

Circular Economy and Waste Management

Master Thesis EMSS S4

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I. Introduction

The document will discuss a new economic model, which is the circular economy. The feasibility of the model will be analysed and the report will discuss whether or not circular economy fits into sustainable development and how it increases resource efficiency.

The effects related to climate change are now becoming one of the most relevant environmental issues in the history of our planet. The intensification of catastrophic phenomena's such as floods, tsunamis and hurricanes strongly contributed to finally generate global awareness on this burning subject. The primary institution involved in monitoring climate change issues is the International Panel on Climate Change (IPCC). The IPCC considers the increased level of greenhouse gases (GHGs) in the atmosphere as the main cause of the phenomenon. What is commonly known as the greenhouse effect is an intrinsic process, which happens naturally on our planet, and causes a general warming of the Earth. The process itself plays a major role for human survival, in fact it has been estimated that due to the GHG effect earth's temperature is 3,3°C higher than how it would have been without that much pollution (Turco, 1997). What is highly problematic with the GH effect is that the increased level of the GHGs in the atmosphere generates an unnatural but also extremely high rise of global temperature. The vital need to counteract the phenomenon has been understood by the scientific community and now progressively by governmental institutions but some studies have stressed the fact that nowadays the cost of an efficient action against global warming could cost around 1% of the global Gross Domestic Product (GDP), if an effective but also a general action within the entire world is delayed, the cost could rise up to 20% of the global GDP (Stern, 2006)

Since Climate Change is on the agenda of the Brundtland Report (1987) as well as the Rio Declaration (1992) stated the need for sustainable

development in the whole world, nations agreed on contributing to a better life for not only the current, but also for the coming generations.

Reducing greenhouse gases and reducing wastes amount is today's most crucial challenge the world is facing. Since the general wake up call, many solutions have been discussed and proposed, as it can be seen in the Kyoto protocol (1997), an international treaty that sets binding obligations to industrialized countries to reduce their emissions of greenhouse gases. According to the economist Robert O. Mendelsohn: "*the agreement is highly inefficient and inequitable*" (Robert O. Mendelsohn, 2005). Furthermore the fact that the two most polluting nations refused to sign undermines the credibility of this treaty. Although even if signatory countries have managed to reduce their CO2 emissions, the world GHG emissions haven't stop growing because of the important growth of developing countries (cf figure 1 and 2). The other aspects that make the Kyoto protocol's efficiency's questionable are the facts that the treaty only takes into account GHG emissions without underlining waste issues as well as all the environmental issues that are rising today such as deforestation, water quality and soil contamination.

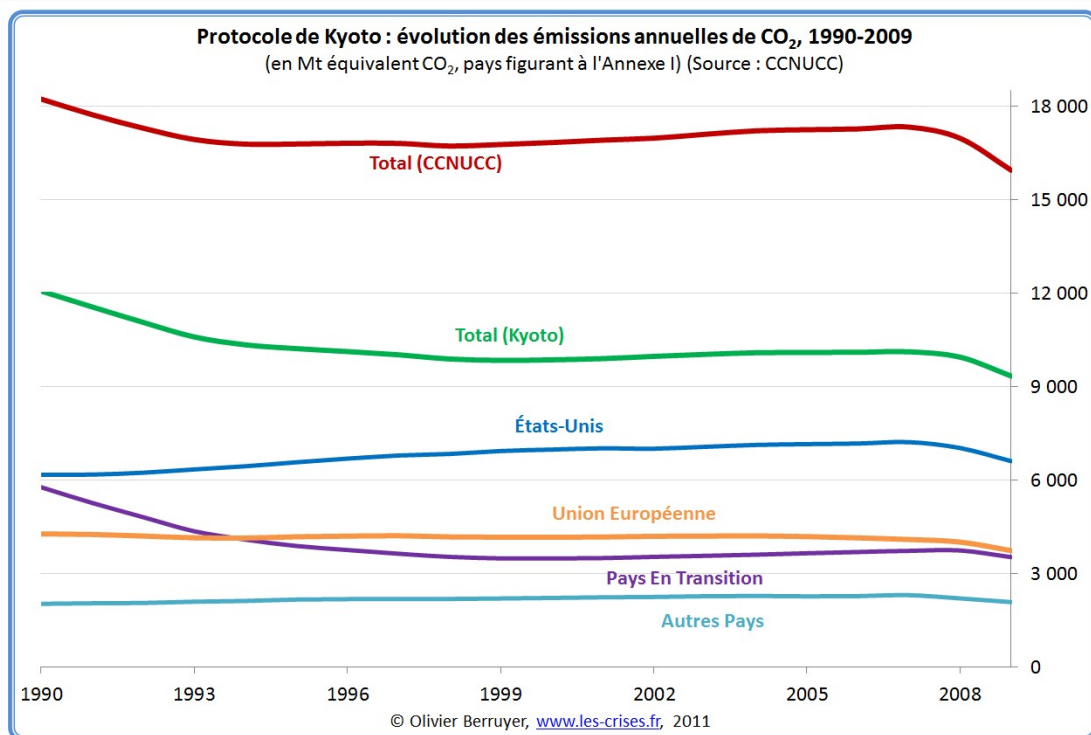


Figure 1: Kyoto protocol: Evolution of CO2 annual emissions, 1990-2009, Source: UNFCCC (=CCNUCC in French), copyright: Olivier Berruyer

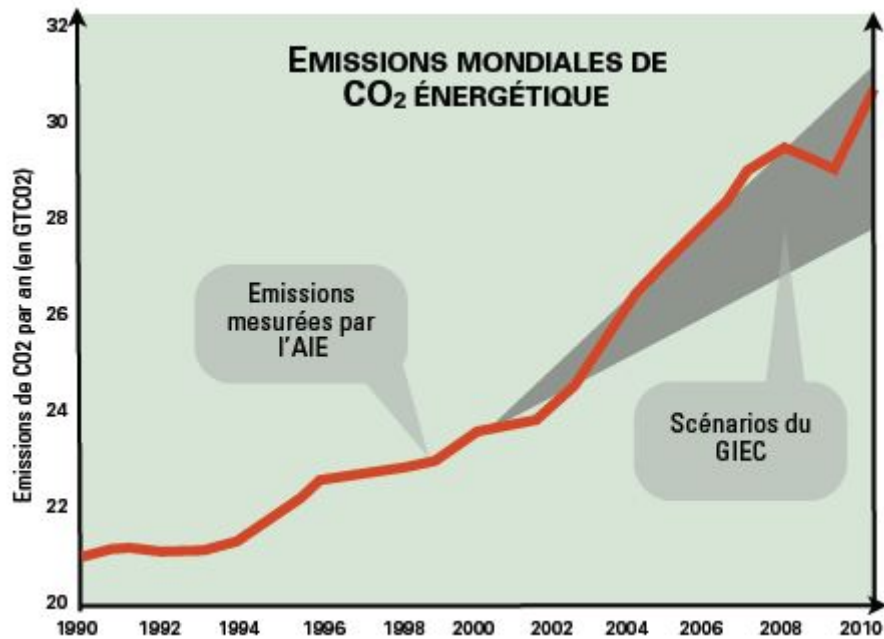


Figure 2: World annual CO2 emission from 1990 to 2010 source: Nicolas Hulot foundation¹.

It is a fact that after the industrial revolution water quality have been significantly decreasing, as well as the soil and air have been contaminated due to the release of toxic substances and Greenhouse gases made by the industrial processes and also the creation of non-biodegradable wastes. Indeed, since the beginning of mass production in the beginning of the twentieth century. Companies did not take into account the carbon emission efficiency while designing their products. At this time the understanding of the nature was not the same as today, natural resources seemed immeasurably vast. Nature itself was seen as "mother earth", a much greater power than human beings and could not be harmed by human activity. Today, even if our understanding of the nature had dramatically changed, *"Modern industries still operates according to paradigms that were developed when humans had a very different sense of the world. Neither the health of natural systems, nor an awareness of their delicacy, complexity, and interconnectedness, has been part of the industrial design agenda."* (William Mc Donough and Michael Braungart, 2002).

¹ Emissions mesurées par l'AIE = Measured Emissions by the International Energy Agency

According to Braungart this industrial system is based on a linear model also called the take-make-dispose model. The premises of this model are simple: companies extract raw materials, apply energy to them to manufacture a product, and sell the product to an end consumer, who then discards it when it no longer works or no longer serves the user's purposes. This design dominates the industries processes today, which incurs unnecessary resources loss in several ways.

However, this linear model has now shown its limits as it increases company's exposure to risks. For example, an increased number among them feel trapped at some point by market volatility as natural resource's prices are unpredictable and have, on average, been rising during the past decades to reach today prices heights that were never seen in the past century. On the other hand this rise of price is squeezed by a stagnating demand in many consumer markets.

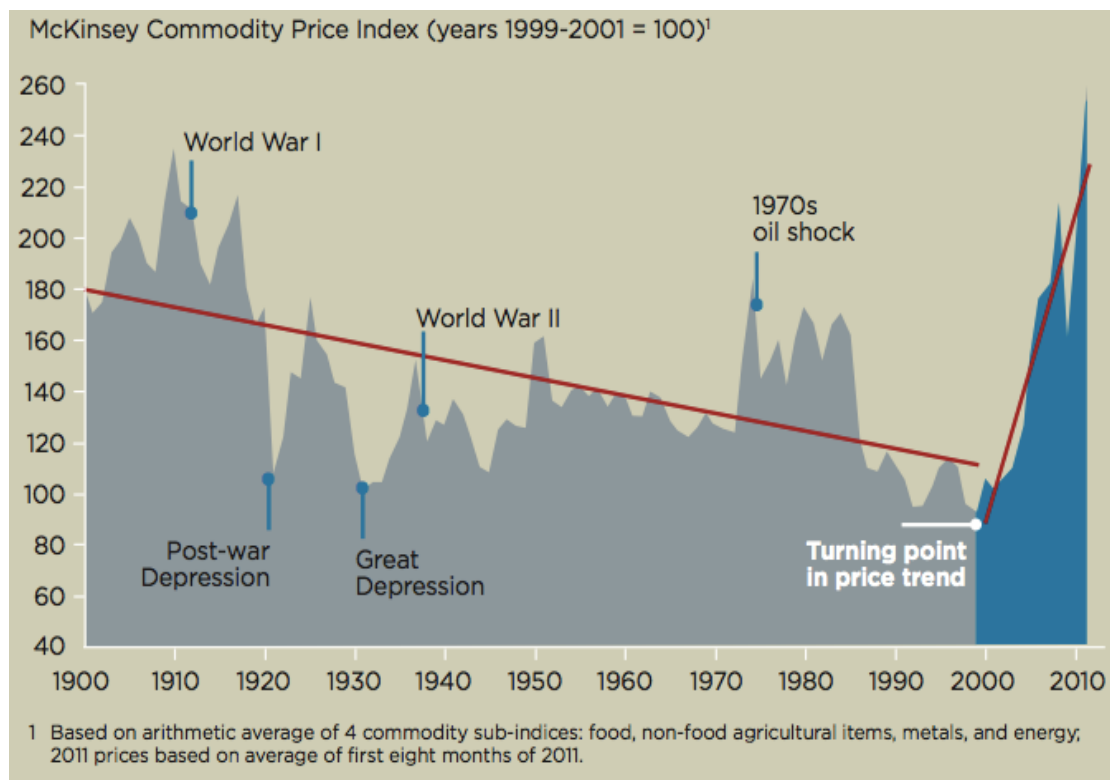


Figure 3: Price Volatility had risen above long-term trends in recent decades

Even the biggest companies are facing this “profit squeeze” due to price volatility, for example PepsiCo stated in February 2011 that they expect a rise of their input costs by 1.4 to 1.6 billion dollars (which represents 8% to 9.5% of their total input costs) because of the commodities raising prices. In the other hand, the company cannot plan to offset these losses only by raising their sales price because of the competition the company is facing.

Yet, the worst has not come as the population is exponentially growing as we passed from 2.5 billion inhabitants in 1950 to 7 billion today and it is projected to grow to 9 billion in 2050. Moreover, while global population keeps growing, it is expected that about three Billion people will join the ranks of middle-class consumers by 2030, led by the economic growth of huge populated countries as China and India. *“Their new prosperity will trigger a surge of demand both larger and in a shorter time period than the world has ever experienced”* (Mc Kinsey Company, 2013). The expectations suggest that demand for natural resources will rise by at least a third.

A massive chain reaction will be a result of global population growth as the amount of waste is also expected to be growing from 65 billion tons in 2010 to over 82 billion in 2020. As all products are not yet recycled (only 40% of wastes are recycled in Europe). If this actual model is still applied, the earth will not be able to support the rise of resource extraction demand, and disastrous consequences could be engendered.

As stated above, today the world has now to face a crucial environmental and energetic challenge. Due to the rise in population and prosperity, some drastic changes will be necessary in order to reduce waste production and greenhouse gas emissions. To do so, a significant yet economically viable change of the actual economic model has to be made, in order to not only be accepted but also implemented by companies. Those three aspects have to be fulfilled in order to meet the various challenges ahead of us and give our future generations a chance to live on a less-polluted planet

New industrial models have been designed and proposed in order to initiate a change in the production line so that companies reduce their carbon emission and create less waste. Circular economy is a new industrial economic model, which "is restorative by intention and design. In a circular economy, products are designed for ease of reuse of vast amounts of material reclaimed from end-of-life products, rather than the extraction of resources, that is the foundation of economic growth." (Mc Kinsey Company, 2013).

Many countries are considering implementing the circular economic model. For example in Europe, the European Union published a manifesto, on December 17th 2012, it is stated "*In a world with growing pressures on resources and the environment, the EU has no choice but to go for the transition to a resource-efficient and ultimately regenerative circular economy.*" (European Commission,2012). This statement underlines the serious dimension that regenerative economy is getting as developed countries see the urgent need in reducing resource consumption and are considering this economic model as more viable. This is why the European commission wants to make resource efficiency the key concept of the 2020 Europe strategy.

In France, the concept of circular economy is also facing a key moment as an institute of circular economy (IEC) has been created in February 2013. The association was created with the financial help of its founding members, such as the gas distribution company GrDF², Paprec, a paper recycling company, French postal service 'La Poste', the cement workers' trade union Euromed Management. The goal of the association is to propose important law reforms to promote the circular economy model.

Concerning Denmark, having an economy based on polluting fossil fuel like coal, force them to base their energy strategy guidelines towards an independency from fossil fuel (transition to a 100% green energy consumption). This is why the government is turning their effort towards

² GrDF : Gaz réseaux Distribution France

energy consumption reduction more than towards resource efficiency and regenerative economy. However, some Danish companies have followed the path of regenerative economy. It is the case of Baisikeli, a bike seller company, whose business model is to use old bikes as raw material and to reassemble them into new bikes and will then sell them in Mozambique and in Copenhagen.

Creating a restorative economy gives great advantages to the companies. These benefits are not only environmental but also economic. As its core, circular economy aims to "design out" waste, in this model waste does not exist, every products is designed and optimized so that it fit into a cycle of disassembly and reuse. Circular economy process does not only modify the product design but also a change in the customer status as the concept of consumer have to be replace with the one of the "user" as the product will be based on performance and durability. All this changes will engender many deviations in today's linear system. We could ask ourselves if this circular economy model is implemented, until where can it go? What are the limits of the concept? Is circular economy sustainable? How is it helpful in term of environmental benefits?

These questions lead us to the research question of this report, which will be: ***"Is circular economy a viable economic system? How does this model increases resource efficiency and fits into sustainable development?"*** This thesis is going to analyse this new concept through developed theories, figures and examples of companies that followed the path of regenerative economic model.

The methodology chapter will develop the methods used to answer the research question and how the investigations are done. The actual linear economic model implemented will then be analyzed in order to see what are its limits and determine what parts of it needs to be changed. The concept of circular economy will then be introduced, developed and compared to the actual model to show the differences and the benefits of it. Examples of successful companies will be shown, and a more specific analysis will be made on different companies that implemented this new

model to show the benefits the regenerative model has made in terms of economic benefits, energy savings and social goods. The analysis will be followed by a critical discussion and a conclusion.

II. Methodology

Methodology of the Literature

The focus of this report lies on analysing the potential of the circular economy concept on different case level. It is relevant to point out what is the benefits and the limits of this new model, and check how sustainable implementing this economic model in our industries can be not only sustainable but the solution of the future to avoid the environmental crisis the world has to face. To be able to determine if this concept is sustainable it is needed to find out if the concept fits into the three spheres that compose sustainable development:

The Three Spheres of Sustainability

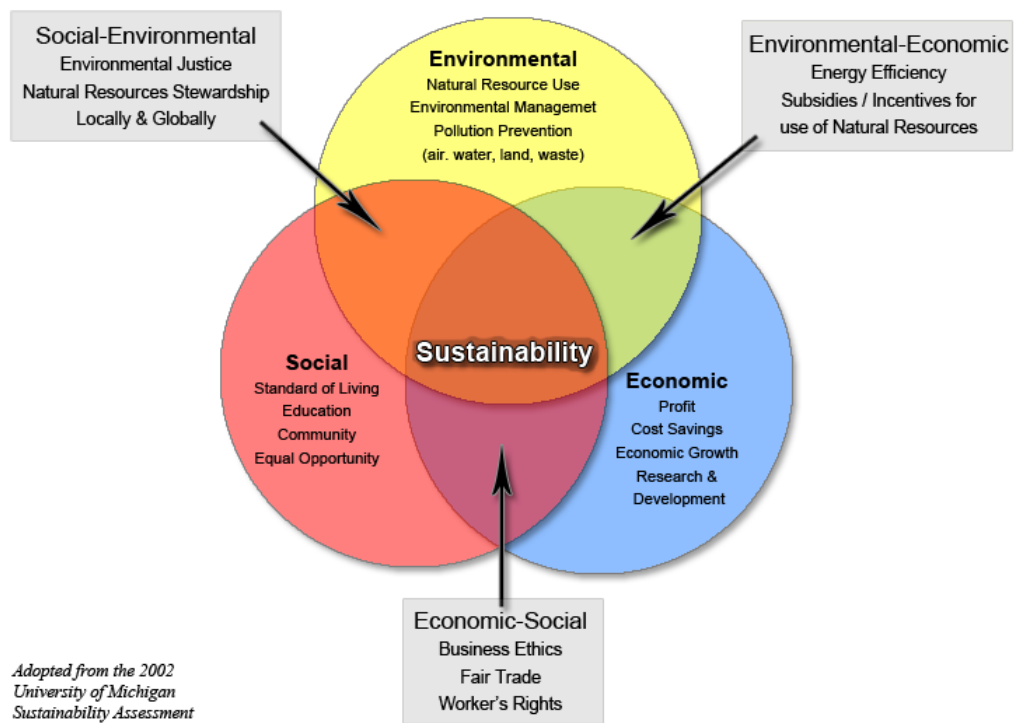


Figure 4: the 3 spheres of sustainability. Source: University of Michigan

To answer the research question the author will base his arguments on theoretical methods and empirical examples based on the research made and our sample company Baisikeli.

The thesis will present the following concepts: In the first place, the actual implemented economic model will be presented, which is called the "Linear model". It is important to focus on this model to show what its limits are and what are the most significant parts of it that need to change. Circular Economy is the main part of the report to be presented, not only to answer the research question, but also to describe and analyse Baisikeli Company and the other examples shown with the different case studies. In order to analyse and demonstrate the benefits of circular economy I will investigate this model through the three pillars of sustainable development, which has been developed during the first two semesters of the Masters of Science. A definition of sustainable development will be given in the analysis part. Developing it in the report is fundamental to highlight the benefits of the circular economy model. It is important to see how the model fits into the three spheres that characterized sustainable development.

By exposing the actual economic model, circular economy and sustainable development, some other major theoretical perspectives will be analysed, the concept of waste efficiency management will also be important to develop, as it is one of the key points when talking about environmental issues and energy savings. While analysing the different economic models stated above, many macroeconomics notions would be stressed, like commodities pricing, cost reductions, income potential. Industrial production chain and product design will also be fundamental concepts to describe as the implementation of the circular economy model leads to an important change in the product design, which entrains a change in the production chain.

This analysis will also make us discuss resource efficiency and climate impacts. These two key concepts will be seen through the definition of sustainable development and the different analysed reports detailed below. Furthermore the results shown in the different case studies conducted will give us a better understanding in the climate impact reduction potential the implementation of circular economy can have.

This report won't be supported by a large bibliography as the concept of circular economy is recent and very few reports or books have been published on the subject. However, already conducted researches, underline some very interesting theories, that will be analysed through the case studies in the analysis report. It is the case of the book written by Michael Braungart and William Mc Donough called *Cradle-to-Cradle, Remaking the way we make things*. This book is today an international bestseller, which was first published in the United States in 2002 and later within Europe in 2008. The circular economy model has been inspired from the fundamentals of the cradle-to-cradle concept. It proposes a regenerative economic model by modifying the production chain design like circular economy does by reusing and recycling manufactured products materials. The author gives directions on how to change the design of the product, but also the commercialization methods to pass from a consumer-oriented product to an efficient-oriented one that is evolving. He also states that following the linear model companies are actually based on, will lead the world to "an environmental disaster". Statements and Examples will be extracted from this book to support the thesis arguments.

An interview by phone has been conducted with Professor Michael Braungart, the co-author of the book, where we exchanged on the subject of cradle-to-cradle and circular economy. His ideas and the examples he stated will be presented in the Analysis and discussion part and a transcript of the interview will be given in the appendixes

Different associations were created to promote the circular economy model and demonstrate the different benefits that this model would have on the planet and in the businesses, if companies decide to implement this model in their production chain. The most popular foundations are the **Ellen Mc Arthur foundation** and **the Circle economy**. In 2013, a macroeconomic report has been ordered by the Ellen Mc Arthur foundation and conducted by prestigious consulting companies (Mc Kinsey and TNO). The report is called *Towards Circular Economy*. It gives many interesting figures to end up stating that circular economy is an opportunity to

produce over 2 trillion dollars in the global economy. These figures will make the author analyse the methods learned in the sustainable consumption and production classes, seen during the first two semesters of the Masters of Science. Many of these charts will be used to show the audience how circular economy can be significantly efficient not only environmentally speaking but also economically. One of the goals of this thesis is to demonstrate that being a greener company doesn't mean making less business. In this report we will see examples of success stories of European companies that implemented the circular economy model and that are today green efficient companies.

This paper will also be supported by the European Commission reports on resource efficiency found on their online resource efficiency platform (OREP) this platform contain many information on the need to reduce resources consumption, Many references are made on this website to the Ellen MacArthur foundation, which underlines the major dimension this association is starting to have. Furthermore, on December 5th, 2013, a conference on "European Innovation Partnership on Raw Materials" (EIP RM) will take place to present "the EIP RM Strategic Implementation Plan along with the guidelines for the Call for Commitments and some concrete examples of possible commitments" (European Commission, 2013). Unfortunately, the author will not be able to participate to the conference, but an analysis of the conference will be done from the released report of the conference, where circular economy will be an important part of the discussion. This analysis should give us much information on how the European Commission wants to implement the concept of circular economy, and what is their point of view of the model.

Methodology of Case studies

Thanks to different case examples and especially with the information collected from the company Baisikeli, many cases will be described to support the literature. A case study has been conducted on the company with the intention of having a better understanding of the complexity of the business model they are based on. An interview was conducted with the CEO of the company Niels BONEFELD. The interview was set in two parts. First, different questions that I prepared have been asked and then an open interview have been set between where he explained to me what was his vision of his company and what were his goals for the future. The content of the interview will be used as a case in the analysis to illustrate the circular economy model and the potential of Baisikeli as a business model. Indeed the whole business model of Baisikeli will be analysed, as well as a LCA (Life Cycle Assessment) that have been conducted in September 2013. This assessment analysis method, which has been seen during the first two semesters of the Masters of Science, allows to gain a broad and comprehensive perspective of a product's footprint from the raw material extraction process to the end-of-life of the product. This assessment will show the environmental impacts of the Baisikeli business model.

Many other companies will be analysed, it is necessary to see how big industrial groups like KERING (ex Pinault) decided to implement the circular economy model and what are the benefits they got from it since the implementation. A contact has been made with Kerstin Neuber, the head of corporate communication at Puma, but unfortunately, she could not disclose sales figures of their individual collections. Hypothesis will be made from the Puma income statement but because of the lack of information, we will only be able to do assumptions.

Finally a study has been made on the furniture waste collection and management within France has been made, the goal is to illustrate what are the politic led by the French government concerning, At what stage are French in the material recycling process and material reuse and what is the strategy.

The circular economy will be analysed through the three pillars of sustainable development, economic, social and environmental. The strengths of the proposed research methods is mainly to cover not only the important points of how good the implementation can be, but also to analyse the feasibility of implementing such a model. Indeed, no companies would implement such a system if they get no profitability out of the implementation, even if the model was the most environmental friendly ever seen. Analysing the different theories thanks to the different figures found in the literature will bring a more precise approach to the thesis. Using empirical examples and the case studies on the company Baisikeli, Puma and the French waste furniture management case will be a strong support for the advanced theories. Furthermore analysing the European commission point of view on the model is an important process, as if they do support the model, the implementation will be much easier and faster for the companies, as they will gain advantages doing it. The limits that loom up in the research method design are that not many point of views have been gathered, to understand what is the stakeholder position and thoughts on this model.

III. Results and Analysis

1. Context: The limits of the actual model

Concerning resource consumption, the actual economic model is based on a linear model, which follows a pattern of 'take-make-dispose'. Indeed, Companies extract raw materials, apply energy and labour to manufacture a certain product and then sell it to a customer who will then throw it when it will no longer serve. This wasteful model was created at the beginning of the industrial revolution and has not changed ever since. Back then; people were not aware of the environmental problem that could come up if they keep on extracting and using natural resources as much as today. In the years 2000, such an excuse of not knowing the consequences cannot be true, politics as well as companies know about these problematic and choose not to change the ongoing model, as it is not economically efficient and primary resource's prices were stable on the market.

Recently, some companies have noticed that this linear economic model can increase their exposure to risks, as resources prices are rising more and more as they are becoming rarer. "Businesses are trapped between rising and the less predictable prices in resources markets on the one hand and stagnating demand in many consumer markets in the other." (Mc Kinsey Company, 2013)

During the past century, economic growth was supported by the declining of the resource prices compared to the rise of labour costs. This is why the current wasteful system was implemented; reusing as well as recycling material was not a major economic priority, given the profusion of raw material. Indeed, in the 20th century, using more and more resources particularly energy to lower labour costs (more and more machines for less employees) generated economic efficiency.

Since the industrial revolution, the world population has been growing exponentially fast to reach today 7 billion inhabitant and we are expecting to be 9 billion by 2050. Furthermore emerging market are expecting to increase their quality of life, the expectations are that about 3 billion of inhabitants to join the ranks of middle-class consumers by 2030. "Even the most conservative projections for global economy growth over the newt decade suggest that demand for oil, coal, iron ore, and other natural resources will rise by at least a third with about 90% of that increase coming from growth in emerging markets." (Mc Kinsey Company, 2013).

This system is showing its limits today, and a need of change is getting more and more necessary to keep our future generations living on a "clean" planet. By 2020 the expectations of resource extractions are 82 billion tons.

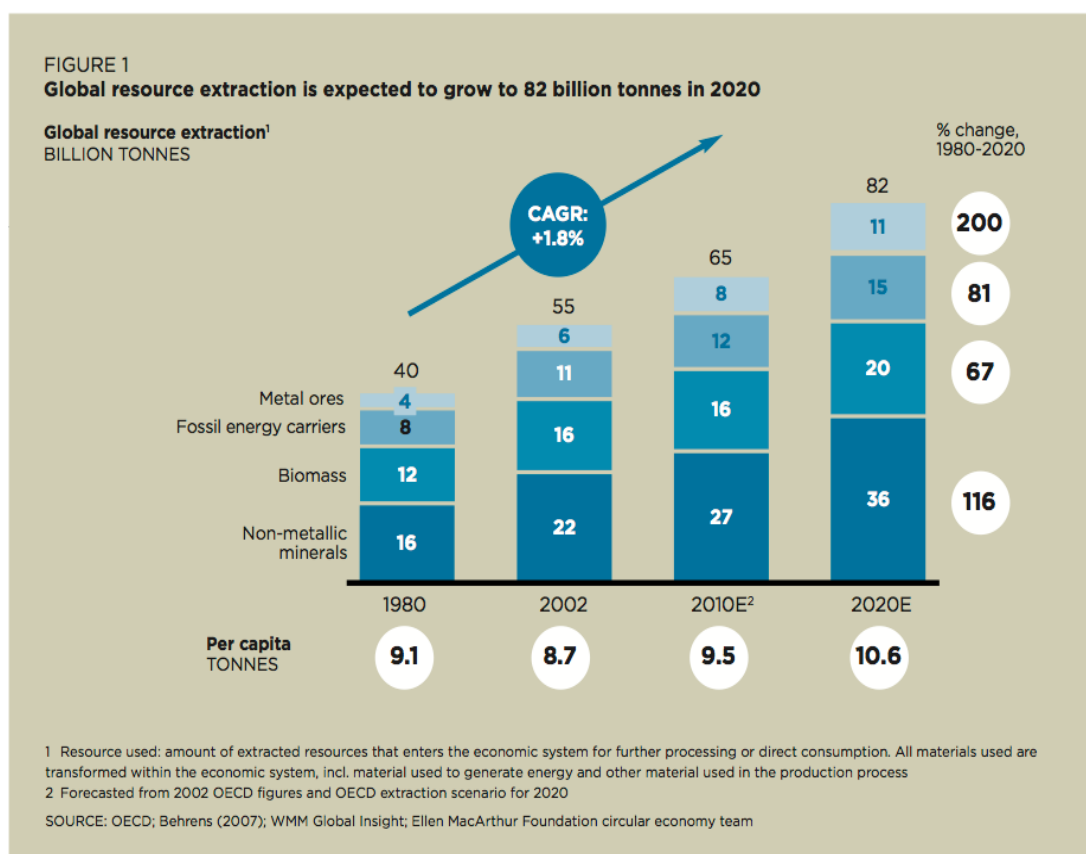


Figure 5: Forecast of Global resource extraction evolution until 2020, source: Ellen Mc Arthur foundation, Mc Kinsey Company

This bar graph represents the growth evolution of resource extraction from 1980 to 2020. We can underline that the resource extraction rhythm has doubled since 1980 passing from 40 billion to 82 billion. The point in question lies in the fact that this extracted material is almost immediately transformed in waste. According to Braungart, more than 90% of the extracted material is transformed in waste less than 6 months after being manufactured. We can distinguish 3 kinds of wastes:

- **Waste in the production chain:** During the whole product creation process, significant volumes of resource are commonly lost in the chain between extraction of the material and the final manufactured product. According to the Sustainable Europe Research institute (SERI), they estimate that the OECD (Organization for Economic Co-operation and Development) countries consume each year over 21 billion tons of resources that are being extracted and not physically incorporated into the manufactured products (the material never enter in the economic system). For example food production market, which incur one of the biggest losses on the whole value chain: from food extraction, to the supermarket selling, an important amount of food is transformed into waste before entering the economic system.

- **End-of-life waste:** These wastes did enter the economic system; they represent the products that are thrown away by the consumers after being bought and used. According to figure 5 page 18, these wastes represent today 65 million tons and are expected to reach 82 billion in 2020. From these wastes, a two few quantity of waste is recycled reused or composted and digested, for example in Europe, 2.7 billion tons was generated in 2010 and only 40% of the waste was recycled. It is important to note that not recycling brings huge losses in term of profit, for example, if we focus on ferrous and non-ferrous metals the potential benefits according to the UNEP (United Nation Environmental program) report if 100% of the copper waste were recycled the additional profit will be about 52 billion USD, for gold 34 billion USD, aluminium would represent 15 billion USD.

By adding up the waste in the production waste and the end-of-life waste, we obtain a total amount of waste in 2010 equivalent to 86 billion tons,

which could reach more than 100 billion tons 2020. This value stresses the need of change that the world is facing, as it is impossible to hold on the same linear system applied today. The important benefits that can result from recycling the material as emphasize above show an important opportunity to develop a material recycling and reusing system that can provide huge profits to the companies implementing these processes.

Energy use is also considered as waste, especially in this linear system where energy is used inefficiently, as all the products disposed in landfills means that all its residual energy is lost. The energy recovery processes used today like incineration or recycling of discarded products creates a small share of this energy, although reusing product's material can save significantly more energy. The use of energy resources in a linear production model is particularly more intensive in the upstream parts of the supply chain (i.e.-: The steps involved in extracting materials and converting them into a commercially usable form). For example in the production of semi-finish aluminium, 80% of the energy consumed are used to refine, smelt and cast bauxite into it. By using a system that would relies less on upstream production (that does not use new materials as input each time to manufacture a product), most of the energy applied to produce the aluminium could be save. According to the UNEP, recycling rates for ferrous or non-ferrous metals is not optimal (43% to 70% for aluminium, 43% to 53% for copper, 19% to 52% for zinc) as on 60 metals known today only one-third of them have an end-of-life recycling rate higher than 25%. Recycling those metals would have been particularly efficient as our economic system is mainly dependent from fossil fuel and raw materials this would have reduced the consumption of non-replaceable energy, which comes with a greenhouse gas footprint as well. "The reduced energy intensity of the circular model results in a reduction of threshold energy demand and further enables a shift to renewable energy — a virtuous cycle." (Mc Kinsey Company, 2013).

Another issue this linear model is raising is the damages made on the ecosystem natural services. They are primordial as they support and enhance wellbeing, such as forests that are essential as they counterpart atmospheric, soil and hydrological by absorbing carbon dioxide and

emitting oxygen, it also allows to regulate water tables and deliver way more other benefits. According to the Millennium Ecosystem Assessment, out of 24 different ecosystems, 15 are being degraded or used unsustainably. It proves that people are consuming more than the nature production capacity, thus reducing the earth natural capital and reducing its productivity, the same way climate and water regulation change have a huge impact on the agricultural productivity.

All these wastes and issues show that each environmental issue have impacts on the entire ecosystem, which eventually hurts or will hurt earth's population and improving efficiency on all these three problems, waste, energy use and ecosystem will bring an effective change to our economy.

The inherent disorders of the actual system, which does not maximize the benefits of energy and natural resources, are recently becoming more and more obvious and dangerous for businesses. Indeed, high level of real commodities prices and their volatility are more and more noticeable, especially for oil, metals and food. Since the late 90's, natural resource prices have dramatically risen. It was a turn point as for the whole century, worth of real prices declined.

It can be noticed on the figure 3 page 6, that today, prices are reaching the highest value the world has never seen. These brutal changes of prices bring a lot of uncertainty to companies. Together, high and volatile commodities prices dampen the growth of global businesses, thus ultimately economic growth. The effects are expressed by two main ways: input cost spikes and increasing hedging costs. These fees represent not only a direct cost but also an opportunity cost—in less volatile markets, money is more likely to be spent on business projects, research, and innovation, potentially leading to growth.

After analysing all the characteristics of the actual linear economic model, it is obvious that compared to the three pillars of sustainability development, which are economics, environmental and social this model is not sustainable for the world. This model brings along important problems, such as important waste creation, important energy

consumptions that result in the augmentation of greenhouse gases, high commodities prices and their volatility, and erosion of the ecosystem services. If no other system will be implemented in the future, the earth will face an important environmental crisis and the human kind will not have enough resources to support their needs. Furthermore, the waste created by the manufactured products will be too important to stock and can produce diseases to the people living around, as well as the erosion of the ecosystem that is happening because companies are not extracting resources in a sustainable way.

This change can happen with huge business opportunities that can be developed thanks to recycling, energy consumption optimization, material reusing and more. In the next chapter we are going to analyse these opportunities of change with a new economic model, which is circular economy.

2. Circular Economy: The right Solution?

As we have seen, it is needed not only to work towards efficiency alone but we need to change the entire actual economic system, as the goal is not only to delay the inevitable but to implement a deep change in today's economy.

The circular economy is by definition an industrial economy that is restorative by intention; its goal is to rely on renewable energies, to eliminate the use of toxic chemicals, and by changing the design eliminate the concept of waste in the whole value chain. The term goes beyond the mechanics of production and consumption of goods and services in the areas that it seeks to redefine (examples include rebuilding capital, including social and natural, and the shift from consumer to user).

The concept of circular economy fits into the study of non-linear systems; one of the major consequences of this system is the notion of "optimizing system" rather than "components", which can also be referred to as "design to fit". This concept involves a cautious material flows

management. Mc Donough and Braungart describe these materials as two different types: Biological nutrients, designed to re-enter the biosphere safely and build natural capital, and technical nutrients, which are designed to circulate at high quality without entering the biosphere.

As a result circular economy makes a strong distinction between consumption and use of material. Implementing the circular economic model means changing the selling schemes already implemented, indeed, it advocates the need for a “functional service” model where industries increasingly retain the ownership of their products and as much as possible act as service providers (They are not selling only one product but the use of the product). This turn in merchandising methods will have direct involvement for the development of efficient recovery systems and an effective expansion of the product model design, which will generate more durable products, facilitate disassembly and refurbishment. According to Walter R. Stahel implementing this system is a sign of smart management and represents the future: “In the past, reuse and service-life extension were often strategies in situations of scarcity or poverty and led to products of inferior quality. Today, they are signs of good resource husbandry and smart management.” (Walter R. Stahel, 2011)

Circular Economy relies on the following simple principles:

- **Design out waste.** When the product is designed by intention to fit within a biological or technical materials cycle, and the design is made to facilitate disassembly and refurbishment of the product, waste will be considered as new material and reused. The concept of waste is then discarded. Biological wastes (or nutrients) are natural and non-toxic material that can be composted simply. It implies that these nutrients have the ability to be reintroduced into the biosphere through non-toxic. Restorative loop is at the head start of the idea. Technical components, which are made by man, are designed to be used again with minimal energy and highest quality retention. Improvement in quality is also possible after being reused, this process is called up-cycling
- **Enhance resilience through diversity:** According to Braungart: “Natural systems support resilient abundance by adapting to their

environments with an infinite mix of diversity, uniformity and complexity. The industrial revolution and globalization focused on uniformity so our systems are often unstable. To fix that we can manufacture products with the same flair for resilience by using successful natural systems as models” (M. Braungart & W. Mc Donough, 2002). It means that in a fast-evolving world, modularity, versatility and adaptivity, are very important features that needs to be prioritized. In other words, new products does not have to be build in order to be only efficient but also resistant so that it increase it lifetime.

- **Use as much renewable energies as possible:** Systems should ultimately run on renewable resources. Walter Stahel argue that if governments were shifting taxation from labour to energy and material consumption, it would create a fast-track to eco-effectiveness and circular economy. This solution can be a very interesting one, as it would put efficiency pressure on the right stakeholders of our resource consuming economy.
- **Think in term of “systems”:** It is crucial to be able to understand how different parts influence each other within a whole and the relationship between the whole and the parts. The infrastructure environment and social context have a strong impact on an element and analyzing it is primordial.

This figure resume very well the process of circular economy, technological and biological nutrient-based products and materials cycle through the economic system, each with their own set of characteristics, which we will analyze below.

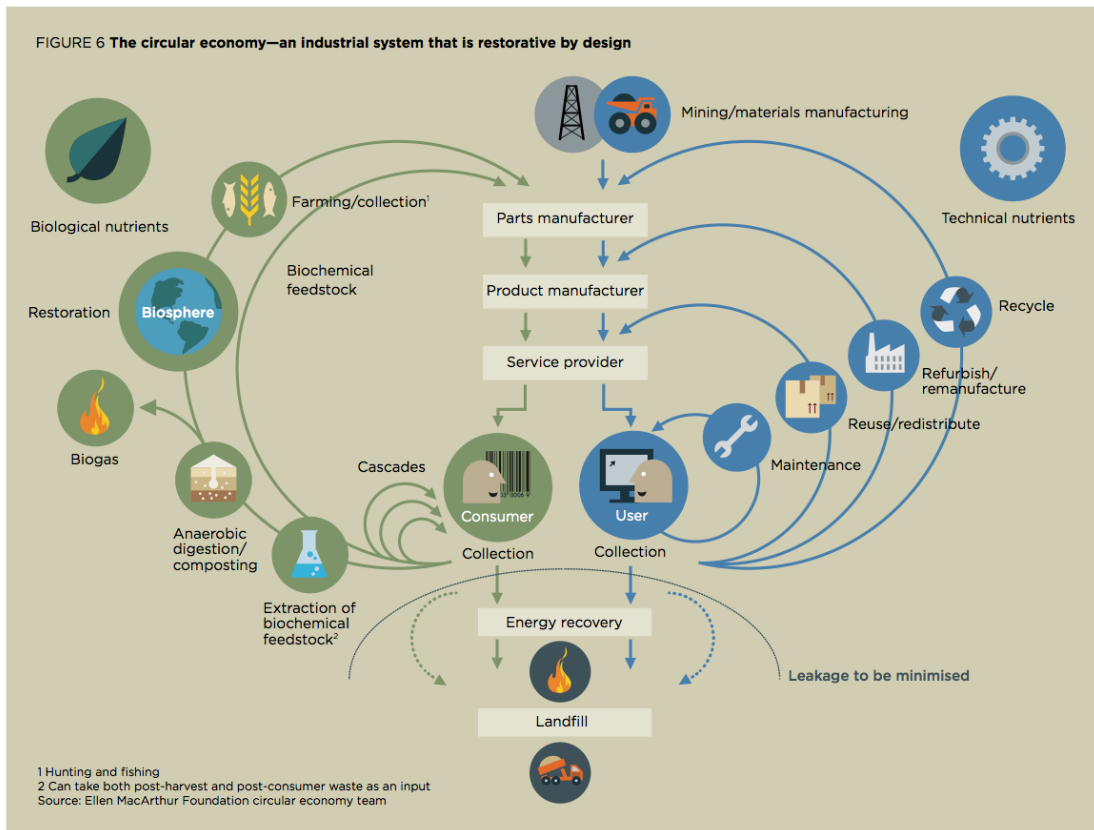


Figure 7: The Circular economy Model, source: Ellen Mc Arthur foundation, Mc Kinsey Company

3. Circular Economy as a huge economic opportunity

It is important to raise a question on the economic effectiveness of the model. Is it possible to implement circular economy, can these advantages match the ones of product designed for mass production based on low labour cost and economy of scale?

First in term of net material cost savings, the Mc Kinsey company estimates in its report a potential cost savings of “USD 340 to 380 billion at European Union level for a ‘transition scenario’ and USD 520 to 630 billion [...] for an ‘advanced scenario’”. Even if it is a rough estimation, the magnitude of the figure shows us that this model is a huge opportunity to boost the European economy. Moreover a move towards circular economy could potentially create moderate benefits in terms of job growth, indeed according to the SITA group, an affiliate company of VEOLIA estimates that the recycling industry already created 500,000 jobs in the European Union, we can only imagine that this number will exponentially rise with the implementation of circular products.

Beyond the fundamental value creation potential the circular economy model offers advantages on a long term scale, it promises to respond to major long term economic challenges the world is facing today: improving material productivity, increase innovation capacity, and encourage a shift from mass producing labour to skilled employment. The model has the capacity to completely innovate our actual economic system ‘take – make – dispose’, Implementing circular economy as a new economic model, will also create new fundamentals that would prevent to revert back to the old linear economy. *“Importantly, with its greatly reduced material intensity and a production base that is largely running on renewable sources of energy, the circular economy offers a viable contribution to climate change mitigation and fossil fuel independence. Moreover, the demonstrable decoupling of growth and resource demand will also slow the current rates of resource depletion.”* (Mc Kinsey Company, 2013)

4. Circular economy and sustainable development

This chapter goal is to see how this economic model fits into the three pillar of sustainability, which is economics, environmental and social.

First, it is important to define clearly the concept of sustainable development: the term was first introduced in 1987, in the Brundtland report. The definition of sustainable the report from the report was "Development, which meets the needs of the present without compromising future generations to meet their own needs". Today, it is accepted that the concept goal is to bring a convergence between the three pillars of economic development, social equity and environmental protection. Indeed sustainability is met when a business is energy efficient and Natural resources use is optimize. Good work conditions, Fair trade and business ethic are also important to meet sustainability. Implementing this concept have been hard to see since today, and it is important to do so, as future generations need to have a liveable planet with resources to subsist, clean oxygen to breath and a sustainable economic system.

By analysing what are the sources of value creation by dint of the principles of the model, we will have a better understanding of the convergence between the three pillars. Of course some principles will depends on the industry and the product type but four simple ones can be generalized to the whole model:

- **Power of the circle:** As it is described in figure 3, the model works with different circles step, and we can analyse that the tighter the circles are, the larger the savings should be in term of costs (material, labour, energy...) but also in term of the associated external problems such as GHG emission, water or toxic substances. Considering the current inefficiencies in the linear supply chain, tighter circle will benefit from higher virgin material substitution effect. Whenever the costs of collecting, reprocessing, and returning the product, component or material costs will be lower than linear alternative in particular the end-of-life treatment

costs of the products. With the increasing of resource prices and the higher end-of-life costs, this solution become more attractive than the linear model.

- **Power of longevity:** An important potential core value creation of the system is from keeping products, materials and components in use longer within the circular economy. As the models have been created for, material and components can be implemented in different products by being reused. This increase in the longevity use of the product will replace the virgin material inflows to counter the dissipation of material, which does not enter the economic system. Increased operating and maintenance costs should be compensated by efficiency gains due to rapid innovation of the products. Here too, by increasing resource prices, it will make this solution more attractive.

- **Power of cascade:** Circular economy can bring a cascading system for products, components or materials (e.g. as seen below in the figure 4, where the scheme shows the transformation from cotton-based clothing into fibrefill for furniture and, later, into insulation material before returning as biological nutrient in the biosphere). In these cascades the value creation is made on the lower marginal costs of reusing the material instead of using virgin material inflows.

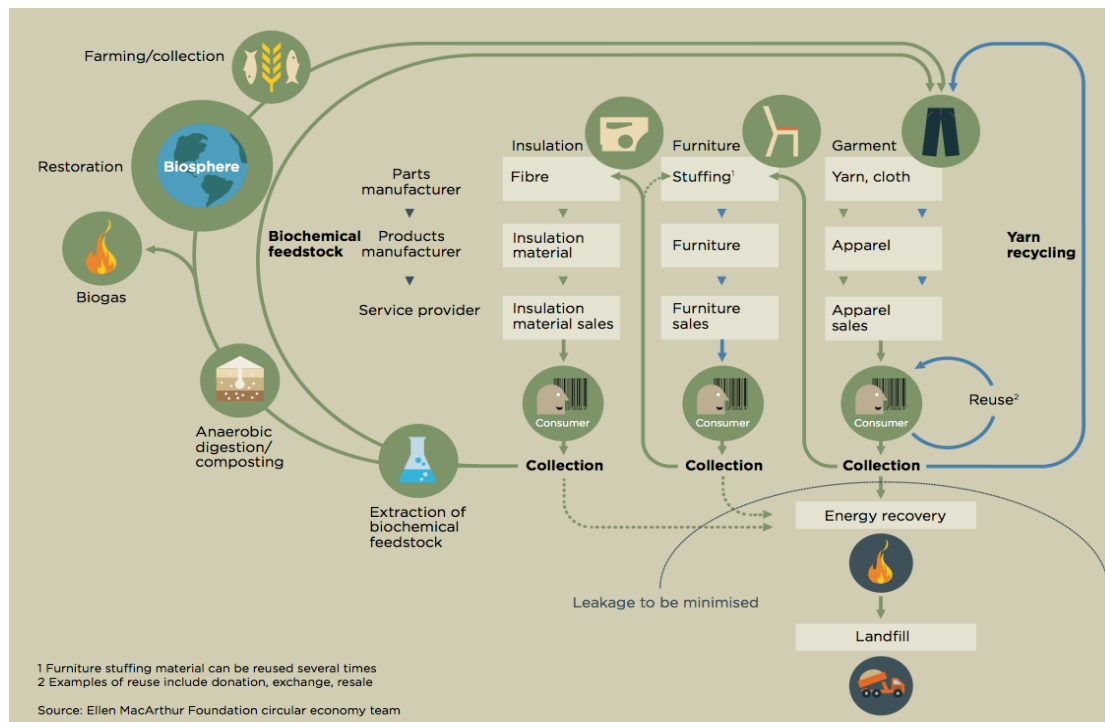


Figure 8: Cascading Method Model, Textile example, source: Ellen Mac Arthur foundation, Mc Kinsey Company.

- Power of design:** As seen above, circular economy modifies the whole design and inputs of the product, indeed circular economy advocates the creation of the product with non-toxic substances, pure and easy to disassemble. Important efficiency gains can be made through the improvement made by the new design of the products and its cycle, such as component and input separation, better identification of embedded components, material substitution, reduced contamination of the material streams during and after collection. Furthermore, these improvements come along with more benefits and efficiency reducing costs as it maintains different nutrients longer, especially technical ones, which will be produced at a higher quality in order to live longer and not just to be consumed, which will imply an overall material productivity. More than eliminating all the toxic components changing the design can also have measurable business opportunities like entering in clean strictly regulated markets for example the aviation markets where products must be conform to fit in airplanes.

After analysing the added values of circular economy model, we can say that it fits completely sustainable development as the benefits are

multiple not only in term of costs and economy but also in term of social risks and environmental benefits and GHG emission reduction. Indeed the fact of deleting toxic materials off the products manufacturing is a huge benefits for the environment as composting will be easier to manage, but also for the people, who use the product daily, because even if it's not 100% proven it can't be denied that toxic material can be harmful for human health. Braungart call these toxic material **crude products**: "products that are not designed particularly for humans and ecological health are unintelligent and inelegant" (M. Braungart and W. Mc Donough, 2008). In his book he gives the example of antimony that is used in the polyester fabrication, which is a current catalyst in the polymerization process and is not necessary for polyester production. The question asked by the author is: Why is it there, if it is not needed?

Also, the fact that raw materials are not only to produce one product, but are entering in a circle that reuse them or compost them, gives an important efficiency the process which will lead to a more sustainable use of the world resources, which will bring longevity to the planet resources. Reusing material will lead to an important energy reduction that will entail GHG emission reduction. These aspects show with no doubts that implementing circular economy, as a new economic system will have great environmental and social benefits, the convergence between the three spheres can be reach thanks to this model.

5. Circular Economy in Europe, Focus on France and Denmark

In Europe the need of resource management system change is being discussed within the European commission, and companies are starting to have a look at this system, as it can be a lucrative business as well as being clean. Circular economy today have mainly be promoted by the association of Ellen MacArthur (ex-professional sailor) especially by launching its program called circular economy 100 where more than 40 important companies have signed to participate; companies are American like Coca-Cola, Chevron or Cisco or European like Ikea, VEOLIA³ Environment, Nespresso. The European Commission has recently lunch an online platform on resource efficiency (OREP). Their objective is to provide high-level guidance to the European Commission, Member States, local and regional authorities and private actors on the transition process towards a more resource-efficient economy. This platform is used to promote and discuss different actions that are related to increase resource efficiency. The European Commission and the council are putting up resource efficiency as the flagship of European 2020 strategy: "A resource-efficient Europe is one of seven flagship initiatives as part of the Europe 2020 strategy aiming to deliver smart, sustainable and inclusive growth. This is now Europe's main strategy for generating growth and jobs, backed by the European Parliament and the European Council" (European Commission, 2011). In the process of implementing new resource efficient methods, the European Commission rise circular economy as one of the key point for delivering the 'resource-efficient Europe'. The conference on "European innovation partnership on raw materials" that was held on December 5th, the goal was to develop a strategic implementation plan for Europe to move towards a more resource efficient system. The EIP RM (European innovation partnership on raw materials) has an overall target of reducing Europe's import dependency on the raw materials that are critical to Europe's industries. Again in this report, circular economy is presented as one of the key point

³ Veolia Environnement S.A. is a French transnational company with activities in four main service and utility areas traditionally managed by public authorities – water supply and water management, waste management, energy and transport services

and an important step to implement before 2020: "Several action areas contained in this priority area have to be seen in conjunction with some of the recommendations made by the European Resource Efficiency Platform [...] move towards a circular economy and promote a high quality of recycling" (European Commission, 2013). According to Tony Hartwell, the commission also launched a R&D program called Horizon 2020 that started on December 11th 2013, with a budget of 69 million dollar allocated to raw materials project. Many of the themes relating to Raw Materials were derived from the SIP⁴ developed by the EIP RM and there will be significant funds available in this sector. For example in Area 5 of H2020 (Social Challenges) 20% of the budget of about €3 billion will be allocated to raw material issues. Additional funding is available for secondary materials (wastes).

In France, an institute for circular economy has been created this year on February 6th, 2013. As stated above, GrDF⁵, Paprec, 'La Poste', the cement workers' trade union and Euromed Management created the institute called "l'Institut de l'Economie Circulaire" and is located in Paris. Their end-goal is to propose different law articles that will facilitate the implementation of circular economy for French industry by 2017, which could promote circular economy.

Their strategy is to find solutions through: mutual brainstorming between the different stakeholders involved (industries, politics at the national and European level), anticipate the different issues and problematic, prepare the legislative laws and create an important lobby for circular economy to influence politics and promote circular economy through events with all the stakeholders in France. Since today the circular economy French institute has only promoted the concept of circular economy within French companies and politics and results are starting to be shown as the institute has won a prestigious award of excellence in sustainable development, called "Marianne d'or du développement durable", which shows that politics are starting to pay more attention to circular economy

⁴ Strategic implementation plan released by the European Commission in September 2013

⁵ GrDF : Gaz réseaux Distribution France

as a possible solution to bring resource efficiency in France. Moreover, the Minister of Environment has ordered a study on circular economy. According to them, this study focuses on the implementation of circular economy in 4 precursors countries: Germany, the Netherlands, Japan and China. Its objective is to provide useful elements of appreciation for its development in France, the date of release of the report have not been disclosed yet. This reflection has as main objective to emerge proposals in preparation for the International Climate Conference to be held in Paris in 2015.

In Denmark, to my knowledge the government did not propose any action to implement circular economy or even to promote it. Nevertheless, some private and public companies have teamed up in order to expand their business with the help of circular economy. It is the case through the project rethink business where 21 Danish small or medium sized companies got together and worked to strengthen the development of their green business models. Kalundborg Symbiosis where public and private companies can buy and sale waste that comes out from industrial production like steam, dust, gases or many other waste products. Other companies like Baisikeli have developed businesses that are based on the circular economy concept.

6. Case Studies

Baisikeli is a new conventional bike manufacturer company based in Copenhagen. Its specificity is that the company does not use raw materials to manufacture its product, but old bikes that have been abandoned and thrown away. This company allows these bikes to have a second life.



Picture 1: Stock of used bikes in Baisikeli warehouse

The Baisikeli process is very innovative and like the CEO said their model is made from the infinity symbol: First the old bikes are collected from the police stations that gather stolen, broken and abandoned bikes, these bikes are sent to Mozambique, where a workshop have been installed and Danish bike technicians have been sent. Bikes are then remanufactured into new bikes according to Danish standards and then sold in the country. Some of the bikes will also be exported in Demark, where the products have the CSR title (Corporate Social Responsibility), a sort of corporate self-regulation integrated into the business model. It reward companies thinking about social matters while doing business. It gives a marketing advantage to the shop in Denmark, where people will prefer doing social goods when they have the choice for the same product.



Picture 2: Transporting the used bikes to Mozambique in order to be reassembled

Baisikeli also relies on the prestigious image of Danish bikes to sell its products in Mozambique, as in Africa the western image through products is very important for the local population. The workshop in Mozambique is also used to educate the local population in mechanical according to Danish standards so the bikes could be repaired and their lifetime be increased. The extra effect will be that poor quality new bikes will be less popular in the area.

The Baisikeli vision of the CEO for Mozambique is that in a long term period an entire bike industry be implemented in Mozambique, and the creation of a bike culture like in Denmark thanks to education, safety and creating infrastructure with the instauration of bike lanes etc... It is maybe a bit ambitious but in terms of social matters, this vision can be very prolific for local population in Mozambique with the proliferation of bikes and the instauration of a new bike culture in the country.

To measure the environmental benefits of the company the company conducted an LCA, this report will not be analyzed into details, as there was no English version of the document. Nevertheless the conclusion is

striking as the authors' states that per bike recycled the study considers that each recycled bike provide a saving of 458 kg of CO₂

Some other companies have implemented the circular economy model. In France the group KERING owned by the entrepreneur François PINAULT have followed the path of circular economy through its sports brand Puma, by launching a new line of clothes called the Puma InCycle collection. This line is either recyclable (i.e. jacket from the incycle collection that is then transformed in polyester pellets) or biodegradable (i.e. shoes who is then ate by microorganisms nutrients). The collection includes sneakers, jacket, shirts, backpacks and also many other products. At the end of life of the products, they are then taken back by the customers and put in a bin available in all puma stores, the products will then be biodegraded thanks to powerful nutrients and then entering again the eco-system as cotton, or the product will be shredded and sorted in order to recover the raw material and reuse it to manufacture new models. This process is similar to the circular economy model as these products as soon as their consumers will return them, will be entering the economic circle another time and won't be landfilled as many other products are. The Puma bins insure the collection and all the collected old products won't be considered as waste anymore. A criticism that can be made would be that not every person would take the time to throw the shoes in Puma "bring me back bin". Only the more responsible ones will do it but many people will just throw it away, the product will then not be able to be collected and recycled. Finding a solution so that people will be forced to bring back to their bins would be a great advantage for their collection line.

According to Puma 2012 annual report this collection reduce the environmental costs⁶ of GHG emissions by 31% compared to their conventional outfit line. This definition implies that reducing these costs leads to a more sustainable activity even if not all conditions of

⁶ Costs linked to the actual or potential deterioration of natural assets due to economic activities. (OECD source)

sustainability are settled. By launching this collection, PUMA put into action his plans of becoming “the most desirable and most sustainable sport lifestyle company”. Even if this claim is exaggerated, as Puma production line is located in China, a country not famous for its good employments conditions, which is not very sustainable, entering in a circular economic process is a commendable act. No information have been disclosed yet about the sales numbers of the collection, but it should come along with the 2013 annual report, which have not been released yet.

T.17 ENVIRONMENTAL COSTS OF T-SHIRTS

PRODUCT	GREEN-HOUSE GAS	WATER	WASTE	AIR POLLUTION	LAND USE	ENVIRONMENTAL COSTS	RETAIL PRICE
	€	€	€	€	€	€	€
CONVENTIONAL PUMA T-SHIRT	1.79	0.33	0.10	1.00	0.20	3.42*	20
BIODEGRADABLE PUMA INCYCLE BASKET	1.20	0.34	0.06	0.70	0.06	2.36*	20
INCYCLE SAVINGS IN %	-33%	+2%	-36%	-30%	-70%	-31%	0%

*These environmental costs are provided as units of comparison and are not related in any way to the retail price of the product.

Figure 9: Environmental cost difference between Incycle collection and the conventional one, source Puma Business and sustainability report 2012

Furniture waste management in France.

In July 2010 France released the *National Commitment for the environment* law (in French *grenelle de l'environnement II*), a part of this law deals with furniture, in the case of the Law number 541 article 10 paragraph 6 of the Environmental Code which says:

Art. L. 541-10-6. – “As of January 1, 2012, any natural or legal person manufacturing, importing, or introducing furnishings to the French market shall assume responsibility for collecting and processing the waste resulting from said products at their end-of-life.”

Starting on July 1st 2012, all distributors on the market who do not meet this obligation are subject to the general tax on polluting activities.

A decree of the French parliament shall specify the conditions of application of this article”

The principal objective of the law is to reduce the environmental impacts and health issues by establishing a waste collecting cycle financed by the different stakeholders of the furniture business. Furniture companies since January 1st 2012 are responsible of the waste created from the furniture sold.

According to the law, there are two different way to participate to the collection of the waste:

- The company can implement their own waste collection system.
- The company can contribute to finance an eco-organization, created by the distributors and manufacturers like *eco-mobilier*, which has been created by 24 furniture fabricants. It is a non-profit organisation that helps companies answers the different regulatory obligation, and organizes industry national collection and waste treatment under the law.

It is important to identify what is the different product types of furniture, and what are the different systems used for the collecting process of furniture waste:

According to INSEE (National Institute of Statistics and Economic Studies) in France, furniture regroups a nomenclature of 9 major categories:

- Office furniture,
- Furniture for bathroom
- Kitchen furniture,
- Garden furniture,
- Indoor furniture / household furniture,
- Seating (chairs, sofa, bench seats),
- Technical, sales, and contract furnishing,
- Bedding and Bedroom furniture

This eco-contribution is paid by the customers and has to be displayed clearly. The eco-contribution is paid when the customer buys the furniture, it is added to the bill and it is calculated as follows:

- Furniture: the eco-contribution is determined by product weight, (per kg)
- Bedding: the eco-contribution is calculated according to the size (in cm depending on the length),
- Seating: the eco-contribution will be defined based on the product type and the number of seats (e.g. number of people a sofa can handle).

The ADEME (Environment and Energy Management Agency) in France, conducted different interviews to find out what were the average lifetime of furniture and how the collection and the treatment of furniture waste was ensured. Furniture lifetime can be very high (more than ten years), and can be increased with association like Emmaus (non-profit association who helps disadvantaged people) who also collect furniture through they own collection system and revalorise the furniture by giving it a second life. Communities had established a collecting door to door on call system where citizens call the commune to schedule an appointment to come and

pick up their waste, with the use of waste collector trucks. For example the Parisian town hall put in place a furniture collection system called "les encombrants" where citizens book a date on the Internet where the service staffs will come and pick up what they want to throw away so that the material can be treated or reused.

Furniture waste management cost is estimated around 600 Million Euros per year for an average amount of furniture waste of 2.7 Million tons/year, so an estimated of eco-contribution the furniture companies will need to pay around 0.22 € per kg of furniture.

The French environment agency has put in place 3 different solutions of waste valorisation that have sensibly the same costs of implementation:

- Scenario 1: high priority to voluntary contribution, material use of wood and scrap reuse and landfill.
- Scenario 2: high priority to voluntary contribution, material use of wood and scrap reuse and energy recovery.
- Scenario 3: strong development of matter and energy industrial development priority.

In the French actual system, furniture waste is treated in different ways, landfilling the waste is still the most used process to remove them. In the actual context, 4% of the total wastes are reused, 25% are materials recovery, 33% are incinerated with energy recovery, and 38% of it is landfilled.

The following figure shows the distribution between the different processes used in each scenario.

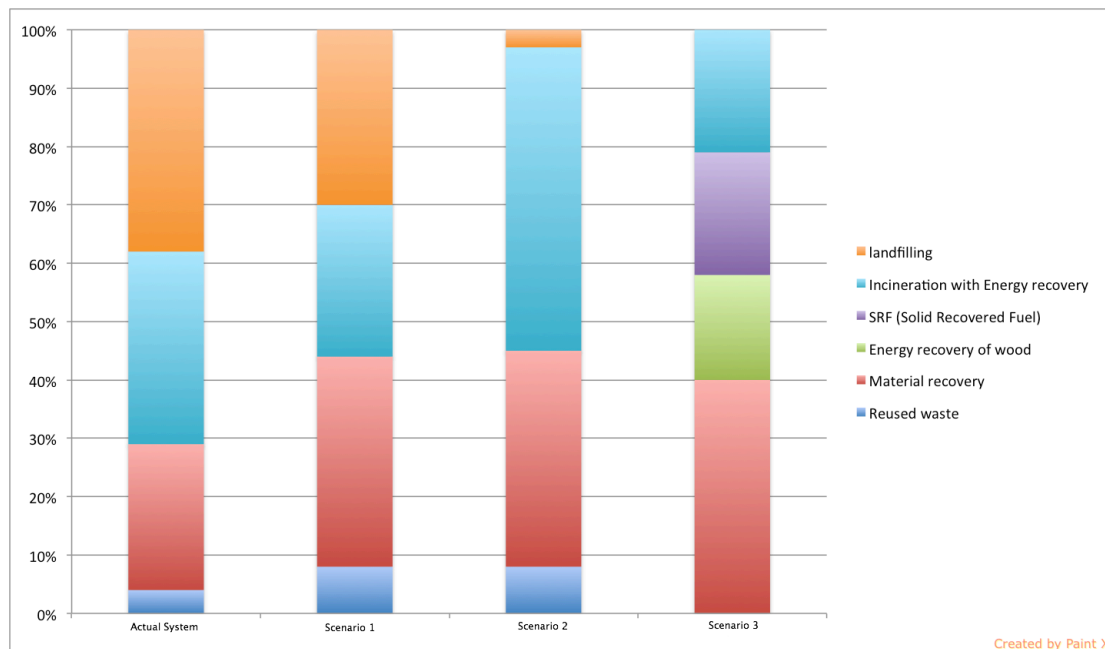


Figure: processes used in the different scenario Source: Environment and Energy Management Agency in France

According to the French agency, In terms of cost the 3 scenarios are approximately the same but the treatment processes used to deal with the waste are different.

The first scenario seems to be the less sustainable and landfilling stays at a high rate. The second and third scenarios are much more interesting as the process of burying waste down the ground is not used anymore (or it would represent a very small of part of the total waste). The total amount waste will be re-used thanks to material recycling and energy recovery. In France, thanks to the *National Commitment for the environment* law, many dispositions have been taken in terms of waste collection organisation. Having a well-organised collection and selection system is important to plan the implementation of circular economy. Modifying the treatment processes of the collected products is according to the Ellen Mc Arthur foundation a step that makes France follow the circular economy path. Indeed the second and third scenarios are based on two major points: material recycling (revalorisation of an old product) and energy recovery (considered as renewable energy), the material recovered would be used to create new furniture or different products using a cascade

reusing process, and the energy recovered by the incineration of materials and wood are considered as renewable energies.

Another important law that shows that France is trying to follow circular economy is the law number 2009-967 article 40, which states that construction, furnishing, wall and floor coverings products as well as paintings and varnish with the purpose or the effect of emitting substances in the ambient air, must have specific mandatory labelling. This law is made to prevent the customers of the composition of the product he buys, thanks to this law the customer will logically chose the product that have the less chances to harm him (product with no toxic substances), so the economy will turn to cleaner product with less harmful substances for the environment and human. As it is stated in the report, circular economy is also about using non-toxic substances to produce clean product.

It can be seen that actually many countries sees the potential of circular economy but needs to find a direction to apply it in today's economy. It is the case of France where since 2010 and the *National Commitment for the environment*, they have established the first foundations to reduce our carbon footprint, by making the companies involve in the collection of the products they sell. However circular economy is still theoretical in France and more and more stakeholders are starting to talk about it, and many commission are put in place to propose law projects to implement circular economy in France.

IV. Discussion of the Analysis

Since the industrial revolution, the world have been focusing on creating mass production systems, the goal was to produce as fast as possible without taking into account the energy or resource used to achieve the products. Nowadays the world is facing a turn in its producing way and new challenges are being introduced. Companies have to face the important rise and volatility of Raw material, the rise of energy cost through oil and gas and many more factors. It is obvious that the actual economic model based on a linear, which consist to 'take - make - dispose' seems today obsolete and changes have to be done. Since today, politics and the different stakeholders tried to compensate their use on the resource without really changing the system (e.g. KYOTO Protocol with the implementation of Clean Development Mechanisms project), People are more and more talking about sustainability and households even started recycling, but companies didn't do much to change their resource quantity use and GHG emissions, contrariwise, by trying to cut the number of employees, they had to use more energy and resources to compensate their departure.

The question of a more sustainable world have been raised but since today no real solutions have been found, because being sustainable for companies is expensive and is not profitable for the company, except in term of marketing image. This is why the actual sustainable tools used are not sufficient, it is important to find new solutions to make companies be more sustainable. In my opinion, circular economy can be this new tool that can bring sustainability to the actual economy. Indeed Circular economy does not only contribute to sustainable development as seen above but it is an enormous opportunity for cost savings, job creation, and revenue growth. It is not only an innovation on one product but on a whole economic system, which means that implementing this model can have huge repercussion on the whole world business, commodity prices and fluctuation, market prices and much more. Although, As Professor Braungart states in the interview, implementing a regenerative economy like cradle-to-cradle and circular economy is not about optimizing our actual system but about revolutionizing it, to bring innovation. This fact

could be a limit to the efficiency of this new economic model. In fact in order to implement circular economy in a company, a clear definition of the model needs to be done with specific parameters, which will make the company not only optimizing its production chain process, but also innovating it.

However, implementing such a wide model as circular economy will be very difficult, and it will require the participation of the whole stakeholders to work all together to help implementing this model. I believe that the economic crisis can increase this transition towards a circular economy. Indeed companies by cutting costs are trying to optimize their systems. According to Mc Kinsey survey made in 2011, 33% of the respondent companies had pursued sustainability initiative to reduce costs or improve operating efficiency (up to 70% compared to previous years). This figure shows that companies have changed their strategy as the crisis led to a decreased demand. Moreover governments are developing more and more resource efficiency by putting in place efficient collect systems and by forcing companies to contribute to funding this collection process. As seen above, France, with their national commitment for environmental law program are developing resource efficiency by making companies responsible of the products they sell, The example described on the furniture sector shows that it works as now the waste collection and treatment system is now centralised by Eco-mobilier and the town-halls organisation. Waste treatments scenarios are being more and more sustainable as landfilling is being less used and material revalorisation is promoted.

Of course this change will take time to happen, as Professor Braungart implementing regenerative economy is: "It is about effectiveness not efficiency, where do you want to be in 20 years from now. In traditional sustainability you tell your customer not to buy your stuff in order to consume less, in cradle to cradle your customer become a change agent because the more you buy the quicker the company can change". According to him the concept of regenerative economy can change the definition of sustainability, as sustainability will not be anymore about

consuming less but consuming smart. Consuming less will then be a consequence of it. This is why when professor Braungart talks about cradle to cradle, it is about celebrating the human life on this planet. Humans are the principal actors of this over consumption situation and they are the only ones capable to implement this change.

Politics have a primary role to play in that transition. The position and the actions the European Commission is going to adopt these next years towards circular economy will be determinant for the implementation of circular economy. The investment made on research to implement a better resource management system, should be effective and the European Union will be able to meet their strategy goal, which is to be less dependant from raw materials and commodities in 2020. Professor Walter Stahel, proposed a very interesting change on the taxation system that could boost the transition to a regenerative economy implementation: *"Shifting taxation from labour to energy and material consumption would fast-track adoption of more circular business models; it would also make sure that we are putting the efficiency pressure on the true bottleneck of our resource consuming society/economy (there is no shortage of labour and (renewable) energy in the long term)."* This action, as well as being a preponderant shift to circular economy, will be the best social move Europe have made for a long time as labour cost will be decreased especially in France and Scandinavian countries who apply high taxes. It could even solve the problem of delocalization, knowing that today many companies implant their manufactory in developing country as in western country labour costs is too high. Another interesting law that could be implemented, which could help the development of circular economy would be to force companies that use toxic materials to notice the customer by labelling it on its products. This law would give an important marketing and sales advantage to companies that remove toxic materials from their products. Moreover labelling circular economy would also not only give a primordial marketing bonus to companies but also establish the main parameters that a company would require to fill in so that its business model would be considered as circular.

The Ellen MacArthur is a very active foundation that militates for the development of circular economy. The association is today; very famous for its lobby on circular economy within the European Union, the European commission often refers to them while talking about circular economy. The association launched a massive program called "circular economy 100". This program is a platform, which regroup together leading companies, Emerging innovators companies, and regions. Their goal is to accelerate the circular economy transition process. The program is to be supported by all the foundation's partners and network as well as McKinsey as a knowledge partner by providing three methods of support:

- Creating a platform for collective problem solving.
- Building a guidance library regrouping all information on circular economy to give businesses a fast track success
- Provide a scalable mechanism for implementing circular economy capabilities within companies

The circular 100 has also for goal to create an alliance between the different key stakeholders so that they can be connected to enable relationships between them. This connection can create a new lobby which will bring circular economy in the spotlight, not only at a company level but also at the regional or national level.

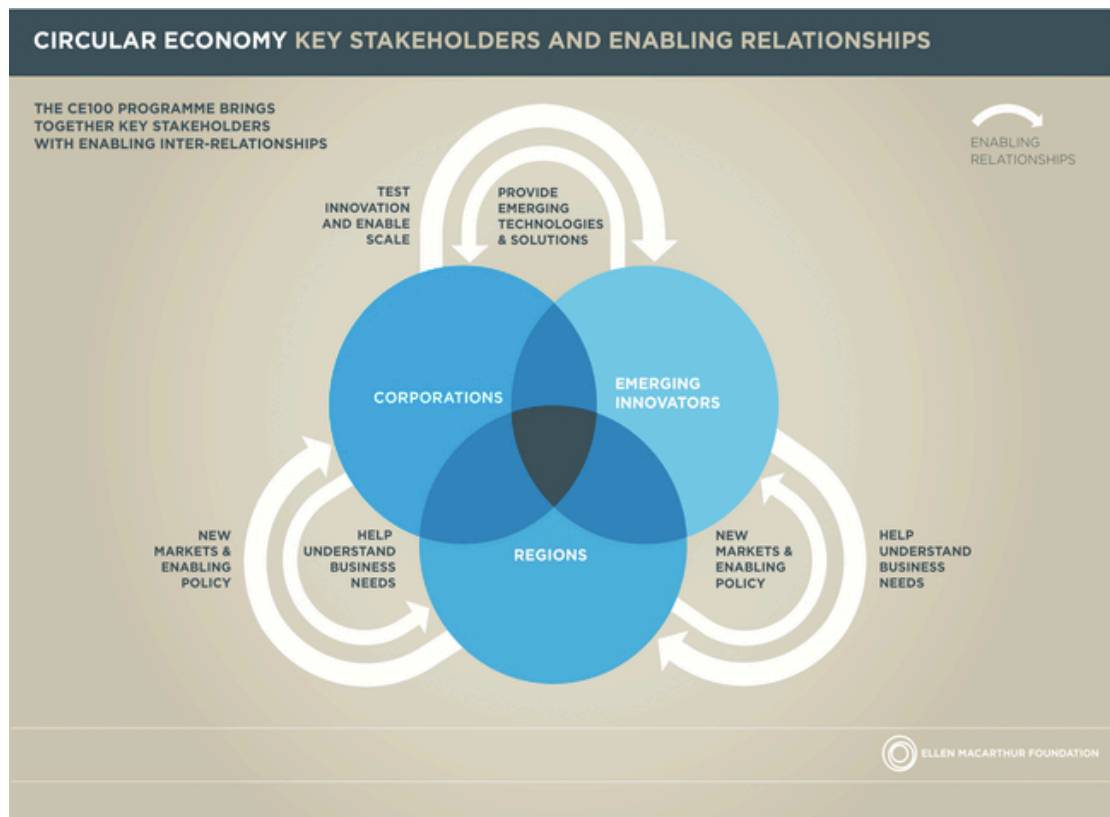


Figure 11: Circular economy 100 inter-relationship between key stakeholders, Source: Ellen Mc Arthur Foundation

As an overall, circular economy could be the basis of an economic revolution. Indeed by using renewable energies, recycling and reusing raw material, removal of all toxic materials, changing the actual consumption and sale system could engender an import upheaval in the occidental society. It could bring an important contention in the companies and force all the companies to follow the path of circular (or at least make their business more sustainable) to have the opportunity to respond to this concurrence and to be able to keep their businesses working.

V. Conclusion

To conclude, following the circular economy path can bring resource efficiency to our businesses. Circular economy fits into the three spheres of sustainable development not only in terms of economical profits, but also in term of social risks and environmental benefits and GHG emission reduction. This economic model leads to a significant reduction of waste creation, and thus a reduction in the energy use. It is not only an environmental friendly model but also a huge economic opportunity for different businesses, as according to MC Kinsey consultants, this model could create potential costs savings up to 630 billion USD for the companies.

According to Braungart regenerative economy can change the conception of sustainability, the relationship with the customers is different as you don't need anymore to sell less in order to consume less, but the more you sell products the quicker you can change the company, the customer become a "change-agent". By having a better management of the natural resources, the world will be able to live with 9 billion inhabitants including at least more than the half of the population being part of the middle class (top 5 billion in 2030).

Implementing this economic model will be very complex, and will need the involvement of all the different stakeholders (Industries, politics at the national and European level) to boost the transition to a new regenerative economy. It requires massive changes of the design product, the value chain, but also new generation of materials (i.e. new materials that does not require the use of toxic substances to manufacture a product) and innovative development on production process. Indeed, in order to put in place this model, it is needed to change the selling methods by making industries to increasingly retain the ownership of their products and as much as possible act as service providers (They are not selling only one product but the use of the product). It will allow businesses to optimize the use of their resources. Selling the benefits of the product and not the

product itself, companies will start designing for long-life products and not anymore mass consumption ones, without any unemployment implications as revenue will not only be based on the product sold but on the longevity of use of the product.

Many companies today started implementing the circular economy system, it is the case of Puma or Baisikeli but also all the members of the circular economy 100 associations, it is the case of the company Philips, where its CEO Franz Van Houten states: *"Philips is committed to the circular economy and is applying its principles throughout the organization. We are redesigning our products and looking at ways to capture their residual value. We are shifting from transactions to relationships via service and solution business models. And we are changing our culture to focus on the long-term and to co-operate closely with our customers and suppliers. It is not easy to change, but we feel called upon to assume leadership and inspire others."* (Franz Van Houten, 2014)

This transition has to be supported by the politics to boost companies to implement circular economy, the need to release new laws like taxing the energy consumed and natural resources instead of taxing labours. Other laws like labelling the products that contain toxic substances and creating a label for products that are made under the circular economy model. The European Union has an important role to play as they are making resource efficiency as a flagship for 2020 strategy, and are investing a lot of money in research and development to increase resource efficiency of raw materials thanks to their lobbying at the highest level every country, regions and business will be able to enter this transition and start implementing circular economy.

VI. Bibliography

M. Braungart and W. Mc Donough (2002). *Cradle-to-Cradle: Rethinking the Way to Make Things*

Mc Kinsey Company and TNO (2013). *Towards the Circular Economy volume 1*

Mc Kinsey Company and TNO (2013). *Towards the Circular Economy volume 2*

European Commission (2011). *A resource-efficient Europe – Flagship initiative under the Europe 2020*

Emmanuel C. Gentil (2013). *Municipal waste management in France*

Puma SE (2012). *Puma annual report 2012*

ERNST & YOUNG (2010). *Dimensionnement et Cadrage de Filières pour la Gestion des Mobiliers Ménagers et Professionnels Usages*

European Commission (2012). *Manifesto for a Resource Efficient Europe*

TNO (2013). *Opportunities for a circular economy in the Netherlands*

IMSA Amsterdam (2013). *Unleashing the Power of the Circular Economy*

European Environment Agency (2011). *2011 survey of resource efficiency policies in EEA member and cooperating countries - DENMARK*

Anthony Hartwell (2013) *Notes from European Innovation Partnership on Raw Materials Annual Meeting 5/12/13*

Drexhage, J. and Murphy, D. (2010). *Sustainable Development: From Brundtland to Rio 2012. Background Paper. New York: United Nations.*

Ellen Mc Arthur Foundation (2013). *The circular model - an overview*

VII. Annexes

Transcript of the interview with Michael Braungart.

J: What are the reasons for companies to implement it in your opinion and what are the reasons do companies in general have to not implement?

MB: I can't tell you I can't only speculate about this you need to ask them, cradle to cradle is so much the opposite of regenerative economy, it is about a beneficial footprint impact of opportunity.

J: When I read your book I saw a lot of parallelism with regenerative economy and cradle to cradle like for example eliminating toxics materials from industries,?

MB: It is about beneficial footprint it is not about regenerate, it is more about reinventing things (reinvent methods)
Using old PVC stinking cups to make new stinking PVC cups is called circle economy as well
There is a lot of abuse of terms basically

J: Do you think science can help the world economy.?

MB: Cradle to cradle It is not about economy but the role of human on the planet economy is just a consequence of it, A city like Copenhagen that want to be climate neutral and no tree are climate neutral so they want to be more stupid than a tree. It s completely abusive and even the term cradle to cradle doesn't have the same purpose than what I stated.

Massive policy problem

This Circular economy thing is nice but it is a very old concept that have more than 500 years I'm not talking about circle economy because it only optimize existing things it really about innovation quality, a product that contains toxic materials is a quality problem so I m only talking about quality

J: All these consequences of what is happening are reverberating on the economy and do you think that a change in the economic system can bring a change of human behaviour consumption production, that 's why I wanted to make a parallelism between your version of cradle to cradle which is more scientific and circular economy. How do you see the future? Are we going to change our linear economical model? How companies can change their mode of function (political help, ONG, organisations)

MB: I think these are more interesting question that you ask me. We need long term political goals here, look It took me 18 years for my colleagues to work on paper which actually can be composted or that you can burn in your fire place. 18 years because when you take the new york times or other papers and you burn there is still particles the ashes are still contaminated and cannot be used for agriculture or now we have paper that you can burn and which will go in the biological system for the first time in the human history before that people where using any kind of material just to print paper [...] And now the question is how you can get it in place? You can do it when you make legislation that in 2020-25 the paper in Europe should be 100% compostable. [...] It is about effectiveness not efficiency where, In traditional sustainability you tell your customer not to buy your stuff in order to be sustainable, in cradle to cradle your customer become a change agent because the more you buy the quicker the company can change. This is why we celebrate human life on this planet not to try to minimize damage to reduce toxic stuff etc... it s only one of the consequences

J: Yes of course, but you need to start from somewhere, right? Nothing will change in just a day; it has to go slowly right?

MB: No it cannot go slowly, we are talking about a revolutionary change, because then we will not have any industry in Europe, because to do the same toxic stuff, it can be made for much cheaper in India or China.

J: And do you believe that this revolutionary change can happen?

MB: compared to complete different paradigm, you know in France between the Declarations of human right and right to vote for woman it took more than 180 years so for 180 years people though maybe woman aren't really actually humans can you imagine. Cradle to cradle is the opposite of accepting paradigms in lot of case for example they say when you use recycled paper, you save 50 trees, so why not producing Double more paper and we will save 100 trees but it is not a question of saving, today it is not anymore about how much you save but more about reducing your footprints I am amaze of how far we are going. It is amazing how fast we conceive the changes.