

THE CIRCULAR ECONOMY AS A NEW APPROACH FOR SAVING THE ENVIRONMENT AND RAISING THE LEVEL OF WELFARE

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ABSTRACT

Since the industrial revolution, the total amount of waste has constantly grown as economic growth has been based on a ‘take-make-consume dispose’ model. This linear model assumes that resources are abundant, available, and cheap to dispose of. But this approach had led to harmful effects and problems both economically and environmentally, which are threatening the future of humanity. For this reason the circular economy was born to bring environmental and economical even if societal solutions. Based on what we have mentioned above, this paper aims to clarify the concept of circular economy, and taking a look on what is expected from this new economic model, where it’s working for answering the dilemma “How can the circular economy contributing in protecting the environment from wastes?”, through the analytic descriptive approach by taking a look on the DSM Company which bases on this new model.

KEYWORDS: Circular economy, DSM company, Linear economy, Resources, Wastes.

1. INTRODUCTION

Since the twentieth century, the demand for continuous growth has been met by a high throughput economy that extracts, uses, and eventually disposes resources, this has led to a wasteful system in combination with a growing population have manifested in global issues such as resource depletion and environmental degradation. These consequences have obliged many scientists and specialists to look for an alternative visions that are more compatible with nature, less harmful to the environment, less deplete of its resources and therefore more sustainable which means continuous state of productive balance between society, environment, and economy.

So one of the solutions proposed was the idea of circular economy that centres around the idea of an economy that uses resources in closed loops rather than linear flows. Then imagine if someone gave you a study which clarifying that through simple actions you can provide 100.000 jobs, contributing to the fight against global warming, and attracting new opportunities for development rather than traditional investment, would be considered a rational human or foolish. So in light of this dilemma we posit the following problematic:

How can the circular economy contributing in protecting the environment from wastes?

For answering this dilemma we have been addressed the following points:

- Describing the circular economy: a theoretical framework from linear to circular economy.
- What are the expected benefits of a circular economy transition?
- SWOT Analysis for Circular Economy versus Linear Economy.
- Case study of Circular Economy.

2. DESCRIBING THE CIRCULAR ECONOMY: A THEORETICAL FRAMEWORK FROM LINEAR TO CIRCULAR ECONOMY

For long time our economy has been based on a linear system, which means following one direction of producing goods that will be wastes after consumption (see figure 01); this is what is called “Cradle to Grave”. So the linear means ‘take-make-dispose’, which results in massive amounts of waste. While this economic model has generated an unprecedented level of growth, the rising demand on resources has become unsustainable. So this one of disadvantage of our current linear economy is based on the fact that the planet has a finite amount of materials and their availability depends on several mechanisms (E.MACARTHUR,2015), in addition to the damage caused by this economic model where nearly 269,000 tons of plastic pollute world oceans, and the USA sends 40 % of its food to the landfill and disposes of 70 to 80 % of its construction and demolition wastes by an average of 145 million tonnes a year, and in 2012, Europe sent nearly half of its wastes which attained 2.3 billion tonnes to the landfill. (Barbara Kiser,2016) As a result of all this damages, the humanity was obliged to finde some solutions that benefits the environment, climate and economy, which is represented by the Circular Economy.



Fig 01: Model of Linear Economy(Jianguo Qi · Jingxing Zhao & Others,2016)

2.1. The concept of Circular Economy

the circular economy’s concept is a fairly recent one and has been extracted from a though where treating wastes adequately to become resources again. Also it includes several preceding concepts, but its definition is not yet stabilized, and therefore we’ll mention some definitions of CE as follows:

Definition of CE : the concept of the circular economy is therefore based on two simple ideas: on the one hand, the awareness that what is considered waste can be re-used as a resource, much like the process at work within natural cycles; on the other hand, the need to decouple economic growth from natural resource use. (Report of INSTITUTE MONTAIGNE,2016).

According to the Ellen MacArthur “A circular economy is an industrial system that is restorative and regenerative by design. It aims to enable effective flows of materials, energy, labor and information so that natural and social capital can be rebuilt. It seeks to reduce energy use per unit of output and accelerate the shift to renewable energy by design, treating everything in the economy as a valuable resource.”

Also depending on Ellen MacArthur foundation report which was published on 2013, “The circular economy is considered as a new industrial model which is opposed to the linear model of resource consumption based on the “take, make, dispose” triptych. Its objective is to eliminate waste that is harmful to the environment. It promotes the use of goods with natural components called “nutriments” which can be reabsorbed into the biosphere without damage, as well as the repurposing (via reuse, repair and recycling) of technical components not suited for the biosphere. The final consumption of goods must, in a circular economy, be based on a “functional service economy”; that is, the rental of goods and no longer on the sale of goods which generates waste.(Delphine Gallaud &Blandine Laperche, 2016).

Here Also well bring the next definition: A circular economy is an economic and industrial system based on the reuse of products and raw materials, and the restorative capacity of natural resources. It attempts to minimize value destruction in the overall system and to maximize value creation in each link in the system.(Ton Bastein & others,2013).

The circular economy is a generic term for an economy where growth is decoupled from scarce resource use. This model is regenerative by design. Material use is of two types: biological (renewable) materials, designed for reuse and ultimate return to the biosphere; and technical (nonrenewable) materials, designed to move back and forth between production and consumption with minimal loss in quality or value (look at figure 02). (Peter Lacy & Jakob Rutqvist, 2015).

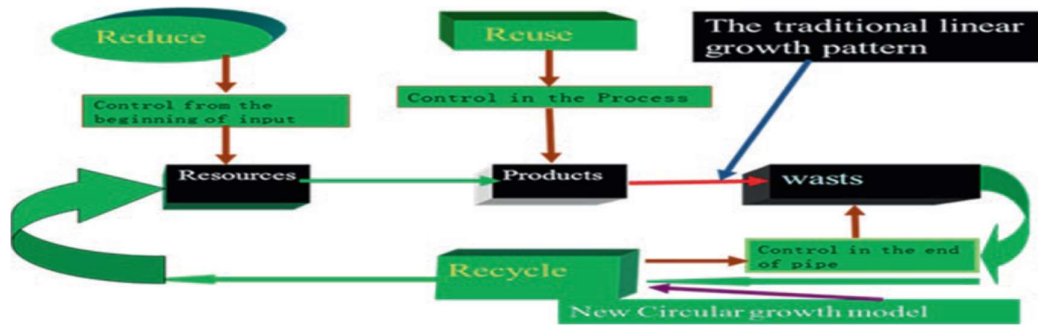


Fig 02: Model of Circular Economy (Qi Jingxing Zhao & Others, 2016).

Finally we can write our definition of Circular Economy as the follow:

The C.E is an industrial system which doesn't produce wastes or pollute the environment. it's based on two main idea, on the one hand the realizing that any waste might be re-used a resource, and on the other hand decoupling the growth from natural resources use. It promotes the use of goods through biological nutrients which are designed to re-enter the biosphere safely, as well as the repurposing (via reuse, repair and recycling) of technical components not suited for the biosphere.

2.2. The principles of circularity

According to the C.E definition, we can consider that the C.E has the same goals of sustainable development, where it's based upon many different schools thoughts which have been appeared since the late of 20th century. basically the C.E doesn't offer any new approach for sustainable development, but instead of that it adds value through synergy, which means combining multiple approaches to one coherent strategy. The C.E is dealing with a group of influential concepts which include the Cradle to Cradle philosophy, the performance economy of Stahel, the design principles of biomimicry as introduced, the industrial ecology, the blue economy systems approach, and the natural capitalism. The analyzing of this schools thoughts has led to determine five key principles that are fundamental to a circular economy. These are: (Nick van den Hout, 2017)

- organise reverse cycles;
- be resource effective;
- think in systems;
- priorities the future;
- create mutual benefit.

These five principles are strongly related to each other, if any company wants to go in a circular approach need to adopt these principles and know their relatedness.

2.2.1. Organize reverse cycles

Using resources in circular flows is an obligation in a circular economy, this is what presents an obvious contrast compared with the contemporary economic system. So to achieve the circularity it should collect and treat value from end-of-life products through a system. These, which include processes that return resources back to the value chain like refurbishment and recycling. Then, the output (waste) of one process becomes the input (food) for another process, which effectively eliminates the concept of waste. So finally the development of reverse cycles primarily relates to logistics and process innovation, but can be greatly supported by product development strategies that promote resource recovery.

2.2.2. Be resource effective

The aim of C.E is increasing the effectiveness resources' using in economy, which means use resources to their full potential to create a positive impact. This proposes working for achieving a desirable outcome instead of looking less undesirable results, such as using resources to repairs damage to the ecosystem instead of causing less additional damage. To consider that resources are used all their potential should:

- Firstly product or service needs to address a relevant societal need to give it right of existence.
- Second, the product must be constructed to use only suitable and necessary energy, materials, and components.

The intensity with which the product is used by the consumer is also relevant, where products that spend most of time out of utilizing are considered as wastes.

2.2.3. Think in systems

System thinking is a way which helps to understand the way of interact parts system and how they relate to the system as a whole. So according to the complex relations that affect the interaction between both businesses' environment internal and external variables, the outcome of actions will be difficult to be predicted.

Circular economy aims to optimize the total system performance rather than that of a single component through recognizing the existence of complex dependencies and to adopt a holistic perspective to assessing and optimizing the impact of corporate activity.

2.2.4. Priorities the future

In the economy any company or business works for staying alive as more as possible. so to achieve this objective they need to be adapted with environment variables, then they should evaluate and predict risks which is an equally relevant driver for change from the problems of linear economy to the circular economy that offers an approach fundamentally different from the contemporary status quo in economy and industry.

These changes need time to bear fruit. So the C.E work for Designing a product to increase its end-of-life value, only starts to repay when the product becomes obsolete, commonly after several years. However, in order to realise and benefit from the circular economy, opportunities and consequences of actions should be considered from a more long-term perspective.

2.2.5. Create mutual benefit

The circular economy has the same goal of linear economy, which is meeting society's needs for goods and development. But the methods for using resources and the ways to create benefit change. So when changing these methods, it is essential to organize every activity to create mutual benefit for different stakeholders through organizing all company processes to benefit from the transition to the circular economy, also offering new value propositions and revenue models that align the principles of the circular economy with an organization's profit-oriented strategies. This also extends to the supply chain level. Because increasing resource effectivity by extending a product lifespan, but increasing revenue by selling more products could present a conflict.

3. WHAT ARE THE EXPECTED BENEFITS OF A CIRCULAR ECONOMY TRANSITION?

There are many benefits associated with activating the various levers of the circular economy, both for the environment and for economic growth. It is a process of innovation and transformation of business models, which, despite having a very positive overall impact, could see both winners and losers, notably among companies whose value chain will be affected (Report of INSTITUTE MONTAIGNE,2015).

3.1. Earth and humanity: environmental benefits and resource savings net material savings reduce risk of resource depletion

The circular economy offers an efficient utilization of material value where greater demand can be satisfied by a smaller amount of resources through reutilizing wastes as resources. As a result, the risk of depleting natural resource reserves is mitigated. In a transition scenario – assuming conservative changes in product designs and reverse cycles – the EMF expects an annual cost saving of 340 to 380 billion USD at European level for high-potential product industries. These include eight sectors of medium-lived complex products that together represent 48.6% of the manufacturing industry's contribution to Europe's GDP (Niek van den Hout,2017).

3.1.1. Reduced supply risks and stock price fluctuation

Stock prices has become high and fluctuating because of the increasing demand for natural resources combined with the exhaustion of easily accessible resource reserves. For example the natural external resource cost the European Union 6 times more than what it imports, which presents risks to the European Union. Control over circular material flows will lower Europe's dependency on resource supply. Moreover, the decrease in demand resulting from net material savings is likely to balance stock price increase and volatility (Niek van den Hout,2017).

3.1.2. Reduced CO₂ emissions because of higher resource effectivity

The unsustainable consumption of good has been caused some damages on earth like climate change, CO₂ emission from the combustion of fossil fuels. So Consuming less materials and using them in closed loops, will decrease negative externalities and their associated costs. Across mobility, food systems, and construction sectors, CO₂ emissions could drop to 48% by 2030 and 83% by 2050, relative to 2012 levels.

So, the circular economy working to changes the ways of using and disposing resources. In a circular economy, less resources are needed and less waste is created in serving the needs of a population. This change will positively influence the carrying capacity of the earth, supporting a greater population with the same amount of resources. (Nick van den Hout,2017)

3.2. For countries and regions: generating economic value and employment, improving the trade balance, securing access to strategic resources

Every country and region should naturally benefits from the global impacts of a circular economy transition, moreover, the most advanced countries take the lead thanks to a competitive asset from an environmental point of view. They shall benefit from a certain safeguard against strategic resource shortages, an improved trade balance (with certain imports being avoided); and create jobs and growth opportunities. (Report of INSTITUTE MONTAIGNE,2015)

3.2.1. Protection against strategic resources shortages

This means abundance of wastes to be used as resources instead of fresh raw materials, which will free the economy from the dependency. At the end of 2010, China announced its intentions to reduce its exports of rare-earth elements. These substances are notably used in the production of semi-conductors, and are essential to the functioning of most electronic equipment.

In addition, as their name suggests, they are present in very low quantities on the surface of the earth. At that time, China controlled around 90% of global production. As a result, reducing the consumption of elements, the circular economy is in itself a strategic lever, allowing economies to limit their supply problems.

3.2.2. Jobs and growth opportunities

By a way or another employment and economic growth will be influenced by the circular economy. However, it must tread carefully when it comes to offering up precise predictions. New jobs will indeed be created in certain sectors leading the transition, such as waste sorting and recycling, the thermal rehabilitation of buildings, and the development of alternative modes of transport. At the same time, other jobs will disappear, like those in car dealership. It is not easy to quantify the overall consequences, nor to judge whether the final balance will be positive or negative. Nevertheless, recent studies suggest that the circular economy would have a positive effect on employment.

In France it's estimated that the circular economy sector represents roughly 800,000 full-time equivalent jobs in France, or 3% of the total workforce, without taking into account certain other activities linked to the circular economy like the leasing sector and reuse/recovery, as they are impossible to draw out from the available statistics. These jobs are mostly represented by the repair and leasing sectors, notably in the automotive industry.

A macroeconomic study done on behalf of the European Commission estimates that each percentage point reduction in resource use through increased efficiency would generate 12-23€ billion, and between 100,000 and 200,000 jobs across Europe. At a more microeconomic level, we can already see the impact on employment. For example, a study of the Île-de-France region suggests that every tonne of domestic waste that is sorted and recycled generates ten times more jobs than if it were incinerated, and thirty times more than if it were deposited on a landfill.

3.3. For consumers: innovative and cheaper services, new revenue sources, an overall reduction in the cost of owning certain goods

From the consumer's point of view, the circular economy will bring new opportunities, which directly benefit the producers of goods and services, also eventually lead to lower prices and a new offering.

For example, the eco-friendly mobile phones, these new designs prolong the life-cycle and increase the salvage value of these products, all of which benefits the consumer. Practices stemming from the circular economy in areas such as the agri-food industry can also have a major impact on health. One example is organic farming, which is making headway in Europe, and which turns away from the use of synthetic and chemical products. As such, with a growing demand for locally-grown, fresh and healthy food within cities, organic and peri-urban agriculture is evolving.

Characterized by short-chain distribution channels between local farms and consumers, it aims to reduce food wastage linked to transport and to preserve product freshness. Finally the development of the circular economy is an opportunity for additional value for the consumer, either providing him or her with the same good or service at a lower price or with additional functions (Report of INSTITUTE MONTAIGNE, 2015),

4. SWOT ANALYSIS FOR CIRCULAR ECONOMY VERSUS LINEAR ECONOMY

Even if we had talked about advantages and opportunities of circular economy, we also shall to cope with a series of hardships. Circular economy implies a more manageable waste, recyclable resources, profitable organizations and more sustainable environment, however, awareness of it is still arguable and tendency upon Circular economy by sectoral and governmental still is quite minimal level.

A set of legal, R & D, capital and introductory rules and campaigns yet needs to be done. As described below, it is intended to indicate some certain values which may assist us to scale current and future standing implicated by the SWOT analysis (Furkan Sariatli, 2017).

4.1. Strengths

- The restoration of wastes by a proficient way is a potential competitive edge.
- Elimination of waste from the value chain has the quantifiable benefit of reducing systemic and direct material cost and diminishing resource dependence.
- Incorporating the attributes of CE in the R & D phase of operation yields spurs progress in material sciences and yields the development of higher quality and more durable components.
- Due to the closed-loop processes, the economy grows less exposed to price fluctuations of the materials and the flattened cost curve ultimately results in more efficient use of resources in terms of both value and volume.
- Externalities are associated with the use and flow of material, lower material consumption evidently decreases the exposure to externalities.

4.2. Weaknesses

- Circular economy still requires amalgamation of the entire product life cycle from raw material provision to annihilation.
- No specific guidelines to sectors on how to implement circular economy.
- There is still no internationally recognized standards institution to regulate the sector.
- Circular Economy may omit the feature of semi-recyclability when choosing a raw material for production process.
- Public opinion about CE is yet inefficient and social marketing campaigns lack to access sectoral people.
- There is still no special legal regulation about circular economy and its application.
- Investments about circular economy to introduce the system to sector are not enough.

4.3. Opportunities

- By reducing the level of material input needed, the economy may save billions of dollars. The EU may save up to 600 billion USD in material costs annually.
- Deploying circular design in technological products, results in securing access to better and cheaper materials.
- Developing expertise in legal, mechanical, operational or cross-sectoral challenges in circular solutions opens business opportunity for the enablers.
- Developing expertise in sectoral or cross-sectoral challenges in circular solutions opens business opportunity for the enablers.

4.4. Threats

- If companies can control entire life cycle, they can easily cross-subsidize different activities and that can cause high prices and incapable products.
- If producers could direct their own product-waste, it may be more difficult to benefit from waste management for those in scale economy.
- Managing whole life cycle of product and strong collaboration can cause cartel structures.

- A gradual or sequencing financial disruptions in the system can cause unpleasant outcomes for the interdependant sector due to complex and interlinked sector.

Generally we can summarize the SWOT analysis of the Circular Ecoomy in figure 03.

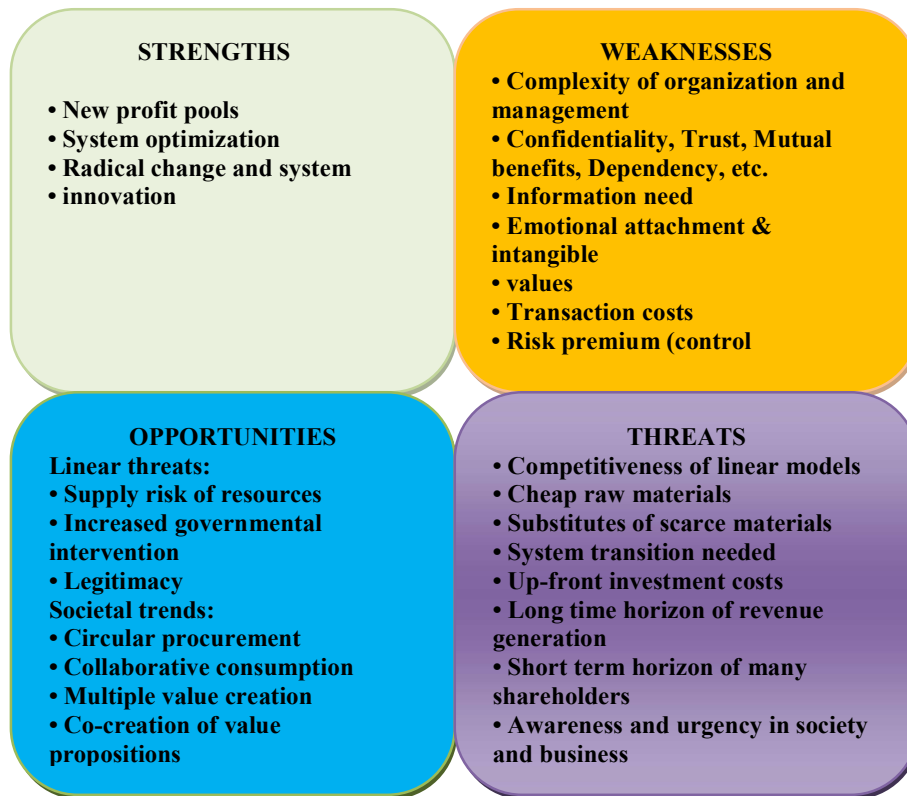


Fig03: SWOT analysis of CE for business(Bas Mentink,2014).

5. CASE STUDY OF CIRCULAR ECONOMY

Through this axe we'll going to clarify the theoretical side of C.E by explain how The DSM company aplicate the C.E and how does it benefit from it. (Annemarie van Oorschot & Bart van Ratingen, 2017).

5.1. About the DSM company

DSM is a global science-based company active in health, nutrition and materials. By connecting its unique competences in life sciences and materials sciences DSM is driving economic prosperity, environmental progress and social advances to create sustainable value for all stakeholders simultaneously. DSM delivers innovative solutions that nourish, protect and improve performance in global markets such as food and dietary supplements, personal care, feed, medical devices, automotive, paints, electrical and electronics, life protection, alternative energy and bio-based materials.

DSM and its associated companies deliver annual net sales of about €10 billion with approximately 25,000 employees. The company is listed on Euronext Amsterdam. DSM focuses on developing solutions with better ecological performance over the life cycle and a more positive impact on people than competing products. DSM empowers its innovation capability focusing on products with a higher sustainability performance. (Official cite of DSM company)

5.2. Circular business model

The aim of DSM is continuing to use fewer resources and stay delivering a higher contribution to the economy and society. The company operates in the earlier phase of product value chains, which allowed it to contribute to the composition of materials and ingredients.

Also DSM aims to secure future availability of natural resources, and unlock more value from resources in use. In case of food, this means efficient production and preventing food waste by developing solutions that extend shelf life. In case of materials, DSM develops nontoxic materials that can easily be recovered and safely used and reused.

5.3. Four focus areas of DSM's circular business models

5.3.1. Replace finite and polluting resources by safe and renewable ones

Examples include lightweight bio-based plastics for the automotive industry or paints based on water and renewable resources.

5.3.2. Increase the lifetime of products

DSM creates and develops circular products which stretch product life. DSM's Dyneema, for example, is used in a range of applications such as offshore, maritime, and workplace safety applications. In addition, the properties of Dyneema offer limitless potential for applications in the apparel industry. In collaboration with Levi's, Dyneema is now used in jeans to improve durability.

5.3.3. Enable recovery of valuable materials

For example DSM's Niaga technology. The Niaga helps and enables the producers of carpet to recycle their materials to the highest value through using a material which can be fully reused at the end of its life, or enable them to separate ingredients in case which more materials are used. Through its thought of C.E., DSM has achieved the point where the energy used in production has been reduced by 95 percent because of its simplicity and pure materials in material design, compared to a traditional process, and the manufacturing process is water-free.

5.3.4. Valorization of waste streams

We can prove this point through the renewable energy field as an example. Project LIBERTY is a cellulosic biofuel plant that uses crop residue — corncobs, leaves, husk, and some stalk — to produce 20 million gallons of bioethanol per year, later to be ramped up to 25 million gallons per year. POET-DSM Advanced Biofuels intends globally to license an integrated technology package that converts corn crop residue into cellulosic bioethanol for third parties.

Usually Circular Economy known by decoupling growth from resource use, which means the need of decoupling resources from cost and revenue. When fewer resources are used, especially critical resources like water, DSM reduces hidden costs to local economies, and can capture this societal benefit in the business model. By doing so, DSM is able to secure commercial success of a circular solution. Furthermore, it helps to find leverage points to set a broader systemic change in motion.

5.4. Challenges of DSM company

As all the world DSM company has the same challenge of any company and all the humanity which is wastes, in this point P. Kotler said "one of the biggest threats of human well-being is pollution that is caused by wastes". So the main challenge of DSM is how to tackle the wastes, according to Lukas Hoex "a Manager in DSM", DSM has the scientific knowledge to develop new products that will contribute to solving the challenges of today's society, which requires a new type of partnership and new business models. So the DSM has developed some products like the following:

5.4.1. Adhesives and paint

To apply the circular economy, DSM targets its research to minimize the use of critical resources, replacing scarce and toxic materials and substances, and facilitating reuse and life expansion.

DSM invests in materials that are easy to recover and can be used for a wide range of purposes. "Conditions for success are reduction of the diversity of materials used to manufacture products and a radical phase-out of toxic ingredients. The latter implies that the plastic used in laptops, for instance, must be so safe that in its second or third life, it can even be used to manufacture toys for children. These conditions offer not only an interesting innovation agenda for materials, but also for packaging products, paints and adhesives."

DSM is conducting research into ingredients for adhesives, for example, that ensure that there are no obstacles to material separation in waste treatment. "We do need strong adhesives, of course, in order to extend the life of our products, but apart from this, we aim to ensure that the adhesives and paints form no impediment to the second life of the materials."

5.4.2. Carpet Industry

To proof their orientation in C.E, DSM Company has innovated a new carpet technology to make its carpet recyclable. Recycling is difficult as most carpets consist of a multitude of different materials that are interwoven. As a result, separation would be a costly affair, even though several market parties have already taken significant steps in the right direction where certain carpet ingredients and elements are concerned.

DSM has developed a technology that enables the manufacturing of high-quality carpets from one single material or two at most. In the event that two materials are used, they can easily be separated as a result of an innovative interlayer, this makes the materials fully recyclable so that they can be used to manufacture new carpets, for example, or for different purposes.

So finally we'd say that every company has to transform its orientation from the linear economy to circular economy which means transforming their way of production from "Cradle to Grave" to "Cradle to Cradle" just to save our planet and satisfies the needs of the present without compromising the capacity of future generations, guaranteeing the balance between economic growth, care for the environment and social well-being. So DSM is therefore dedicated to securing the future availability of natural resources, and unlocking more value from the limited resources that are available. DSM focuses on the following to further progress to a Circular Economy: (Official cite of DSM company)

- Reduce resource use of our own manufacturing processes, those of our customers and the end-consumer.
- Replace the scarce and toxic resources in our manufacturing processes and the final products of our customers.
- Extend the durability of products and materials.
- Recover materials after first use and valorization of organic waste streams.

6. CONCLUSION

Many scientists and specialists have agreed that the continuing of excessive production and consumption approaches and the harmful effects of current industrial systems are threatening the future of humanity. Many of them have worked on developing alternatives that are more compatible with nature, less harmful to the environment and less depleting its resources, and thus more sustainable. Among the creative ideas developed in the last two decades is the circular economy.

According to the Swiss architectural Walter Stahel, who invented this term and described it in 1976 as "cradle to cradle", which means benefit as much as possible of the product by recycling it and reintroducing it in new forms and uses to serve both the economy and the environment. Through this study we had reached some results which will be listed as follows:

- The circular economy model was born not only out of the necessity to change the course of today's linear model, but also out of the huge opportunities for both the environment and business in delivering new circular solutions.
- The circular economy is essentially an economic model that aims to use resources in fundamentally different and more effective ways.
- A circular economy is a realistic way to provide an expanding world economy with the raw materials that will be required. A more circular economy envisages increased reuse, repair and recycling of manufactured goods and the utilization of the waste streams generated by modern society.
- The circular economy focuses on recycling, reducing, and reusing physical resources and using waste as a resource with the overall goal of decoupling economic growth from resource use and associated environmental impacts.
- Both the economy and society as a whole would benefit greatly from embracing circular principles. It would lead to more jobs, reduced environmental burden, and economic growth. According to the Chinese Association Council of sustainable development researches, the development of the circular economy will contribute to the establishing of seven new industries which are: the environment industry, waste recycling, energy saving and reduce its consumption, renewable energy, health, service economics, creative designs and imaginations.

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