure – The online communities provide an easy and accessible way for businesses and individuals to connect, discuss and collaborate with others on particular topics related to the circular economy. Even though the platform does not provide a physical reverse infrastructure, the open source platform and its communities provide a great infrastructure for stakeholders to find each other and connect.

Institut-economie-circulaire.fr

The French Institute for Circular Economy is financed from membership fees that are calculated based on indicators like turnover, employees, or for cities inhabitants. The Circular Economy workshops of the Institute are only accessible for members.

Contribution towards a Circular Economy transition

Education and awareness – The offline workshops that are only accessible for members provide the education that is necessary to transition towards a Circular Economy. The fact that the platform has a presence on several social media platforms likely results in the creation of awareness about the Circular Economy among the general public.

Policies and legislation – One of the ambition points on the website is to change regulation and legislation to boost the Circular Economy transition.

Markets and transparency – The platform does not seem to connect supply and demand of products, materials or services of any sort. The fact

Platform name	Institut Economie Circulaire
Internet address	institut-economie-circulaire.fr
Main goal	To combine and exchange
	expertise and resources
	between all experts and
	stakeholders. Facilitating
	research, pilots and results
	towards a Circular Economy
	by creating synergies
	between stakeholders and
	change limiting rules and
Chautad in	legislations.
Started In	Tost: not applicable
	Launch: Endrugny 2012
Logal form / ontitu	Association
Initiated by	2
Business model	: Membershin fees
Who can join	All legal entities individuals
	only if they have exceptional
	knowledge or qualities
	related to the CE.
Information input	Closed input
FTE's online part	5
Country of origin	France
Scale / scope	France
Languages	French
Social impact	LinkedIn: 1.726 members
measures	Facebook: 4.231 likes
	Twitter: 11.867 followers
	# members: ?

that the platform is for members only lowers the ability to create real transparency on the Circular Economy.

Consumer behavior – Economiecirculaire.org seems to be focused on legal entities, and thereby does not seem to put effort into changing the behavior of consumers.

Finance and risk – The website does not seem to facilitate a decrease of the financial and/or risk barriers towards a Circular Economy transition.

Collaboration and infrastructure – The platform provides collaboration and synergy creation among its members. The fact however that it is a payed membership decreases the number of members and thereby lowers the number of organizations to collaborate with.

Circulareconomyaustralia.com

Circular Economy Australia is a network of professionals that can be booked for workshops, training and talks about Circular Economy. The website provides a blog, overview of events. On their 'deviate2innovate' page they showcase 5 Circular Economy projects.

Contribution towards a Circular Economy transition

Education and awareness – The offline training, workshops and talks definitely provide education and awareness around the topic of Circular Economy.

Policies and legislation – The website does not state anything about policies and legislation.

Markets and transparency – The showcasing of Circular Economy projects creates some transparency of what projects are currently available, but other market or transparency actions or tools are not published on the website.

Platform name	CE Australia
Internet address	Circulareconomyaustralia.com
Main goal	A network of professionals
	helping to drive the
	awareness and adoption of
	Circular Economy principles in
	Australia. Can all
	professionals become a
	member of the network?
Started in	Domain: June 2014
	Test:
	Launch:
Legal form / entity	None (volunteer based)
Initiated by	- Candice Quartermain
Business model	Training, speaking
Who can join	Volunteers
Information input	Closed
Country of origin	Australia
Scale / scope	Australia
Languages	English
Social impact	LinkedIn: n/a
measures	Facebook: n/a
	Twitter: 233 followers
	# members: no members, 25
	volunteers, 10.000
	subscribers

Consumer behavior – The services offered by Circular Economy Australia seem to be focused on businesses rather than individuals, therefore the current influence on changing consumer behaviour is minimal.

Finance and risk - The website does not state anything about overcoming the financing or risk barriers towards a Circular Economy.

Collaboration and infrastructure - The website does not seem to facilitate collaboration between individuals or organizations towards a Circular Economy. They do however offer some kind of an infrastructure in order for businesses to find experts to help them achieve their goals.

Circularsg.com

The recently launched online platform of Circular Economy Singapore is an informal network of individuals, businesses and organizations. The objectives are to share Circular Economy news and resources, connect stakeholders to explore collaboration opportunities, and to organize regular talks and networking sessions.

Contribution towards a Circular Economy transition

Education and awareness – The news articles, the resources pages and the networking events contribute to the education and awareness about the Circular Economy and its opportunities. The three resource links on the website are all resources produced by other parties than CE Singapore, but that does not make the information it provides less valuable.

Policies and legislation – In their <u>news</u> <u>article</u> about the opportunities for the Circular Economy in Singapore, the first point mentioned is the potential of Circular Economy policies. The online platform does not show if or how Circular Economy Singapore is realizing this objective. The fact that there is no government agency in the members list suggests that it might be hard to actually influence policies.

Platform name	Circular Economy Singapore
Internet address	Circularsg.com
Main goal	To spread awareness and
	accelerate the shift towards a
	circular economy. With the
	vision of establishing
	Singapore as the first Circular
	Economy in Asia where there
	is no waste, only nutrients.
Started in	Domain: January 2015
	Test:
	Launch:
Legal form / entity	?
Initiated by	Co-founded by:
	- Eugene Tay of Green Future
	Solutions
	- Bhavani Prakash of Green
	Collar Asia
Business model	No fee, so now earn money?
who can join	organizations?
Information input	Closed: Circular Economy
mormation input	Singapore (the
	information/events on the
	website are kind of dated, is it
	still active?
Country of origin	Singapore
Scale / scope	Singapore?
Languages	English
Social impact	LinkedIn: 219 members
measures	Facebook: 199 likes
	Twitter: 41 followers
	YouTube: n/a
	# members: 14 (of which 3
	founding members)

Markets and transparency – The website does not provide a market mechanism to match supply and demand online. The offline talks and networking sessions might include collaboration opportunities on the supply and demand of resources or services. The fact that the platform asks no fee for membership increases the level of transparency, since it lowers the barrier for individuals and organizations to join the platform.

Consumer behavior – The fact that individuals are able to join the platform increases the influence on the potential consumer behaviour. The low measures of social media impact suggest that the reach of changing consumer behaviour is limited. The talks and networking sessions seem to be more focused on businesses and organizations and to a lesser degree to consumers.

Finance and risk – The website does not say anything about helping to overcome the financial and risk barriers towards a Circular Economy.

Collaboration and infrastructure – Regular talks and networking events provide opportunities for collaboration between different Circular Economy stakeholders.