

BARRIERS & ENABLERS to Circular Business Models



A whitepaper by A.G. Pheifer

April 2017

A.G. Pfeifer



Langesingel 3
3231 LE Brielle
The Netherlands
+31(0)6 8667 0001
www.ValueC.eu
allard@valuec.eu

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I would like to thank Peter Hopkinson (Bradford University) and
Dave Fetterman (Philips HealthTech) for the support given.

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1. Introduction

The idea of a circular economy (CE) has gained prominence in EU policy, business and academic literature since 2011. At the heart of this conception, the circular economy has the potential to create superior value and address many systemic societal and business challenges in a coherent and practical way. There are many examples of successful business models and business case studies, but it is recognised that there are also many policy barriers and obstacles that need to be overcome, in order to initiate and scale up or move from a linear to a circular practice. To understand more fully the barriers and obstacles experienced by actual CE practitioners within businesses, a survey of leading practitioners was undertaken to identify the most significant barriers and enablers.

With the elevation of the circular economy at the EU policy level, business and academic discourse is driven by a continuing search for models of economic growth and business profitability against a background of numerous systemic global challenges and trends including a rising global population, continuing overall material inputs into the economy and ever more waste and pollution¹. The notion of circular business models and value propositions suggests that businesses can increase profitability whilst reducing reliance on virgin material and fossil energy inputs². Shifting an existing system or business from linear to circular is, however, not easy as most business processes have been historically designed for a linear economy and logically, many barriers come forth out of the legacy of the company's 'linear' past.

The aim of this whitepaper is to identify, from a range of current leading CE business practitioners, the key barriers and opportunities that prevent or help them to adapt their current 'linear' business to a 'circular' business. Although this research is based on a broad range of businesses, it will not focus on showcasing existing circular business models, as there are already many business cases and documents available on this topic. Little research exists regarding the barriers and enablers of circular business models from the perspective of successful CE practitioners. This whitepaper will offer a contribution to the understanding of challenges and enablers to practice-based business model innovation.

1.1 Methodology

This whitepaper is based on a management project thesis. This thesis was the final exercise to complete the MBA Innovation, Enterprise & Circular economy at the Bradford University. This pioneering initiative, is set up in collaboration with the Ellen MacArthur Foundation by the Bradford University through its Distance Learning platform.

The overall research design is a case study, using interviews with practitioners as a primary source of data. The qualitative approach to data collection involved a number of design elements. Nine interviewees have been purposely and deliberately selected for this research. The interviewees selected have different backgrounds and roles from various types of business to allow for different contexts to be represented. The sample is relatively small as there are a limited number of people who have expertise in this field and are also strong knowledge holders on the topic of circular economy. They are hands-on experts in implementing circular business models or thought leaders in the concept of the circular economy.

Whilst the sample is too small to generate theory, it is sufficient for wider analytical generalisations. Data analysis involved looking for barriers and opportunities named during interviews followed by a classification into a micro-, meso- or macro-economic level. Barriers named by the interviewee were identified along with common and divergent concerns and opinions. A number of illustrative quotations from the interview notes were also identified for each category and provided as supporting statements. The barriers and opportunities named the most by the interviewees are described first. In order to differentiate the barriers, a division has been made between micro-, meso- and macro-economic barriers. Micro-economics describe the environment of an organization and or consumer and how they choose to interact. Macro-economics describes the entire economy that takes place on governmental, national, regional and global level. Meso-economics concentrates on the aspects not described by the micro- and macro-economics and address supply-chains, web of contracts and industry level³.

1.2 Global Trends

The current trends that drive the need for a circular economy are the 'canary in the coalmine'. These major trends all interconnect to each other as population growth acts as a lever to ecological deterioration & resource scarcity.

Population growth

The current global population is 7.3 billion and is expected to grow to 9 billion by 2050⁴. Around 30% of the current population belongs to the middle class or higher⁵. This means there are 2 billion people that have enough purchasing power to buy consumer goods and live in prosperity. It is expected that this number will grow towards 4.9 billion people by 2030⁶. In the current linear economy 1½ planets are needed to support present demand. If the status quo remains, there would be a demand in resources that can only be supplied by more than 2 planets in 2030⁷.

Ecological deterioration

Ecological deterioration is revealed by the extinction of species, environmental pollution and global deforestation. The Stockholm Resilience Center has developed nine planetary boundaries (figure 1) which, if exceeded, could trigger irreversible environmental change. Two of the nine planetary boundaries are currently exceeded and two other boundaries are gradually getting there⁸. 'Biosphere integrity', focussing on the extinction per million species, is in the danger zone⁹ and further decline could cause a collapse of ecological systems. Biogeochemical flows like eutrophication of freshwater systems with phosphate and high biological fixation of nitrogen threaten the natural balance and make ecological systems less resilient.

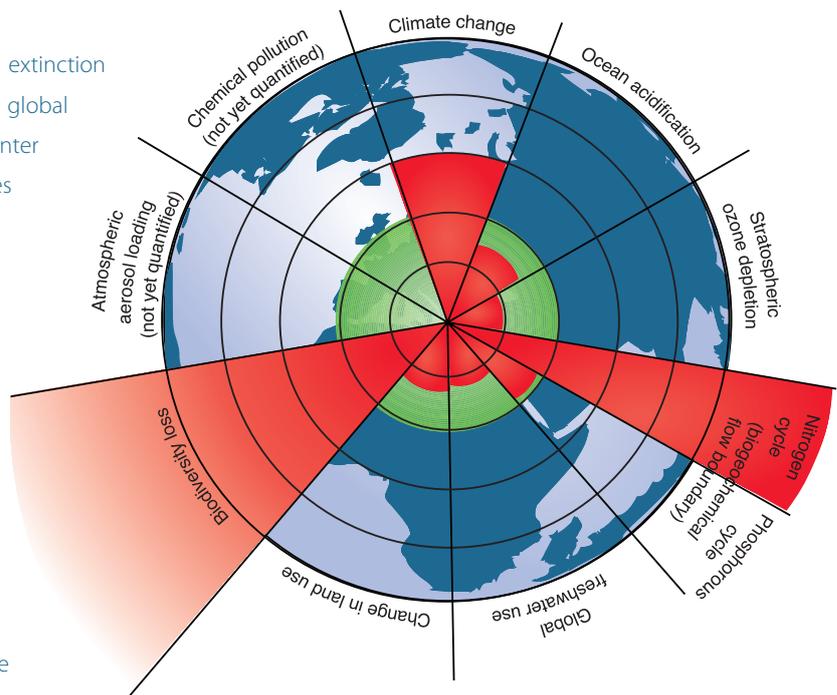


Figure 1. The planetary boundaries (Source: Stockholm Resilience Center 2009)

Climate change

The other boundaries that are close to surpassing the limits are 'Climate change' caused by continuous release of greenhouse gasses and 'Land-system change' through deforestation and conversion of natural vegetation to monoculture vegetation for agricultural purposes. These boundaries are connected as the forests are seen as the lungs of the earth, as trees convert carbon dioxide, the number one greenhouse gas, to other nutrients and oxygen.

Climate change is a global issue affecting local communities¹⁰. Occurring in the news on daily basis; it has already developed into a business risk that should be accounted for in taking strategic business decisions¹¹. Recently it has been confirmed that climate change coincided with the beginning of the industrial revolution and this means that global warming has already started around 1830¹². The capacity of the world's oceans to store heat and dissolve CO₂ prevented the effects of discernible climate change until the last decades.

Prosperity gap

For a long time, we have seen the increase of uneven distribution of wealth and availability of resources that should give people the ability to live in prosperity and freedom. There is a clear discrepancy in prosperity between developed countries that have a well-educated population with strong purchasing power and undeveloped countries that have a poorly educated population, dependant on a labour intensive, low-tech economy. This inequality is expected to grow and negative social and environmental outcomes will deepen, specifically for the poor¹³.

Resource availability

Hottelling already recognized in 1931¹⁴ that resources provided by our planet are managed poorly. In a linear economy these resources are taken and transformed into products one can briefly benefit from and are discarded to the environment when they no longer hold value to its user. This on itself wouldn't be an issue if these products and services would be part of a natural cycle and could regenerate. The planets' resources are finite; what is there, is what is available. It is contradictory when perfectly fine resources are discarded as waste; while there is an increasing population with demand. The demand from the global middle class could grow from \$21 trillion to \$56 trillion in 2030¹⁵. Although this shows the enormous economic potential for the future, the needed amount of resources is simply not available when the current linear model is used. Society is already confronted with shortages of water¹⁶ and high volatility in the cost of resources¹⁷. Resource scarcity must be properly addressed in all layers of the economy and society to maintain and create prosperity in the world.

Technological advancements

Although previous trends will negatively impact society if not addressed properly, this trend supports the development of solutions. Particularly during the last decade, we are experiencing an accelerated increase in the development of technology and its application, commonly referred to as 'The Industrial Revolution 4.0'¹⁸. There are four major topics which immensely impact the economy and society; big data, advanced analytics, human-machine interfaces and additive manufacturing.

Big data are large sets of data that can't be handled by standard statistical software¹⁹ and are best handled with decentralised networks in which each node in the network is given a small portion of the needed calculations in order to process the data. The growth of high-speed broadband Internet has made it a lot easier to solve large complex problems through advanced analytics. Big data generated by billions of users has been a great fishing pond for the e-commerce industry. This will continue to grow as there are 6.1 billion unique smartphone users expected in 2020²⁰.

Human-machine interface is the interaction between humans and machine through software²¹. Examples are controlling certain functions within your personal living area through automation like switching lights on & off or controlling central heating when leaving or entering your house. Further, this interaction could involve feedback loops from sensors that are connected to networks that indicate when to harvest crops based on a specific moisture percentage.

One of the really promising technological developments of the last decade has been additive manufacturing also described as 3D printing²². Digital design can effortlessly be translated to physical objects in all sorts of material, like plastics, metals or biodegradable material. It allows for easy prototyping and also supports the minimization and decentralization of stocking of spare parts as they can be printed on the spot. It is also possible to make one time, tailor-made products, specific to individual needs, like prostheses.

1.3 The origin and need of the circular economy

In order to sustain the current and future generations we need to radically change the current system we rely on. The biggest drivers are population growth and the demand for resources. If this is not properly addressed, competition for resources and deepening ecological problems will ignite international or global conflicts in which religion, ideology or national rivalry could be the trigger²³. A positive trend exists in technological advancement as this will support the management of information of closed business loops.

The Ellen MacArthur Foundation (EMF) has been fiercely promoting the concept of the circular economy the last couple of years to get the concept known on a global level. The concept of the circular economy is based on a combination of approaches like Cradle-to-Cradle²⁴, the Performance Economy²⁵ and Regenerative design²⁶. The report 'Limits to Growth' from the club of Rome²⁷, already alerts us to the negative impact of limitless growth the linear model has on the economy, ecology and society. It refers to system-conditions which come very close to the concept of the circular economy propagated today; like the stimulation of recycling, harnessing of solar energy and the improvement in product design.

In 1981 Stahel and Reday-Mulvey proposed an economic system based on loops in which prevention of waste and efficient resource use is of the utmost importance to create jobs and remain competitive. Lyle's work on regenerative design is focussing on natural systems and how one can work with it instead of against it. Braungart and McDonough build further on work from Stahel and Lyle to develop the Cradle-to-Cradle theory that focuses on design of products with positive ecological impact while reducing negative ecological impact²⁴. With these schools of thought combined, the circular economy can be best described as a holistic approach that supports economical growth with a focus on creating positive societal impact and ecological value.

The definition of the circular economy by the EMF is as follows: "A circular economy is one that is restorative and regenerative by design, and which aims to keep products, components and materials at their highest utility and value at all times, distinguishing between technical and biological cycles."²⁸

A circular economy is based on a closed loop design strategy in which value is kept in a loop as long as possible. If material can't be kept within the loops, it should be cascaded to another loop in order to retain value. The key focus is to organize the economic system as if it is a natural system in which the output of one process is the input to another. The butterfly model in figure 2 explains visually the concept in which the biological and technical cycles are set apart and shows how business loops are closed via i.e. refurbishment/remufacturing.

The EMF has calculated that a shift to the circular economy has an economic value of \$630 Billion in Europe alone towards 2025²⁹. In Italy, Poland & Germany it could create 270.000 jobs without displacing workers from existing jobs³⁰. Another study identifies 3 million jobs by 2030 across Europe in a scenario that fully focuses on a transformational expansion of the circular economy in Europe³¹.

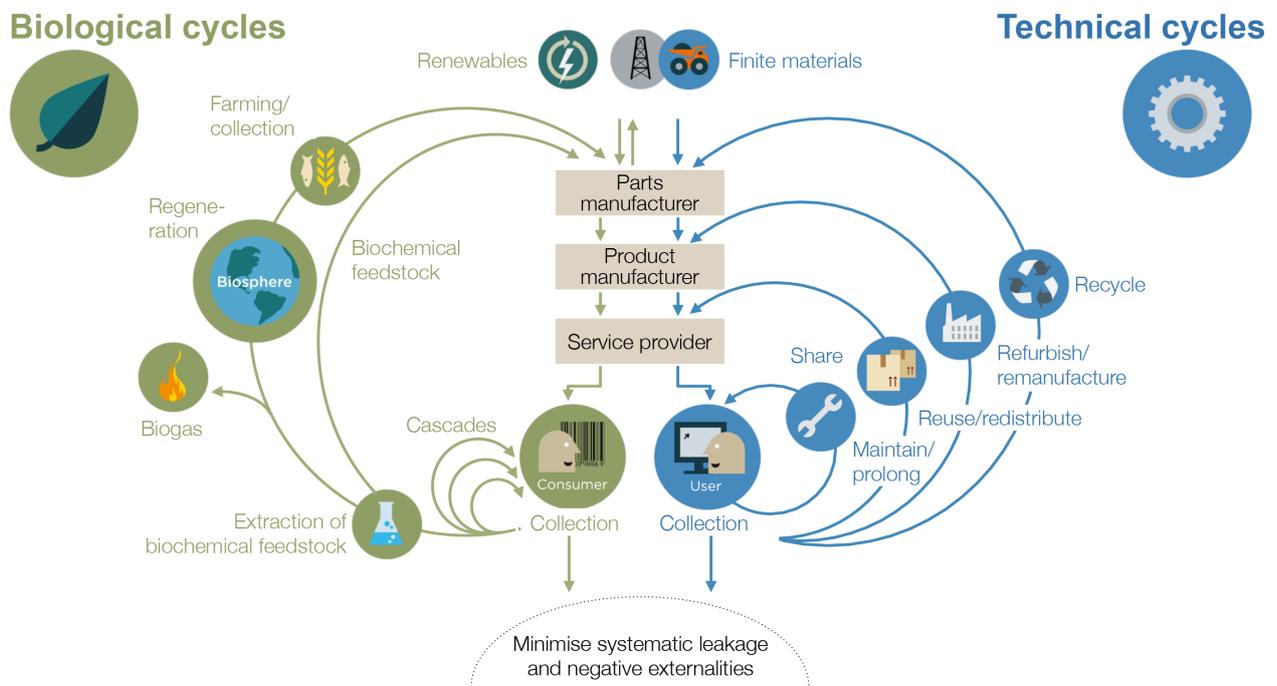


Figure 2: The Butterfly model as developed by the Ellen MacArthur Foundation & McKinsey. (Source: EMF, 2012)

1.4 Which business models support the circular economy?

A linear economy has business models that create economic value translated to a profit in monetary value. The majority of these are based on a one-time transactional model in which ownership of the product passes on to the customer. The description of a business model can be quite abstract and therefore has many definitions. Osterwalder described it as follows: "A business model describes the rationale of how an organization creates, delivers and captures value"³². This description resonates well with the concept of the circular economy that is also focused on creating value, but not only from a monetary perspective. If the definition of the EMF on the circular economy is combined with the definition by Osterwalder, the following can be stated: "A circular business model describes the rationale of how an organization creates, delivers and captures ecological, social and economic value that is restorative and regenerative by intent."

There are five types of circular business models identified by Lacy³³ described below.

1

Circular Supply-chains

Instead of using resources with a heavy environmental burden, the focus is on making use of resources that are fully renewable, recyclable or biodegradable and usable in consecutive lifecycles to reduce cost and increase predictability. Royal DSM is shifting from fossil based chemicals to bio-based chemicals which have no negative impact on the environment and minimize CO₂ emissions.

2

Recovery & Recycling

This model creates production and consumption systems in which all material is reused or revived for other purposes. This requires recapture of end-of-life products and reuse of valuable material, energy and components or cascade them to other loops to minimize value loss. All waste created during production needs to be used for other purposes.

3

Product Life-extension

Life extension means allowing products to be used as long as economically possible by maintenance, repair, remanufacturing or refurbishment. In order to create the highest residual value products need to be designed for life extension through easy reparability, upgradability, disassembly and parts harvesting & recycling when end-of-life has been reached. This model also requires the organization of a take back scheme in order to retain value. The customer interaction needs to move from transactional to relational, to allow the tailoring upgrades and alterations to specific needs.

4

Sharing Platform

This model promotes a platform for collaboration among product users and facilitates the sharing of overcapacity or underutilization, increasing productivity and user value creation. Companies whose products and assets have a low utilization or allow disruptive innovation could benefit by turning customer propositions upside down. Airbnb is a disruptive example enabling people to list or rent short-term lodging in residential properties, instead of booking a more expensive hotel.

5

Product as a service

The Product as a Service business model provides an alternative to the standard transactional model. Instead of buying the products, the service is obtained via a lease or pay-for-use arrangement. Product-design to deliver the service is key in this model. Durability and upgradability needs to be high, as performance is the most important driver. Creating residual value is central in a service business model, where focus is on product longevity and reusability to drive reduction in costs and increases in margin.

2. Barriers to circular business models

The barriers and opportunities discussed in this chapter have been derived from the interviews previously described in the methodology. In the appendix the barriers and enablers identified by the data analysis are summarized. The number of times a barrier has been named is not a measure of their relative importance, hence barrier 1 below is not necessarily the most important part of the picture. Short quotes from selected interview transcripts are presented to illustrate important points.

2.1 Barriers on micro-economic level

Barrier 1: Incorrect design of products, not designed for longevity, easy maintenance, disassembly and reuse

Not surprisingly, given the prominence of the importance of product design to a circular economy, eight of the nine respondents referred to some aspects of product design as a key barrier to successful circular economy business model innovation. The only company not to mention this was Peter Bruun from Bean-to-Barrel. This business proposition was based on the biological cycle as the product design was not directly a major issue.

*“The real change lies in design of products and services. Focus should be on the whole lifecycle.”
Freek van Eijk, Acceleratio*

When products are sold from a one-time transactional point of view, the manufacturer concentrates on delivering the product at the required quality level against a competitive price in which there is enough margin legitimizing its operation. Therefore a manufacturer will pay attention to keep costs low, but deliver the product to the customer in a satisfying manner. Many times this translates into a product that is designed for easy manufacturing, but could be very difficult to repair. From an operational perspective it is cheaper to glue a product than to use screws, as this requires more handling and would lead to a higher cost price. Logically it is more difficult to repair a glued product, as disassembly is more problematic. If, however you want to maximize the value one can pull from a product or a service, it must be designed for multiple lifecycles or in such a way the highest value is retained.

“Incorrect design of products can be a major barrier, as you need to design for longer use and easy maintenance, service & parts harvesting.” Jack Steenbeek, Philips Healthcare

Shifting to circular product design to create and capture new value opportunities is not a straightforward process. It requires a number of organisational capabilities and enabling conditions.

Barrier 2: Not fully understanding the holistic approach of the circular economy

Seven of the interviewees highlighted a poor understanding of the circular economy as a systemic, holistic approach or as a barrier to progress and adoption of CE business models. Ironically each interviewee explained CE in slightly different ways.

“Circular economy is moving away from a linear value chain that we have had in place for more than 200 years, which is based on the concept of take-make-waste” Andy Ridley, Circle Economy

*“Circular economy is an economic model that will ensure the well-being and health of people and society for a long period of time. Something that is still missing in the current industrial model. We need to implement a system, which mimics nature and lives in balance with its surrounding.”
Jad Oseyran, IBM*

The interviewees responded that the circular economy concept is much appreciated when explained for the first time and tends to get an interested audience excited. But it still remains difficult for non-insiders to fully understand the holistic and systemic approach of the circular economy.

“The current perception of CE by many people is that it’s focused on waste and recycling, while CE is a lot broader and more multi-disciplinary than most are aware of. CE is a concept, which is not always fully understood by the broader public.” Peter Bruun, Bean-to-Barrel

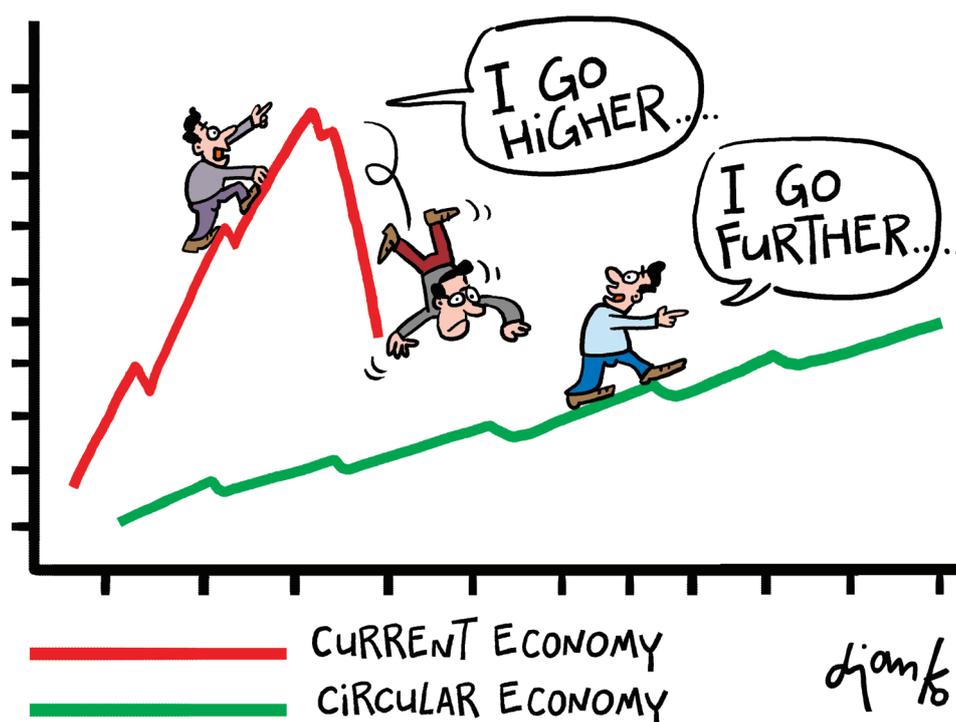
Persons that are not properly familiarized with the concept tend to explain it as a sustainability concept with the main focus on recycling. Recycling is essentially the loop with the lowest value (see figure 2). Loops, like repair or service, are closer to the customers and thus have greater value. Products offered via a service-model proposition have a greater potential to create extended customer retention and subsequently secure future revenue³⁴.

Barrier 3: Not integrated in the strategy, mission, vision, goals & key performance indicators

Similar to any business model – linear or circular – this is a minimal requirement for companies that have serious intentions to drive their business towards circularity and make themselves future proof. Within corporate settings CEO’s, shareholders or other leading managers can be very supportive of the concept, but if circularity does not get a place within strategy of a company, this will be a major barrier to progress as no translation and development to actual plans takes place.

“Most important barrier is when circular economy is not an integral part of the company’s strategy and therefore is not translated to a mission and vision of the company and eventually converted to clear goals for the company.” Nestor Coronado Palma, Philips Healthcare

Strategy is about the key issues that organizations need to tackle in the future. The global challenges set put in paragraph 1.2 should be enough encouragement to prioritize circular thinking into the strategy of any company.



Barrier 4: Availability of circular economy knowledge and skills

This point was referenced by 5 participants and reflects the importance of knowledge and skills that are needed to bring the circular economy under attention and support transition towards it.

“When you go to a more detailed level of CE it becomes a lot more complex. It requires a lot of training and education to make people truly understand what such propositions mean. One of the key challenges is that it requires a wide range of skills and capabilities.” Jad Oseyran, IBM

Circularity requires development of new capabilities and competencies - often managing multiple configurable building blocks simultaneously rather than working in silos. The Ellen MacArthur Foundation currently collaborates with a wide number of ‘pioneer universities’ across the world to develop programs to address this barrier²⁸.

Barrier 5: Financing of circular business propositions (internal & external)

Mentioned four times, financing is a particular issue for certain types of business models. For example, products in a service orientated performance models require a different approach of financing. In a linear model, costs are covered by revenue that comes forth out of the transaction made. In a circular model costs need to be financed upfront and revenue can be postponed over months or years. Organizations that want to invest in circular business models need to be financially strong or have access to an external financier that understands the proposition.

“Circular business models, like a ‘product as a service’ model need higher upfront financing from the producer.” Nestor Coronado Palma, Philips Healthcare

Financial service providers have difficulty in understanding the concept of circular economy and tend to judge investments incorrectly³⁵. Circular businesses can be easily seen as high risk investments due to lack of information and the traditional way of modelling risk, which is done from a linear perspective³⁶.

Barrier 6: Existence of organizational silos and poor collaboration

Also referred to as ‘the silo mentality’, certain departments or sectors show reluctance to share information with others in the same company³⁷. There could be many reasons for this to develop within an organization in greater or lesser extent. Organizational silos prevent straightforward development and implementation of circular business models, as this requires cooperation of all departments. Organizational silos occur as departments develop separate goals, objectives and budgets for which they are held accountable for by higher management. Suboptimal departmental programs prevent circular business models to be effective. Saving costs on the ‘bill of material’ in order to increase margin could eventually negatively impact the business results of a department or supplier that is responsible for servicing, maintaining or repairing the product.

“Silos within your organization prevent alignment of the organizations goals to transfer to more circular business models” Jad Oseyran, IBM

Close collaboration is essential to be successful in business. Results from the JDA/PwC survey for Omni-Channel Commerce show that only 18% of executives have taken the effort to break down organizational silos³⁸. Taking silos away creates significant cost-advantages and make an organization more agile and competitive.

Barrier 7: No sense of urgency, company culture and people opposed of changing current way of working

Leaving the comfort of the prevailing situation is difficult and prevents a comprehensive understanding of the sense of urgency. Furthermore, the world has become highly dynamic and complex. With a massive availability of information, it's challenging to fully oversee and understand important issues from an individual perspective in order to motivate change. The linear economical approach is still prevailing, instead of doing what is best for society and ecology³⁹.

"The current need for change within our customer base is not really big, which is also a barrier to introduce new models." Jack Steenbeek, Philips Healthcare

"Company culture and people can be opposed of changing the current linear processes to circular ones as this is not the way of working." Nestor Coronado, Philips Healthcare

Barrier 8: Focus on short term Return on Investment (ROI) and costs reduction

This barrier occurs mainly in listed companies with shareholders that expect results on a quarterly basis. For example, it was named by the two interviewees from Philips.

"Shareholders of a company could also be a barrier if they expect dividends and ROI on shorter term, which doesn't fit CE propositions very well." Jack Steenbeek, Philips Healthcare

Circular business propositions require long-term investment periods as the payback period will be spread over a longer period of time¹¹. The current ROI tools available do not take residual value created by closed loop strategy into account. Products designed to fit a circular model have a higher residual value. This value could tilt the decision to invest in a proposition.

"The Linear way of driving out cost is a continuous focal point and weakens attention for other values. And in the end could even drive your cost level up as decisions are based on short term savings and not long term." Owen Zachariasse, Delta Development Group



Barrier 9: Processes and quality management systems are organized in a linear way

Existing quality management systems, accounting rules or internal policies may prevent closing business loops. Inventory policies can prevent setting up part harvesting activities as businesses will try to keep inventory low to free up cash and prevent dead stocks or save on warehouse costs. In order to set up a harvesting process, parts have to be stocked until they are needed in the service department or for placement in new products.

“Current company processes are organized and documented from a linear perspective. Current quality management systems prevent setting up circular processes.” Nestor Coronado Palma, Philips Healthcare

Quality management systems describe how business processes are designed, how tasks, responsibilities & competences are assigned and to which requirements products must conform to. In companies with comprehensive and complex processes, where products are heavily regulated such as those in the medical device industry, it is difficult to avert from these processes as this will lead to non-conformities. The use of harvested parts could be contrary to what is described in the quality management systems and great effort is needed to adjust it, in order to fit a circular practice and remain compliant.

Barrier 10: Strong hierarchical organization prevents awareness & recognition CE-opportunities at C-level

Strong hierarchical structures can make it difficult to get ideas for change from the lower ranks of an organization to the top of the organization. It can even create an ivory tower in which the top management is unaware of needed change or opportunities.

“Top down hierarchy within a large company can be a large barrier. It is difficult to get the topic on the agenda of top management if they are not directly spotting the business value opportunity on the long term through a CE transition.” Jad Oseyran, IBM

Clear hierarchical structures and clarity on responsibility & accountability can be very useful in certain operational processes. A less centralized structure, however, is preferred when an organization needs to change to remain relevant to its customers or manage risks. Enabling creativity and innovation is complex and requires a more decentralized approach⁴⁰.

Barrier 11: Culture & behaviour of consumers; price is nr.1 driver in the buying decision

Individuals can act very contradictory. As a civilian, they can be very engaged with the problems of the world and longing to act on the issues at hand. But as a consumer they could be less willing to buy the more expensive ‘responsible’ product as price has the final say⁴¹. If a direct relationship between action and result is not directly seen, it is difficult to create a common sense of urgency to change⁴².

“Currently price is still the number one driver to make a buying decision when buying products and services. Consumers do not take negative ecological impact into account of their buying decisions.” Freek van Eijk, Acceleratio

This could also be seen as an opportunity. Offering refurbished products is a perfect example of a circular business model in which the acquisition cost for the customers is lower than a new product, but still delivers the same quality and experience.

2.2 Barriers on meso-economic level

Barrier 12: No reverse supply-chain in place

Two-thirds of the interviewees emphasized that having no reverse supply-chain in place is a huge barrier. Companies with linear business models have organized their forward supply-chain very well, but tend to lack the processes needed to take back products in different phases of the product life-cycle. In a business-to-consumer environment this is even more problematic as there needs to be an incentive for the consumer to return the product. Other issues are the lack of knowledge about closed loop supply-chains, high costs, lack of the right infrastructure or poor product quality and therefore a low residual value⁴³.

“CE supply-chains are longer and more complex. In order to fully manage such supply-chains you need national coverage.” Freek van Eijk, Acceleratio

Barrier 13: Lack of data and insufficient transparency in the supply-chain

A non-transparent supply-chain complicates the ability to close business loops. This can be caused by internal organizational silos, as the procurement department mainly concentrates on the lowest price while the design department has attention for aesthetics. Having insight in what type of material is in your product, or knowing where it is sourced from can be quite a task if you build complex products that consist of many different materials, parts or modules. This is especially true when you work with many suppliers that source their material from other unknown supply-chains⁴⁴. A supply-chain can't be managed if it is not transparent and this can bring great risk to a company.

“Insufficient transparency in the supply-chain makes it very hard to trace back the total supply-chain path.” Arthur ten Wolde, Circular Future

There are many examples of companies that had their brand reputation damaged because they were not aware that material was obtained from suspicious suppliers or sources. Individuals or interest groups can easily damage brand reputation via the various social media channels⁴⁵ and this will eventually harm customer satisfaction and leads to lower market value⁴⁶.

Barrier 14: Focus on the end of the product lifecycle, i.e. recycling

This barrier coincides with barrier 2 and indicates that the circular principles are not fully understood. Many executives are still under the assumption that with recycling alone, the principles of the circular economy are in place. Recycling is the loop that retains the lowest amount of value relative to the service loop which retains the highest amount of value for both the company as the customer. The service loop also allows a company to enhance the customer relationship, as it could enable customers to run a smoother operation which adds value. Harvesting parts from returned products delivers a higher value when reused in a service channel for repair purposes or remanufacturing practice instead of scrapping the product to receive the recycling value of the material⁴³.

“The perception of CE is currently focussing too much on recycling, which is at the end of the cycle, and influence and minimizing value leakage is low.” Freek van Eijk, Acceleratio

2.3 Barriers on macro-economic level

Barrier 15: Current governmental (waste) legislation & ruling is designed for linearity

This is a barrier which prevents cascading material across international borders and was mentioned by half of the interviewees. If material is defined and allocated as waste, there is quite an administrative burden to get it labelled as a resource for reuse. It discourages waste managers to re-loop materials as the costs are higher than the reward.

“The waste management industry is heavily regulated; this makes it difficult to turn waste into a resource.” Freek van Eijk, Acceleratio

The EMF also identified this as a barrier that leads to economic losses for Europe. It will take a minimum of three years, probably five years to get legislation in place on EU level to take this barrier away. Changing national or local legislation is preferable to tackle this issue on a shorter term⁴⁷.

“Although ‘waste’ is filled with large amounts of useful and valuable materials/resources as long as it has the label ‘waste’, it is very difficult, from a legislation perspective to move material around inside the EU and reuse or recycle it elsewhere.” Arthur ten Wolde, Circular Future

Barrier 16: Current linear system in place / Institutional barriers / Trade agreements

Countries or trade areas will always focus on protecting their economy. This also results in protection against products and services based on circularity. China for example won't allow refurbished medical systems from outside the border into their markets, but has legislation in place to stimulate the circular economy, which implies how contradictory governments can act. In history many trade agreements are set up to stimulate trade and economic development. These trade agreements do not demand any circularity as a minimal requirement and this has developed into an institutional barrier that allows highly competitive linear products to enter the market. Less competitive local products and services with less ecological impact are pushed out. Even within the Netherlands, currently seen as a circular hotspot, structural barriers are still in place due to the ruling of the linear economical system. Linear based companies have more advantages over circular companies due to fiscal frameworks and policies in place⁴⁸.

“Currently the linear economy is often still more profitable and prevents the economy to transform into a circular one, with closed loop supply-chains that is more in balance with available recourses and growing demand.” Peter Vissers, Partners for Innovation

Barrier 17: No financial incentives for circularity, while there is for linearity

There are few governmental financial incentives in place to stimulate the development of more circular business models. In the meantime, there is a great amount of financial support in the form of tax-relief and subsidies for large oil companies. These add up to an estimated \$1.9 trillion globally¹¹. One would expect that a profitable fossil-energy company contributing to climate change would not receive any governmental support. In the Netherlands they do tax energy derived from fossil fuel as the Dutch government wants to discourage the use of fossil energy in this way. However, the proceeds of these taxes are used to lower other taxes instead of investing in sustainable energy sources.

“There is a need for a level playing field, current economy is completely based upon the linear economy that is also financially incentivized by the government. There is need for an economic system in which circular products & services can be just as successful.” Arthur ten Wolde, Circular Future

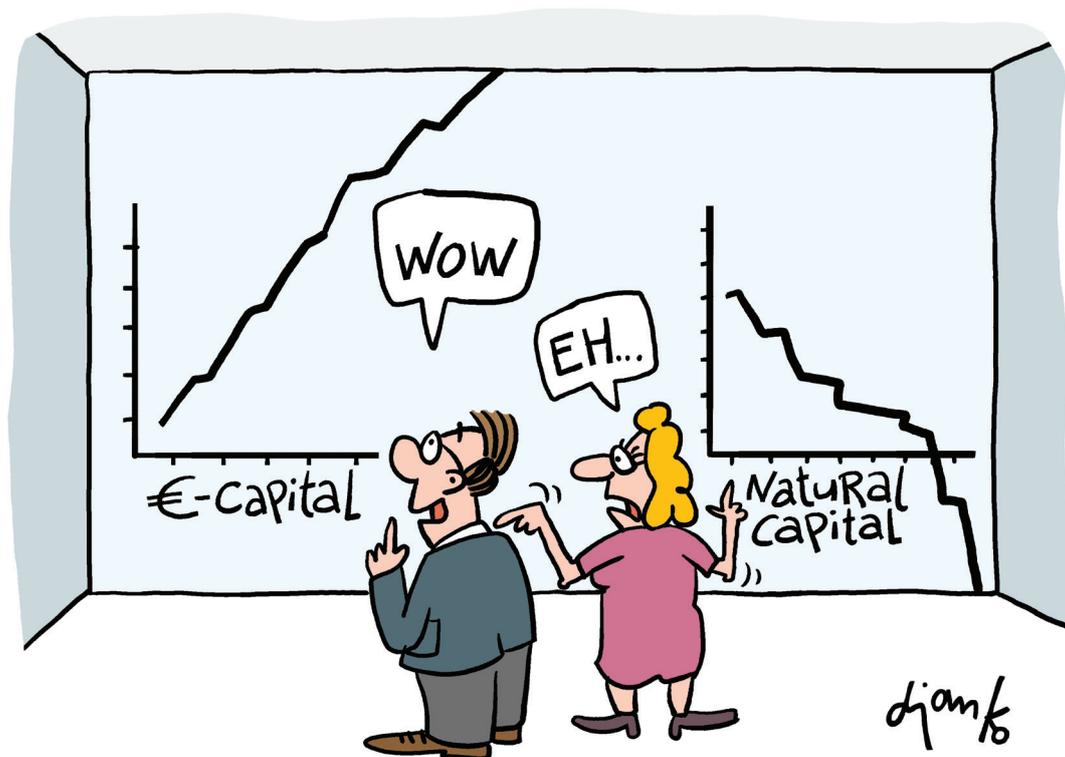
Barrier 18: Cost of degradation of ecology and society not taken into account into cost price

The price of products and services are based on the material and marketing cost in combination with supply and demand. Costs of ecological and societal damage are not included or, at best, poorly calculated into the cost price. What does for example deforestation or mining activities that pollute mercury into local water sources cost? Currently these costs are shifted towards local communities and the society as a whole. Certain environmental degradation can be local, but mostly its overall impact doesn't discriminate between national borders like e.g. climate change. In order to create a level playing field for circular and linear products, a global treaty is needed to fairly calculate such costs. Hence, this barrier is seen as a macro-economic barrier. If the cost of ecological degradation would be taken into account, it would automatically give products and services that are based on circularity a competitive advantage over products and services based on linearity⁴⁹.

"If you poison your customer or eliminate your customer by dumping hazardous waste in its environment, you are essentially diminishing your purchase/sell-pool. This is mainly driven by short term operating models and making quick profits, but has long term negative impact." Owen Zachariasse, Delta Development group

"Products and services based on a circular business model are less competitive in comparison to linear products. The actual societal and ecological costs are not taken into account in linear products." Arthur ten Wolde, Circular Future

Having discussed the barriers, the next section discusses opportunities or enablers to promote circular economy business models.



3. Opportunities & enablers to circular business models

3.1 Opportunities on micro-economic level

Opportunity 1: Organizations/companies need to integrate circularity into their strategy, goals and KPI's

Companies will need to integrate the principle of the circular economy into their strategy and this needs to be translated in clearly described goals and measurable parameters to monitor progress. To have a better alignment and disclosure of aspects of the circular economy into the strategy, the C-suite needs to be involved¹⁵. Support from the top is an absolute requisite for implementation of circular business models in order to make it a strategic differentiator, to mitigate risks and become more competitive.

“In order for companies to become more circular, companies need to have clear KPI's for CE driven propositions within their organizations. In this way the organization is incentivized.” Andy Ridley, Circle Economy

Opportunity 2: Set up training programs on CE to develop capabilities & skills

Expert facilitators, like universities or knowledge centres will be needed to set up training programs and develop the tools to acquire the capabilities and skills needed for circular business models. Currently this opportunity is already actively pursued by the EMF and 'pioneering universities'²⁸ like the Bradford University.

“You need specific knowledge and skills to be successful in a CE environment. This starts with the current generations of kids and young adults that need to be educated. You have to start with the generations of tomorrow.” Freek van Eijk, Acceleratio

Opportunity 3: Create clear communication on circular economy and its concept

As the concept of the circular economy (a focus on retaining value) differs fundamentally from the linear economy (a focus on creating monetary profits) clear communication is indispensable to get the concept across⁵⁰.

“The concept of CE requires a full understanding, although it is a compelling story and no negative prejudice is hold against it, it's still difficult to explain the whole holistic concept of CE.” Jad Oseyran, IBM

Opportunity 4: Create circular propositions based on the full lifecycle of product/service

It is essential to concentrate on the full product lifecycle at the start of the design process. Organizational silos need to be broken down as these can harm development and innovation³⁷. Incoherent departmental budgets and goals can be conflicting to overall organizational goals. Saving money by using lower grade material can seriously impact service performance and negatively impact the overall bottom line, as extra hours of servicing could be required due to product break down.

“Businesses that already adapt to this new situation will be the leading businesses of tomorrow.” Peter Vissers, Partners for Innovation

Opportunity 5: Create a holistic approach in CE projects, involve many different capabilities in CE projects

A holistic approach is necessary to identify opportunities to retain value in the overall process of the customer's proposition¹. This approach should be translated to a strategy and demands the convergence of a wide range of capabilities supplied by the different internal departments, supply-chain partners and external knowledge holders on the topic.

"Once the effectiveness had been mapped, the value proposition could be built. We did this by consulting many parties and requesting help from suppliers and partners and try to understand and learn to do the best thing. From this we developed the right process and managed it according plan."
Owen Zachariasse, Delta Development Group

Opportunity 6: Make sure there is a clear open & transparent platform, which supports collaboration

This allows the separate internal & external participants in the business process to interact. Close collaboration is essential to be successful in business. Results from the JDA/PwC survey for Omni-Channel Commerce show that only 18% of executives have taken the effort to break down organizational silos³⁸. This creates significant cost-advantages and makes an organization more agile and competitive. Collaboration should be stimulated to create a well-conceived, closed loop design. Partnering up with competitors⁵¹ could be a great strategy to successfully break down industry barriers⁵².

Opportunity 7: Develop assessment & implementation tooling

In order to capitalize on previous named opportunities, assessment and implementation tooling is indispensable to identify the value leakages in current (linear) processes and to develop business models that retain value. Both the Circle Economy and the Ellen MacArthur foundation have developed such tools.

"We focus on practical implementation & scaling by putting together the right people. The focus lies on sectors and delivering the right tools to facilitate decision-making and implement action plans."
Andy Ridley, Circle Economy

Opportunity 8: Have insight in all available data and use advanced data analytics

In an era in which data is in abundance, it is challenging to capture the right data and translate this to valuable information that could lead to better customer propositions. Having insight in all available data, using advanced data analytics and interpreting them correctly is still the Holy Grail for many organizations. Big data offers a wealth of information that was not available in the pre-digital age³⁴.

"Make sure you have insight in all data and have advanced data analytics in place." Jad Oseyran, IBM

Opportunity 9: Customers are willing to pay a higher price if the proposition brings greater value

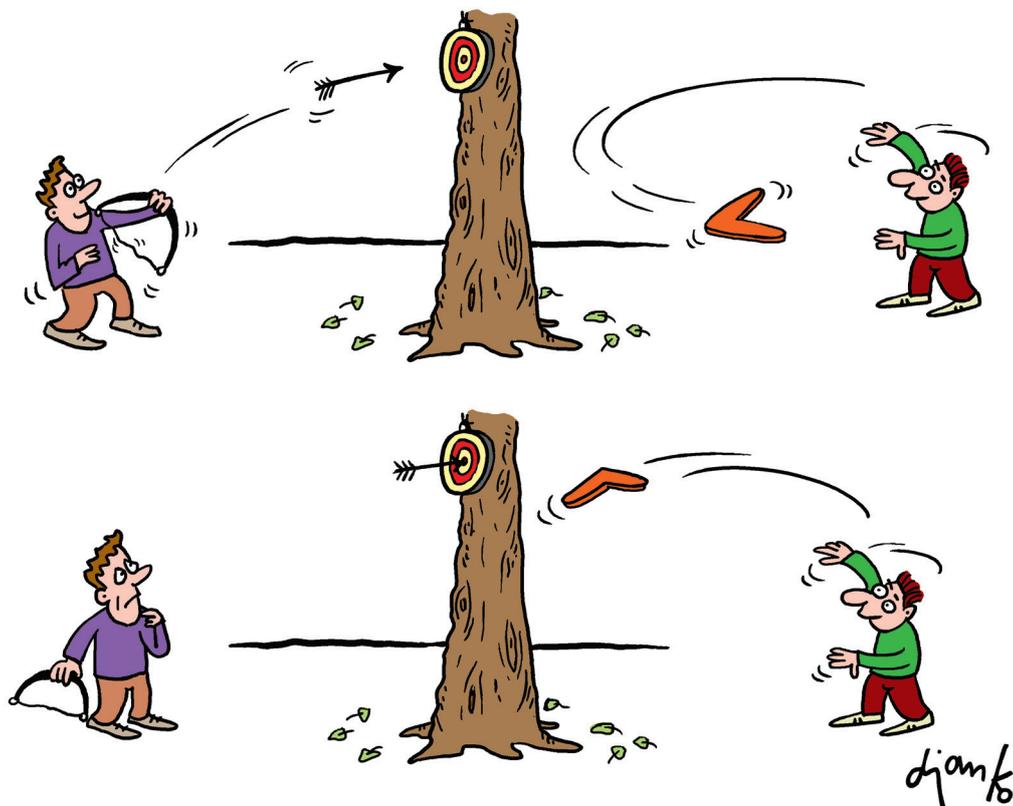
Interpreting available data and translating this into tailor-made solutions for customers creates a competitive advantage when managed smartly. This also permits asking a higher price for the product or service brought, as customers are willing to pay more if the proposition brings greater value.

"Eventually by investing in better construction and putting in a lot more time than usual, we were able to deliver more value and ask a higher square meter price." Owen Zachariasse, Delta Development Group

3.2 Opportunities on meso-economic level

Opportunity 10: Set up a reverse supply chain for return of resources

The interviewees named one meso-economic opportunity that can make or break circular business loops. Setting up a reverse supply-chain for the return of resources is a necessity to implement a successful circular business model. Most businesses have a well-organized forward supply-chain to deliver their product and services, but lack a reverse supply-chains in place that allows repair, refurbishment or harvesting of parts & materials. It is best to closely coordinate the reverse supply-chain with the forward supply-chain to create closed business loops⁵³. The company Ricoh has such a reverse supply-chain in place since 1994 based on the 'Comet Circle'⁵⁴. This model, very similar to the butterfly model, has been developed by Ricoh and is dedicated to retain the highest value possible.



3.3 Opportunities on macro-economic level

Opportunity 11: Mandatory Eco-design/C2C strategies/design for residual value

Governments do not have the agility that corporations have and they are not in a position to set up circular business models. They can, however, put measures in place to create the boundary conditions needed. One of the most named opportunities is that of mandatory Eco-design and Cradle-to-Cradle strategies on all products and services.

“Legislation is a prerequisite to generate sustainable products and services, like mandatory Eco-design or design for multiple (cascading) lifecycles.” Freek van Eijk, Acceleratio

Opportunity 12: Create policy and legislation to integrate ecological and societal costs into final price

Another often-named opportunity is to set up clear policy and legislation to integrate ecological and societal costs into pricing of products and services. In a correctly functioning economy, a valuation is needed of ecological systems and natural capital stocks, as they are critical for a functioning Earth's life-support system⁵⁵. These natural capital stocks, which also have an important contribution to human wellbeing, were valued at US\$ 33 trillion in 1997 (US\$ 48 trillion in current day). Products and services that have no negative impact or positively contribute to the ecology and society will automatically be cheaper and have a competitive advantage against products that are not sustainable.

“If the environmental impact or resource-use is reflected in the price you will naturally see sustainable products/services grow in demand.” Andy Ridley, Circle economy

Opportunity 13: Create Extended Producer Responsibility (EPR) for all companies

The introduction of EPR for all companies would also be needed to support opportunity 12. EPR focuses on making manufacturers and companies responsible for total environmental impact of the full life cycle of material, products and services delivered. This should stimulate environmentally better-designed products and closed loop design strategies⁵⁶.

Opportunity 14: Reform current government programs

The EU could additionally modernize current government programs. The €80 billion Horizon2020 program should be reformed, although current targets within this program fit well within the concept of the circular economy. The current program is perceived as complex and rigid with a high-threshold. Currently it costs €50.000 to fulfil an application with an average success rate of 11,8%⁵⁷. Small to medium sized enterprises only receive 10% of the total Horizon 2020 budget, although they play a vital part in the EU economy as they represent 99% of enterprises active in the EU⁵⁸. Restructuring the Horizon2020 program could help making these budgets available for a larger amount of enterprises within the EU.

“Reform or quit the Horizon2020 program, this program is too complex and has a very low success rate.” Arthur ten Wolde, Circular Future

Opportunity 15: EU governments will practice mandatory circular procurement

Additionally, governments should procure products and services based on circularity. The EU spends 20% of their gross domestic product, €2 trillion on procuring products and services. Such decision would be an enormous stimulant for the circular economy. In the USA it would even make a bigger impact, as public procurement is on average \$7 trillion a year⁵⁹.

“To easiest way for the EU to boost the circular economy is to bring a mandatory CE procurement program in place for all EU governmental bodies.” Arthur ten Wolde, Circular Future

4. Discussion

This whitepaper has briefly outlined the focal concepts of the circular economy demonstrating key drivers, principles, concepts and some of the building blocks to create value from business model innovation.

A short review of the barriers to circular economy practice and activities at macro and micro level, demonstrated wide ranging challenges to overcome to move towards successful circular value propositions. Interviews with 9 leading CE practitioners with extensive experience in CE business model design was undertaken to understand barriers, challenges and enablers from those working in the field. While the barriers identified might apply equally to 'linear' management and business model re-design, the context for the responses are related to circular economy practices.

The nine interviews generated a large number of barriers classified as micro, meso and macro with varying frequency across the total of nine participants. Whilst the number of participants referencing a specific category or type of barrier is not a measure of priority, those referenced most frequently are related to product design, lack of reverse supply-chains and a lack of understanding of the concept itself. This highlights the need for greater awareness, communication and education about the circular economy framework, concepts, and core capabilities, as well as the requirements of product design and reverse logistics to future circular economy practices.

Surprisingly governmental and policy barriers were not stated as prominently as in literature which may have been due to the fact that the participants have entrepreneurial backgrounds and have been successful in delivering circular business models with the current policy and regulatory environment in place. This does not mean that measures taken at the government level are not important to take remove barriers and kick-start the circular economy. For example, costing environmental externalities and mandatory regulation for circular product design were regarded as major enablers even if they are difficult to implement.

The work presented in this whitepaper also concludes my participation in the MBA Innovation, Enterprise & Circular economy at the Bradford University and I feel honoured to have been in the very first cohort. This whitepaper has confirmed my view of the importance of entrepreneurial companies and market led approaches to start the change and grasp the opportunities that are there. The interviews and extended work over the past few years has shown the importance of leadership to define the path, overcome the barriers and focus on the long-term to generate value. It has also provided insight to the paths that enable society, the environment and the economy to find a way to collaborate, create and strengthen the planets' ability to provide. Fortunately, there are many CEO's in the multiple publications referred to that fully support this path^{2,11,28,34}.

This whitepaper attempts to break down the one consuetude that we don't need: 'going back to business as usual'. It comes down to making the right choice for the future and I am confident that current and future leaders from both business and government will make this choice.

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6. Interviewees

- 1) Andy Ridley, Former CEO at Circle Economy*, CEO at Citizens of the Great Barrier Reef founder of Earth hour
- 2) Arthur ten Wolde, Owner of Circular Future, Manager Public Affairs at De Groene Zaak, Member of Coop ARC
- 3) Freek van Eijk, Founder & Managing Director Acceleratio
- 4) Jack Steenbeek, Senior Product Manager Cardiology at Philips Healthcare
- 5) Jad Oseyran, Circular Economy Lead at IBM Global Business Services
- 6) Nestor Coronado Palma, Former Circular Economy Program Director at Philips Healthcare*, Owner of Valueloops
- 7) Owen Zachariasse, Innovation and Sustainability at Delta Development Group - Partner at Zachariasse Consulting
- 8) Peter Bruun, Former CEO Bean to Barrel*, Test Advisor at Testbirds
- 9) Peter Vissers, Senior Partner, Partners for Innovation, Member Certification Standards Board - Cradle to Cradle Products Innovation Institute

** Position held during interview*

7. About the author

With 15 years of experience as an environmental engineer Allard Pheifer (1975) has extensive knowledge on the environmental performance of companies, Ecodesign and the implementation of environmental and business programs & projects that create cost reductions, increase revenue and improve business processes. He has worked for a broad range of companies as a consultant or employee, responsible for improving business and environmental performance. His employment history include PwC, ANWB, Hertel Industrial services & Philips Healthcare. For Philips Healthcare Allard has worked with a special focus on the circular economy within Philips Refurbishes Systems which offer pre-owned medical systems that have been thoroughly refurbished, upgraded and quality tested. Here he has been developing circular economy business opportunities by closing material loops in the life-cycle of medical systems. This translated into the development of new business models, setting up part harvesting schemes and improving business processes to enable circular economy within the whole of the Philips Healthcare organization.

Currently he works as an independent consultant and seeks opportunities to support businesses in creating value, growth and needed change in an increasingly dynamic and demanding business environment. Progressive companies recognize that the linear model of the past cannot deliver the long-term strategic value of the circular economy. A passionate change agent is needed to modify both business processes and company culture, to ultimately embrace the circular economy and reap its benefits.

Allard is an enthusiastic motivator, change agent and champion of results. His strategy is to understand the subtleties and details of the business processes without losing sight of the big picture. He approaches obstacles with creative thinking and focusses on turning business risks into long-term, value-based propositions. Allard has recently finished his MBA Innovation, Enterprise & Circular economy at the Bradford University, which was developed by the latter in cooperation with the Ellen MacArthur Foundation.



8. Appendix

Barriers			x named
Micro	1	Incorrect design of products, not designed for longevity, easy maintenance, disassembly and reuse	8
Micro	2	Not fully understanding the holistic approach of the circular economy	7
Micro	3	Not integrated in the strategy, mission, vision, goals & key performance indicators	5
Micro	4	Availability of circular economy knowledge and skills	5
Micro	5	Financing of circular business propositions (internal & external)	4
Micro	6	Existence of organizational silos and poor collaboration	4
Micro	7	No sense of urgency, company culture and people opposed of changing current way of working	3
Micro	8	Focus on short term Return on Investment (ROI) and costs reduction	3
Micro	9	Processes and quality management systems are organized in a linear way	3
Micro	10	Strong hierarchical organization prevents awareness & recognition CE-opportunities at C-level	2
Micro	11	Culture & behaviour of consumers; prize is nr.1 driver in the buying decision	1
Meso	12	No reverse supply-chain in place	6
Meso	13	Lack of data and insufficient transparency in the supply-chain	3
Meso	14	Focus on the end of the product lifecycle, i.e. Recycling	1
Macro	15	Current governmental (waste) legislation & ruling is designed for linearity	4
Macro	16	Current linear system in place / Institutional barriers / Trade agreements	4
Macro	17	No financial incentives for circularity, while there is for linearity	3
Macro	18	Cost of degradation of ecology and society not taken into account into cost price	2

Opportunities			
Micro	1	Organizations/companies need to integrate circularity into their strategy, goals and KPI's	8
Micro	2	Set up training programs on CE to develop capabilities & skills	7
Micro	3	Create clear communication on circular economy and its concept	5
Micro	4	Create circular proposition based on the full lifecycle of product/service	5
Micro	5	Create a holistic approach in CE projects, involve many different capabilities in CE projects	5
Micro	6	Make sure there is a clear open & transparent platform, which supports collaboration	4
Micro	7	Develop assessment & implementation tooling	4
Micro	8	Have insight in all available data and use advanced data analytics	3
Micro	9	Customers are willing to pay a higher price if the proposition brings greater value	2
Meso	10	Set up a reverse supply chain for return of resources	5
Macro	11	Mandatory Eco-design/C2C strategies/design for residual value	7
Macro	12	Create policy and legislation to integrate ecological and societal into cost price	6
Macro	13	Create extended Producer Responsibility (EPR) for all companies	3
Macro	14	Reform current government programs (like Horizon2020)	2
Macro	15	EU government will practice mandatory circular procurement	2

A.G. Pfeifer



Langesingel 3
3231 LE Brielle
The Netherlands
+31(0)6 8667 0001
www.ValueC.eu
allard@valuec.eu

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I would like to thank Peter Hopkinson (Bradford University) and
Dave Fetterman (Philips HealthTech) for the support given.

