

Circular Economy: Observations and Developments

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Abstract

All the firms are investing to find the most efficient way to employ their resources in order to maximise the profits. Squeeze the best from input and consume less is the targets but the efficiency of our economy is not at its maximum level. The linear model is described as “take-make-waste” model. It takes resources from the ground, use it to make products and then waste it. We take resources from the ground, exploit them to manufacture goods that we use in our everyday life and then, when products are old or arrive at the end-of-life phase we throw it away. This way of consuming creates several problems.

Today the Circular Economy is the first alternative for a sustainable development of our economy. The new trends (such as growth of overall population and scarcity of natural resources) in combination with the opportunity it gives, put pressure for an imminent change. The works gives an overview to the circular system involving all the actors, institutions, businesses and consumers. Furthermore, it cites the benefits of the circular economy but the barriers to implement the change are still very big and mostly they consist in culture and financial difficulties. In this switch of mentality, the consumer will face a great change in consumption methods. Products will leave the place to services in to squeeze the best from the resources. Sustainability will be another key aspect of the change and environmental benefit will be part of the account too. Fortunately, the technological enhancement will help the economy to overcome the linear system. The change is difficult, but it is mandatory, today it is realty for some institutions, and they are pushing to its implementation (i.e. European Union), big enterprises and organisations are following (i.e. Schwarz Gruppe) but the evolution is possible just if every player makes its part.

Why we Need a Change

All the firms are investing to find the most efficient way to employ their resources in order to maximise the profits. Squeeze the best from input and consume less is the targets but the efficiency of our economy is not at its maximum level. The linear model is described as “take-make-waste” model. It takes resources from the ground, use it to make products and then waste it. We take resources from the ground, exploit them to manufacture goods that we use in our everyday life and then, when products are old or arrive at the end-of-life phase we throw it away. This way of consuming creates several problems. The environmental sphere faces huge damages during the first and the last stage. Resource seeking implies great amount of pollution especially for what concerning fossil and mining resources like petroleum and metals. The pollution of petroleum seeking is based on two factors: leaks of wells, pipelines and storage tanks and pollution in the municipal landfills where petroleum-based

products contaminate the ground and so, the aquifers. The example of 2010 British Petroleum disaster in the Gulf of Mexico highlights the risk of the black gold extraction. (Sillanpaa M., Necibi C., 2019) During the end of life stage, products end in the landfills. Products composed of diverse materials are collected all together and just in a small percentage they are properly separate by material. The final consumer waste pollution creates huge problem because not well separated items go in the incineration and create CO₂ pollution in the air. The problem of this is also economical. Waste disposal has a cost for firms that must be considered. The linear consumption model has a great negative impact both in the environment and in the global economy.

From the second industrial revolution on, the linear economy model becomes the main consumption model. The causes of this implementation are several: during the 19th and 20th century there is no issue about resources on the planet. Especially after the World War II average consumption of people steadily increase due to an increase of income per capita. Technological improvements and new sources for fossil raw materials lower the prices of resources until the end of the 20th century. High demand and decrease of resources today render raw material not easily accessible and this lead the price of commodities at the beginning of 20th century level. Another cause is the concern about pollution in the past years. Today landfills are full, and processing of waste become more and more complex in these last years. All these facts lead to an over exploitation of commodities. The rising costs for companies bring to an increasing price of products prices and economy is not efficient as it should be.

Today the situation is strongly changed. Our current way of living and consuming does not consider the fact that resources on earth are finite and the problem will be worse. Demographic forecast tell that whole Earth population is increasing by 1.1% every year. Following the previsions, we will be more than 10 billion human being on earth. The figured are pushed in those direction because of an increasing in GDP per capita within the 2030, especially in the emerging countries. Consumer of the middle-class will be more than 3 billion in Asian countries like China and India. (Ellen MacArthur Foundation, 2019) The economic system we are using is not designed to face such that changes. Raw materials and resources on earth are not enough. (Organization for Economic Cooperation and Development (OECD), 2018)

Earth overshoot day marks the date during a year when the demand for resources overtake what the Earth can generate during a year. This figured is every year earlier than the year before and prove the fact that we are consuming more than the earth can give us. Forecasts state that before 2030 the need for resources will be three times more than the Earth can produce. It means that, in this way, before the next ten years we need resources for three planet every year.

The problem of linear economy lies in its foundations. It is based on finite resources and it is no more sustainable right now. To face these new challenges, we need a new revolutionary way of thinking our economy. The circular economy is the appropriate respond to the new challenges we are facing in the next years. This new model is based on a series of closing loop systems were resources are taken from the wastes of another loop. Therefore, Circular economy will not take its raw materials form the natural reserves on Earth but on the scraps of different product life cycles. European Union views in the circular economy the solution for the future. There is not a unique definition of it, but we can group several definitions that contain all the same concept. Circular economy is an economic model of manufacturing and consuming goods. From the production point of view inputs are second-hand raw materials taken from wastes of previous cycles. Reuse and recycle are the methods manufacture exploit to produce goods. From consumer side it is a model that involves new way of consuming goods such as sharing and leasing economy. Product itself will change its nature, from product to product-as-service solution. The CE system will benefit firms (that lowers it cost), consumer (that would find cheaper lower-price products on supermarket's shelf) and environment (that would have less waste and more natural resources available). Many actors are trying to push the transition to circular economy. Examples are supranational government as European Union, worldwide association like Ellen MacArthur Foundation and multinational companies such as Schwarz Gruppe.

Product life cycles becomes circular. From the “Cradle to Grave” product life cycles shift to “Cradle to Cradle”. (Braungart M., McDonough W., 2002) Now products are not circular. They are produced without thinking to an eventual recycle or reuse: the components made of different material are mixed together, this fact renders collection and separation difficult and inefficient. The transaction pass through a new vision of the everyday items: products must be designed to be reused at the end of their life. This mean to manufacture products that are made of easily disassemble modules, the parts of the product must be regenerated in order to maximise the value of second-hand products. Therefore, we can interpret two different types of closing the cycles: downcycling ad upcycling. The latter is the bast way of using second-hand inputs because it is the cycles through which an item is recycled or reused in a higher value product. An example of this process is the recycling of recycling polyethylene caps. The high quality of this product and the fact that they are just in a small part contaminated by other substances, render it very valuable for recycling process. They are used to have high quality recycled plastic that could be used to make high-resistance items for our everyday life. Above all, upcycling needs a very accurate collection and separation phase because contamination from lower quality plastic would mean loss of value and downcycling would be the only solution.

This latter is the process for what components are reused ore recycles in a lower value product in comparison with the product of origin. Unfortunately, today downcycling is more common in recycling now. The problem comes from the fact product of origin itself are low quality items that in order to win price fights against competitor are contaminated with low quality and low performance components. These components are impossible or at least very difficult to recycle. Examples of downcycling are in paper and wood industry. Furniture are collected, they are fragmented and then pressed together to constitute the content of the panels. This panel are used to produce lower quality wood that could be used for a lower quality and less costly products. In their turn this furniture, once arrived at the end of their life are very difficult or impossible to reuse or recycle.

We can say that the foundation by Ellen MacArthur is the most active player of the game. With its everyday work it tries to push government and firms all over the world to open their eyes and involve circular economy in the short-, mid- and long-term plans in order to have a better world and a healthier world economy. The pillars of the Foundation are the preservation and incrementation of natural capital, optimization of resources through circular cycles and the elimination of negative externalities.

Whenever we are talking about circular economy we must distinguish between technical and biological cycles. The latter render possible the reintroduction of bio-based substances into manufacturing process or involve it as resources in other economical cycle. Alongside the biological cycle there is the generation of biogas that is useful in energy production. We can find an example of biological cycle in the agriculture industry which uses waste of the breed industry as fertilizer in the cultivated field. On the other hand, technical cycles include item made by man that could contain hazardous substances and/or rare metal. An example is the is the automotive industry. End of life cars are emptied from the hazardous substances such as oil and parts such as silencer. Then in the car recovery the parts that could be reused in another car are disassembled and sold. The rest is pressed and sold as second-hand metal. In the step forward the metals are separate and recycled.

The example comes from nature

The truth is that circular economy is not a step forward but a step back. It is not a revolution; it is a system that find its roots in the earth itself. Natural cycles take the needed resources from wastes and constantly reuse it. Circular cycles lead nature to survive at changes during it 4 billion years evolution. Waste in one system is energy for the other, nothing going lost, everything is metabolized. To help the transition the first step towards circular economy should be take nature and natural cycles as model. Biomimicry is the discipline that study nature’s best ideas and then imitates these designs and processes to solve human problems (Benyus J., 1997) and it follows the following principles:

1. *Nature as model.*
2. *Nature as measure:* ecological models are the standards to follow.
3. *Nature as mentor:* Biomimicry focus on what we can copy from nature.

Taking nature as example is the key to implement the transaction especially for what concerning the biological cycles.

Side by side the model of Natural Capitalism is getting more and more important during these recent years. Natural capital is the ecosystem services and natural resources we need to survive and thrive. Born to be the answer to the increasing demand of resources, it proposes a model which take into account the liquidation of the natural resources in the balance sheet. Natural capitalism aims to implement an economical system where the impact on resources or ecological system is very low or almost zero. This mean that natural resources must be extracted at a speed such as planet earth can regenerate it. This is what nature does from the beginning until today. Take into account the natural capital exploitation in the production cost will stimulate the research of new possible resources, and this input could be from second-hand provenience that have already amortized the natural capital cost. (Lovins A., Lovins L., Hawken P., 1999) To do this necessary shift we must:

1. Dramatically increase the productivity of natural resources
2. Shift to biologically inspired production models (Biomimicry)
3. Move to a solutions-based business model
4. Reinvest in natural capital

How does Circular Economy Work?

The circular economy system is based on the 3R concept: Reduce, Reuse and Recycle. The lack of natural resources today and especially in the future, push us in front of big challenge: increase input efficiency. Many steps have been made towards this direction. Because of constant increasing in prices of commodities research and development department in the firms are committed to squeeze as much value as possible from input resources. Technology comes to us, for example thanks to innovation in 3D printing, prototyping become cheaper and more accurate. CAD design is helping industries to find the best possible way to produce items in order to be reused or recycled once they are not longer useful. In order to reduce wastes all automotive car manufacturer are using software which help them to squeeze the best from a metal plate or a “foglio” of leather. Given a piece of whatever shape, computers dispose the parts it needs to have in a way that scraps are as little as possible. Once the process is done, surplus material is collected and sell to the supplier that will reintroduce them in the production line. This process maximises the efficiency of input and scraps. Having less waste is a consequence of having product that last longer. In turn, this mean that circular products must concern two characteristics: higher quality and repairability. Consumerism in recent years leads to high substitution rate of less valuable products. Having the last version of an article become the priority and landfills are full of products that still work but are not fashionable. The consequence of this continuous product rotation is that today the market is full of low-quality products with shorter life. All this is a consequence of a linear view who rewards sales at the expense of the environment and the whole economy itself. Higher replaceability of products is given by the fact that when a component of a product is broken, usually repairing it costs more than replacing it. The problem comes from the first stage of product creation, the design stage. Firms design products that are difficult or sometimes impossible to repair because of cost reduction or simply due to firm’s opportunistic behaviour. Nowadays products are designed to be exclusively repair by the firm who produce it and most of the time repairing cost are exorbitant just because final consumers have no chance and manufacturer speculate on this fact. As a result, repairing products result less attractive than radically substitute it. Automotive industry is an example of waste creation because products (cars) are not designed to be repaired due to a linear way of doing. When a car with more than ten years life has broken, cost of parts and workforce is very high in comparison with the car value. This fact is due to two factors: price of parts does not decrease as the years go by and workforce is depending on the time that the worker employs to repair the car. Problems arise when the workers use more time to disassemble parts to have the access to the broken parts, rather than substituting the part itself. In that way the value of a product

which costs tens of thousands of euros lost all of its value in few years. The example highlights how a bad design can imply a product substitution when a substitution is not needed. Products which are not designed to be circular have a cost on repairing that sometimes exceeds the cost of a new product. Today that commodity's costs are greater repairing must be an alternative that makes economically sense.

The innovation of circular economy begin before the product is made; the design phase is crucial for a circular item. But not only, the characteristics of a circular product are:

- Products inputs comes from renewable resources. The sources of raw materials must be renewable in order to do not degrade natural resources on Earth. Hazardous substances must be avoided, this render products easier (and so, less costly) to reintroduce in the cycles. Furthermore, exploit renewable resources will avoid the presence of negative externalities on environmental, social and economic sphere.
- Circular products must be projected in modules with the scope of being disassembled once they are reintroduced in the economy through reuse or recycle. Modularity will be the key for an efficient product repair.
- The value chain muse be made of efficient production and distribution processes. Take out the maximum from input is a pillar of circular products. Logistic during sales and distribution must consider the impact of environment pollution. Reverse logistic must be efficient too.
- Circular economy aims to substitute hazardous substances with renewable and greener resources. Today some products need very hazardous substances to work properly. In the future these components will be upgrade with resources with zero environmental impact.
- Maintenance and reparability of products is an important factor. Maintaining and repairing circular products is easy and cheap. This will enhance durability and will avoid unnecessary product change. Furthermore, upgrade the products through the substitution of the obsolete components extend the product life cycle. Old parts are, as far as possible, regenerated or reused.
- Circular design is the heart. Product is projected in order to be easily reintroduced in the economy through reuse and recycle. The design must be simple, made of diverse modules which do not mix diverse substances inside. Particular attention is placed on hazardous substances. Products themselves incentive loop-closing because it will break down the separation costs

One big challenge when we are talking about circular economy is making a clear distinction between reusing and recycling. The processes are different, and the value obtained by reusing is much greater than recycling. Reuse permits to reintroduce components of products ore that are not waste for the same purpose for which they were designed. For example, in the computer industry once a personal computer becomes old and some components are still working and not obsolete, they can be recouped and installed in other computers. On the other hand, recycling is a process where wastes are collected, processed and substances, as far as possible, return to their basic status. Finally, wastes are reintroduced as input in the production process. The main difference between these two circular processes lies in the capacity of catching value. While reusing implies not so much effort recycling is much more energy consuming. For example, from an exhausted phone the profitability of reuse is 6.4\$ while in the recycling process is just 0.1\$, a value that is fifty times less. (Ellan Jamsin in her speech "Circular economy - system perspectives for a new enlightenment" at TEDxLiege) Furthermore, performances of recycled material (except for some substances like glass) are poorer compared to virgin or reused material. To sum up, reusing squeeze much more value than recycling, for this reason circular process must aim to reuse. However, they share the dependency on collection and separation phase. So fare we are talking about closing loop systems efficient waste collection and separation assume a fundamental role. Poor attention on these passages implies that costs of setting second-hand

inputs will exceed the prices of virgin substances. Actually, performances and cost of setting-up second-hand inputs are the biggest problems circular economy faces nowadays.

Today the future is really uncertain but the possibilities that circular economy gives us is the most promising opportunity to face the challenges in the next decades. Circular system has a potential growth of more 4.5 trillion dollars within the next ten year. (Beatrice Lamonica B., Rutqvist J., Peter L., 2016). The figure is given by a series of forecast regarding the new circular vision:

- We will have €1.800 per year billion savings globally within 2030. Just in European Union the savings is quantified in €600 billion annually. A great part of this improvement is in sector like mobility and building and construction. (Ellen MacArthur Foundation, 2015)
- Circular economy actualization will have a positive impact in total GDP of more than 0.5% annually. In turn this will create 700.000 more jobs within the next 20 years. (Cambridge Econometrics, Trinomics and ICF, 2008)
- Resource productivity will have an enhance of 27% within 2060. (IRP,2019)
- Increase in the environmental condition is a crucial target in the circular economy implementation process. If circular vision would be applied to cement, aluminium, steel, plastics, and food will reduce the CO₂ of more than half. This mean that within 2050 we will produce 9.3 billion tonnes less CO₂. This figure is likely just if we would reset current emission made by transport sector. (Ellen MacArthur Foundation, 2019)

The Relationship between Final Consumers and Circular Economy

The value chain of circular economy must be pulled from the final consumers who thanks to their knowledge about this new economy. Unfortunately, the system of circular economy is more a business-related topic while customers is sometimes very far from this reality. The question now is how the companies can connect the final customer and circular economy? Firms in general must exploit the relationship between circular and green economy in order to promote a sustainable business model from both environmental and economical point of view. Circular economy is a green business strategy and green strategies has a great communication strategy. The power of this symbiosis can make the difference in the marketing perspective of circular economy. This new strategy is called “Green Marketing”.

This strategy is employed by the most successful furniture company of the world. The Swedish company IKEA in 2012 launched the “People & Planet Positive” project. The goal of this communication project is to persuade customers to follow the circular model through the purchase of circular goods instead of non-sustainable goods. It consists in working on three areas: social, environmental and economic area. The social sphere is pushed by a sustainable way of living. Through the usage of the democratic and circular product’s design. The target is to achieve a healthier, more sustainable way of living through the production and usage of circular products. Environment has a positive influence through the usage of clean, renewable energy and resources. The focus is on the circular vision is the business model. The principles IKEA is following are the protection of the ecosystem and the improvement of biodiversity, through this policy they want to become a climate positive organisation.

The fair and equal policies are extended also to the economic sphere. The target here is to achieve a fair society that benefits the more. IKEA is supporting decent and meaningful work across the entire value chain, nevertheless equality is promoted too.

The strategy of IKEA of promoting its circular business model through a green marketing strategy has paid off. The revenue increase by more than 30% in seven years. For sure not all the credits are given by “People and Planet Positive” campaign but nevertheless it helps to achieve this incredible result. (IKEA, People & Planet Positive, 2018)

The effectiveness of the green marketing strategy is due to the fact that consumers today pay more attention to the environmental sphere during their purchasing decision. More today than in the past, final consumer is paying more attention to the environmental sphere of a product and for a part of them this aspect is currently part of the buying choice. Nevertheless, the road is still long. Most of the consumer prefer to have a cheaper, less durable products instead of a greater quality, more eco-friendly circular product this because of the consumerism influence of the last fifty years. The involvement of people in the circular economy is crucial for its implementation. Some studies take in consideration the engagement and highlight some steps to follow to aware the buyer of circular products or services:

1. Identifies what are the factors between economic, environmental, social and psychological that influence more the consumer choice. For example, the choice between repairing and dispose an item.
2. Identifies the trade-off and barriers that consumers in facing in a circular product or services purchase.
3. The results of these studies are useful to identifies what social and political measures are needed to implement a right communication process between circular companies and final consumers.

The experiment was made by two parts: purchase (the role of durability and repairability is tested) and repair (trade-off between repair and replace with a second-hand product is tested). The second part is a direct comparison between circular and linear system. The results are heterogeneous and highlighted that two over three decide to adopt circular products, on the other hand more than 90% of the interviewees have never buy a second-hand product or experience on renting or leasing.

The experiment aimed also to understand the attitude of consumer towards Circular Economy. The results bring out that self-convinced pro circular economy people are more willing to adopt circular practices like repairing and recycling. Moreover, they found that the comparison between durability and repairability are base on two different aspects. In the consumer vision durability is synonymous of high-quality products while repairability is associated to availability and costs of spare parts. At the end customers are more willing to spend more for a more durable products instead of repairing them, this mean that customer prefer durability than repairability. This is also proved also from the facts that in the ranking of drivers of the respondents is price-quality followed by convenience. The negative aspect of this experiment is that low price is more valuable than durability and repairability. Moreover, a key factor in the repair decision is the effort required.

This analysis concludes that the main barrier in the purchasing circular products is the lack of information. The final report reveals that the customers who have received information about durability and warranties policies before buying are more likely to expect free repair or replacement of defective goods. The consequence of this aspect is that not rightly informed customers are more likely to switch to fewer valuable products because of price convenience. Finally, the study proposes a series of recommendations including promote pro-environmental habits, making repair easier and cheaper for consumer, provide information during sale and provide incentives for repairability and durability through laws and economic incentives. (LE Europe, VVA, Ipsos, ConPolicy and Trinomics, Behavioural Study on Consumers' Engagement in the Circular Economy, 2017)

The outcome tells us that the way to go is still long and final consumers play a key role in in the evolution process because the change pass mostly on the consumer hands. Once the customers are more willing to buy circular products because they perceive better quality-price ratio firms are obliged to follow the new wave and become circular themselves. Final consumers are the key players during the conversion from linear to circular economy because they are the influencer of the economy, companies will follow soon.

In this process institution has the target to inform consumers about the advantage of purchasing circular products. For this reason, Italian institutions have done already some steps in this way. In a report about a consultation about Circular economy published in the Italian Ministry of Environment website, a section is dedicated to the consumers role. The development plan of Italy works on two aspects: increase in the overall production efficiency and change the consumption pattern. Change

culture and consumer behaviour is a very difficult and delicate topic because it deals with priorities and desire of buyer. This change will start directly from the consumer and to aware them about a circular and sustainable way of consuming is the principal role of national institutions today. The plan should be start from the children in the compulsory schools up to the contributes. This allows to have educated buyer today and aware consumers tomorrow. The campaigns should address their attention on the new changing that the circular economy promote from consume to use, from ownership to renting, from cost-driver products to high quality products, from disposal to repair, reuse ore recycling.

The education about circular economy should go hand in hand with the environmental awareness, this will stick together these two realities that could not seems align. In practise it could consists in discriminate non-sustainable brand, fight misleading advertisement and campaigns and promote sustainable behaviours.

The national policies are the starting point but practically speaking the change must be implement within the domestic walls, so families play a key role. Through a policy of sustainable purchasing thy can put pressure on market and pull the circular economy implementation. The main negative aspect that the private consumers face is the higher price of more durable products than the lower quality one. The culture that should be created in the next future is the one which promote the long-term savings instead of the short term one. This aspect has two main advantage: the first is that the total amount of saving is greater and second is that this is more future and environmental oriented.

Thanks to the commitment Italy is one of the more advanced countries circular economy but it is not the only country who make some steps towards this new business strategy. Many countries in Europe and European Union is promoting the circular business model, the strategy that it is using are based on contribution and incentives to firms who is adopting circular models. Fortunately, some countries have already started the transaction many years ago. Finland got in touch with recycling in the middle of 20th century when they implement the system of deposit refund has been established. PALPA is a non-profit organisation in Finland which is owned half by beverage industries and half by retail industry and aim to collect packaging of beverage such as refillable and one-way plastic and glass bottles and cans made of aluminium. It began in 1950 with the refillable glass bottles then in 1996 they began to collect also one-wax metal cans and in 2008 they implemented a system for the one-way PET and glass bottles. The system is based on the refunding final consumer which collect and separate the beverage packaging which pay, during the purchasing phase, a deposit from 0,15€ for each 33 cl metal can to 0,4€ for more than 1l PET bottle. This incentive together with the plastic tax introduced by the government places Finland as first county in the world for returning the plastic beverage containers with a rate of return that exceed the 90%. This is the prove that collaboration between government, firms and individual citizens is the only way to implement the circular economy system. (<https://www.palpa.fi/>).

A Step Forwards the Ownership

Consumers in the next future will be called to change their habits and their choices and switch to more sustainable circular products. On the other hand, these will not be the biggest change on the consumer point of view, the ownership concept will totally change in the future, more probably it will disappear and will shift on the manufacture hands. This process will radically change the habits of all of us because circular economy is based on services instead of products and ownership of items will shift from the consumers hands to manufactures. This new trend will give to all of us great advantages, the main are squeeze the best from the products, higher quality of items and less waste on the environment. The new circular model is based on getting the access to the products instead of owning them. We already made the first step towards this new trend, the sharing economy. For the companies the way to follow is the one which privilege the selling of services linked to the products instead of the products themselves and in this way, we will achieve the product-as-service vision. If we go deeper in our consuming habits most of the items that we own, we buy just to have access to the performance they do

for example washing machines and cars. Thanks to sharing economy we can have access to the services through the products and squeeze all the best from the items around us. A perfect example is the laundromats shops where the people pay-per-use the washing machines.

In this new consumption scheme the system follows different steps than the linear model that put in the middle the sustainability and the product's value. The interaction between firms, governments and consumers begin directly from the production when the manufactures use second-hand raw materials as input, designing a product that in the future is reusable or recyclable and exploiting renewable source of energy. Once produced the products run the whole chain and come to the retailers. Here is the biggest change from the consumer point of view. Salesman will not sell the products but the service plus a fee that have the amount equal to the hypothetical product's value. The great news is that ownership will stay in the producer's hands which keep the ownership burden on their shoulders that include maintenance and repairing. On the background an agreement upon the retailer and the manufacture will split the regular fee the customer pay. In the fee that customers pay there is included also the services and the energy that the item needs to work for example fuel, electricity or insurance. When the consumers take the product at the end-of-life phase, she delivers the item to the producer which reimburse the customer and reuse, remanufacture or recycled it. All these steps are done through a sustainable, economic and efficient way of acting.

A circular product includes five key elements: input are components made or second-hand raw materials, sharing platform are the way where people get the access to the items. Products themselves let the scene to the services and they are just a way to have the access to the service. The product quality is better, and life is extended, and this will lead to a reduction of waste. Finally, the last stage of the product's life cycle coincides with the first one of the products to which the item will be reintroduce in the market. Collection, separation, reusability, remanufacturing and recycling are the core values of the products.

The benefits of this new trend are several. Producer responsibility is enhanced because manufacturers in the future will have all the economic interests to increase products quality and promote a smart easy design to contain repairing, maintenance and recycle costs. To produce a green item is in all the interest of the producer firm because the service and the energy associated to the item are on the owner's shoulders, so in this case the manufacturer. As consequence on the other side the consumer responsibility will decrease, and a conscious and sustainable usage are just required.

The most difficult step to face is the change on the concept of ownership that the final consumers will have. This is very strong and eradicated in our culture and we are deaf when we talk about ownership burdens like maintenance and repair. On the other for certain sector, for example luxury, ownership is the core value and maybe will never disappear. On the other hand, most of the sectors will or not will change. Although the transition is difficult it is unavoidable. For some rare example this is a reality yet. Phillips and the firm Turntoo, a company guided by the architect Thomas Rau. The objective is creating a system that excludes negative externalities by selling light instead of lamps. The Deutsch architect stays that his need is the light and not lamps or electricity, he just needs to give light to his construction. He is not interest in the way he gets the light but just is the illumination itself. Therefore, a close cooperation between Turntoo and Phillips and they develop a plan which give as much as possible natural light into the building. Moreover, the project "Pay per Lux" go live and through LED installation, maintenance, repairs and upgrade by Phillips, Turntoo have great benefits from this initiative. The overall result is a saving on electricity of more than 60%.

This pilot project gives the start for the project "Circular Lightening" program. It gives the possibility to the consumer to do not worry about installation, maintenance and recover. The benefits of this projects include sustainability, technological development and customer relationship. These results are thanks to a product design in a circular way: renewable source of energy, low complexity, less material and flat geometry. This is reality and in the lounge number 2 of the Amsterdam Airport Schiphol. The agreement consists in a contract that include maintenance, repair and energy costs and it lasts 5 years. The results till today are a 75% longer lifetime and 50% reduction in the energy consumption.

Hopefully this trend will continue in the next years and manufactures and final consumers can close the loop together. This was the idea of H&M when it decided to adhere to the campaign launched by Ellen MacArthur Foundation “Make fashion circular” and in 2013 it launched the campaign “H&M Garment Collecting programme”. The project consists in give €5 discount in the following purchase of minimum €25 for each bag of old clothes. Afterwards the clothes can have two possible way to be reintroduce in the market: to be reused and remarket or to be recycled. The campaign has several positive aspects on the environmental point of view like the great reduction of waste. On the other hand, also the organisations get a benefit from this campaign like brand reputation, stimulation of repeat purchasing within the firm and value creation. The result of this is to gain competitive advantage over rivals while implement the circular economy. (<https://www.ellenmacarthurfoundation.org/our-work/activities/make-fashion-circular>).

Where are we Today

Today the situation is critical under many points of views, lack of long-term plans is just the consequence of the uncertainty due to scarcity of resources and constant climate change. These aspects are getting worse in the last year due to COVID-19 pandemic. All these facts pushed institution to implements measures towards the circular economy and European Union is one of the pioneers in this aspect. The targets are to reach a better resources efficiency, to switch from waste treatment to waste management, enhance process sustainability in order to create value from social, economic and environmental value. The problems in Europe are even bigger. European Union have a strength dependency of energy from outside and this makes it vulnerable from the external environment. The rate of dependency in 2007 was bigger than 55%, (https://ec.europa.eu/eurostat/statistics/explained/index.php/Energy_production_and_imports) renewable source of energy is the key strategy to reduce this scary percentage. Energy from natural sources could lead to competitive advantage of European firms. The transaction from linear to circular is crucial and start before the first production step, the design. Products in Europe will be realized thing upon about their second life, so in a way that leads to an easy reuse, remanufacture or recycle. The further steps obviously will follow circular principles and they will imply the biggest change in industry because these changes will touch all the process and the actors involved in the economy every day. European U is pushing hard on this Holist approach. (The European Economy: From a Linear to a Circular Economy, Bonciu F., Romanian Journals of Europe Affairs, 2014) To become a circular product and items born to be circular and live in the circular economy. Because this change will involve all the barriers to the change are greats. The network between final consumer, firms and institution must be close. Even legislation environment must develop in the future in order to go hand in hand with the economy development. EU is aware of these aspects and its commitment is great and gives us the hope that the transaction is possible. The indicators it uses are all based on resources productivity, consumption and overall efficiency. The first target is to have an 30% increase. (The Circular Economy: Connecting, Creating and conserving value, European Commission, 2014)

The first measures do not take much time to be implemented and in 2016 the European Parliament identifies the type of measures that EU will take to implement the Circular Economy in all of its countries. They include laws, communications, reports, guidelines and best practices to follow. Moreover, the document “A new Circular Economy Action Plan For a cleaner and more competitive Europe” includes many circular visions such as product-as-service, remanufacturing and upgradability as vehicles of change. (Closing the loop: New circular economy package, European Parliament, 2016). Moreover, also some restriction against linear economy like bans on premature obsolescence and restriction on disposable products. The states of the Union consequently follow the new circular directives of the Parliament. Italy for example made a great job till now and the development are clear. In thirteen years, from 2004 to 2017, it gets an overall increasing of 30% in recycle of municipal waste. Moreover, Italy is in first place for what concerning total index of circularity in Europe. On the other

hand, the way is still long because the waste generation in Italy is more than 22%, a rate too high to permit the circular revolution to be implemented. Europe in this change is the pioneer and fortunately the other emerging countries like China. The change has been forced from the huge pollution, ecology and environmental problem the country is creating to the ecosystem. So, from the first years of nineties a new circular development plan has been introduced. Finally, in 2002 the central government accepted the plan that consist in working on three major levels: micro level (cleaner production and eco-design), intermediate level (build of eco-industrial parks) and macro level (creation of circular network between circular firms). The vehicles of change are different between the two economies, but a common vision is shared: circular economy is the key for a sustainable value creation now and in the next years. (Circular Economy Policies in China and Europe, McDowall W., Geng Y., Huang B., Journal of Industrial Ecology, 2017).

The Gap between Theory and Practice

Today the world's biggest organisations are including circular visions in their long-term plan but practically speaking the work to do is a lot. The gap between linear and circular implementation are still very big, mostly for the small market players. The lack of network between parties make the implantation not possible in every-days basis activities. Barriers to the Circular Economy: Evidence from the European Union (EU), Kirzherra J., Piscicelli L., Kostense-Smit E., Muller J., Huibrechtse-Truijens A., Hekkert M., Ecological Economics, 2018. Thanks to a study made by the journal "Ecological Economics" we can identify four major sources of barrier to change from linear to circular system. Culture takes the first place, the lack of circular way of thinking and acting brings to a lack in consumer interest and awareness, hesitant company culture in changing system. Market competition soon follows. The difference between virgin and second-hand raw materials is too little in relation to the gap between performance. This aspect in a competitive market is very urgent because the cheaper and higher quality products prevails compared to greener expensive items. To face this problem more incentives should be address to circular business. Another barrier is constituted by the legal aspects. Laws are not up with the time, do not promote circular business and do not hinder linear models. Finally, technology and innovation must be developed in order to encourage organisation and consumers to switch to circular model in consumption and business. On the other hands we have to say that the big steps ahead in the last years make us confident that a solution here is not far. On the micro-level businesses face the problems that are more specific oriented. For example, to finance green projects the effort for small and medium enterprises is too big and not possible to afford. The culture is playing a fundamental role even in the business organisations, a bad habit of management is to focus more on the short-medium-term results instead of promoting long term projects such as circular economy implementation. Skills are also a missing factor for the change. For example, it is not clear what and how a circular product must be designed and produced and what characteristics should it follow to be considered "circular". At the end, the potential of circular economy is huge but the difficulties, mostly related to people culture make the transition difficult. The situation of today is "semi-circular" where bigger organisation are implementing long term strategy towards circular models, however smaller players see circular model as a project to be scheduled.

The Relationship between Innovation and Circular Economy

The technological enhancement in the last decades face huge improvements in the last decades. The doubt is what is the influence of technological innovation and circular economy. For sure the new means given from technological enhancement have a great potential also to help the world in the switch to circular economy. Analysing what technology can do to help circular implementation we can see several positive aspects. Designer can exploit the newest software intelligence to implement circular design of products in a faster, easier and economic way. Another big advantage is given by the fact that waste generation during the developing side is very reduced because prototypes are reduced

thanks to a great accuracy in the simulation. Moreover, possible second use, thanks to the new developed software, can be forecast in advance and design will follow consequently. Secondly, through the exploitation of the new technology, manufacturers increased the efficiency in resource exploitation, this reduce waste generation and increase the overall efficiency of the economy, it leads to have more output with less resources. One of the means that gets many developments is the artificial intelligence. This new software tool can lead to many improvements to economy in general and to circular too. For example, now forms of artificial intelligence can recognise very quickly and efficiently the materials with some sensors. Combined with robotics this can help the sorting of post-consumer waste and give better quality input to the firms which decide to second-hand input as raw materials. The artificial intelligence needs some years to be accessible and we can imagine that will be hard, especially for the SMEs to have it available soon. Nevertheless, for a start-up the combination between circular and artificial intelligence is already reality. Stuffstr exploit the artificial intelligence to evaluate used household items and buy back them from the consumer in exchange of a voucher. This process create value and at the same time make the process more sustainable as the CEO John Acheson stated. (<https://www.stuffstr.com/about>)

Institution should encourage the use of new technologies in order to increase circularity in the economy. This is what European Commission is trying to do with the eco-innovation program, a project that encourage all forms of innovation that create business opportunities and benefit the environment. The program aims to support the closing loop value creation through closing-loop processes and innovation. The program implies great investment in promotion for eco-friendly products and education, the opportunity given by the EU could be a turning point for many companies which are trying to change their business model.

The innovation is a vehicle of change also on the consumers point of view. The industry of music faces a huge change in its history and in more than 60 years it started from the music record to the digital platform. This is a perfect example of switch from product to service sales. In the beginning customers buy music records, use it and when they do not need them, they throw them away. This process has many drawbacks, first it creates a great amount of waste but also it is a great disadvantage for the consumer. Thanks to internet a person has in its smartphone more than 50 million songs for the rate of 9,99€ monthly. It is not quantifiable how much space and money the same commit to have the same amount of trucks available, moreover not at your fingertips. The same happened few years later with the arrival of greater streaming platform such as Netflix in the movies and TV series industries. (<https://newsroom.spotify.com/company-info/>).

The Plastic Polymers Issue

The plastic, as a material for the industry born in the first decade of the 20th century. Today, after more than hundred years, this material is playing a key role in the world, without it we can't survive nowadays. Although the invention is dated at the beginning of the century, a real a production started in the 1950s and from that moment on it constantly increased due also to a total increase in world population. Despite this trend in the last twenty years the production of plastic keep stabile at 60 million metric tons per year. This data has two faces: the positive one is that everyone is decreasing the rate of plastic usage. The drawback is that this number is still very high, considering also the fact that plastic items contains toxic, pollutant components such as benzene and vinyl hydrochloride. Due to the linear economic system together with the production also plastic waste increased. As a consequence, the waste that are not properly collected and reintroduce in the economic system through recycle, coming mostly from the packaging items goes in the environment and pollute landfills and oceans. Today the situation about plastic recycling states that we recycle in Europe just 30% of the plastic that is produced. A very small rate considering the incineration rate (39%) and not collected rate (31%). We have to mention that the letters two process instead of value creation they destroy the value and have a negative impact on the environment.

The European Union launched the “Circular Economy Finance Support Platform”. A project that aims to boost circular economy in private and public sector with the target to recycle more two thirds of the municipal plastic waste within 2030. Furthermore, the “Circular Plastic Alliance” has been established thanks to the commitment of public and private (mostly big enterprises) organisations with the objective to reach the 10 million tonnes of recycled plastic before 2025. (Declaration of Circular Plastic Alliance, Circular Plastic Alliance, 2019). The focus are of the association are six: design for recycling, better collection and sorting system, minimum content of recycled polymers must be respected in the items the member produce, R&D and investment in recycled materials, implementation up voluntary system to monitor volumes of recycled plastics and governance with the support of the European institutions. Finally, the commitment to switch to bio-based plastic is part of the plan of the alliance.

REset Plastic: A Project by Schwarz Gruppe

Schwarz Gruppe is of the biggest retailer in Europe. The owning of brands like Lidl and Kaufland leads them to open more than 12000 stores in Europe in 2018 and to be the sixth largest retailer in the world. Just behind the retail brands the Deutsch holding is the owner of the Green Cycle company. With this brand, the group aims to create value through loops closure and sustainable behaviour. The goal is to achieve zero plastic waste through the PreZero brand. Thanks to two important acquisition (Tönsmeier and Sky Plastic group AG) PreZero become one of the leaders of the plastic recycling industry in Europe and it has the potentiality to become one of the key players in the world. Thanks this two acquisition Schwarz group is the first industrial company who really close the loop: waste/resource generation from the retailers Lidl and Kaufland are collected in PreZero Recycling(the old Tönsmeier) and finally are recycled by PreZero Polymers (the merge between PreZero and Sky Plastic plants). Therefore, the project REset Plastic born. The stages of the are five: REduce the plastic products and packages, REdesign plastic items in order to give them the possibility to have a second life after disposal, Recycle plastic waste/resources in the most sustainable way, REMove microplastic in the oceans and REsearch to find new way of creating value through the reintroduction of plastic waste in the economy. Moreover, this last point aims to educate the new generations to have a greater consumer responsibility to have a better world tomorrow. Thanks to the commitment of such a great group the future of circular economy starts today but the change must start from ourselves before. Think circular, buy circular, use circular, throw circular and restart the loop again and again. This is the only way to really close the loop, together. (<https://reset-plastic.com/>).

Conclusions

Today the Circular Economy is the first alternative for a sustainable development of our economy. The new trends (such as growth of overall population and scarcity of natural resources) in combination with the opportunity it gives, put pressure for an imminent change. The works gives an overview to the circular system involving all the actors, institutions, businesses and consumers. Furthermore, it cites the benefits of the circular economy but the barriers to implement the change are still very big and mostly they consist in culture and financial difficulties. In this switch of mentality, the consumer will face a great change in consumption methods. Products will leave the place to services in to squeeze the best from the resources. Sustainability will be another key aspect of the change and environmental benefit will be part of the account too. Fortunately, the technological enhancement will help the economy to overcome the linear system. The change is difficult, but it is mandatory, today it is really for some institutions, and they are pushing to its implementation (i.e. European Union), big enterprises and organisations are following (i.e. Schwarz Gruppe) but the evolution is possible just if every player makes its part.

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