From linear economy to circular economy: research agenda

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Abstract

The new Circular Business Model will not only be a tool aimed at a simple waste prevention and waste reduction, but on the contrary should represent a long term strategy to be implemented for the re-designing industrial systems and encourage a regenerative economy. For this purpose the basic criteria of Circular Economy will have to be a necessary driver to inspire a fundamental change of the cultural paradigm of production and consuming, including technological, organisational and social and economic innovation across and within new value production areas, addressed to accelerate the move towards a circular economy world-wide. But what exactly can we expect? The experts who are working on the circular economy support programs derive from the awareness that at present about 90% of the global industry revenue is based on linear models of supply, production, consumption and disposal of the material. The European Commission has expressed its intention to encourage and boost investment of companies adopting the circular economy model, rewarding the most virtuous reality through the framework program Horizon 2020. Also other macro geographical areas, are implementing the principles of the circular economy as underline in the article. We'll see if the measures implemented, will be able to transform the current pilot phase in a mainstream scenario, where the industry reference models will actually be based on the concept of circular economy.
KEY WORDS: (Linear economy, Worldwide, Innovation, Circular Economy, Business Model)

Introduction

Linear economy [LE], may be described as model composed of four macro areas: take-make-use-dispose. LE goals are economic: obtain a revenue. The relationship between input and output don't takes into account how the material has been utilized and how much of that material can be reutilized. The relationship is only economic. LE is based on the idea that raw materials can be used just one time. It is the economic model of '900 where for example, some cultural drivers as the idea of unlimited resources - including environment - the easy leadership of a market, don't payed attention to raw material consume and the dependence of our model from other country and economic that we considered only how underdeveloped or backward. The Europe of industry and services has exceeded many economic crises, using the same model, increasing dependence on those arrears Countries considered. LE has been the engine of our economy and culture. The European economic and social deep crisis it could be overcome with a new economic model that is called circular economy [CE]. The European Commission adopted a Circular Economy Package, which includes revised legislative proposals on economic to stimulate transitions in the European Areas. In many world areas, China, Japan, South Korea, United States, towards a CE which will boost global competitiveness, foster sustainable economic growth and generate new jobs. CE represents a development strategy that enables economic growth while aiming to optimize the chain of consumption of biological and technical materials. These two elements are strategic aspects for implementing CE. First step is linked to a deep transformation of production chains and consumption patterns, infact, CE is envisaged to keep materials circulating in the economy for longer, re-designing industrial systems and encouraging the use of materials and waste. Implementing a new production and consumption chain, must take into account technological, organizational and social innovation. Several policies have addressed and realized CE model linked to different industrial sector. In this paper the authors take into account linear economy is reaching its limits and literature review (paragraph 1) which identified and

reviewed relevant literature related to the CE, this was complemented by additional analysis (From linear economy to circular economy, paragraph 2) on barriers and conditions for successful innovation, identification of priority (technical and biological nutrients paragraph 3), material flows and sectors/ products (Barriers to a circular economy and how they can be overcome paragraph 4) where accelerating the circular economy would be beneficial (Priority materials and relevant experience paragraph 5) has a particular role to play. Conclusion underlines topics for research agenda. The relationship between paragraph are shown in Figure 1 below.

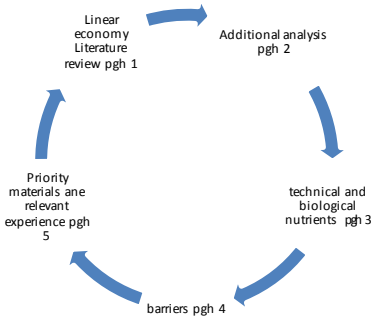

Figure 1: Relationship between tasks

1. Linear economy is reaching its limits

From industrial revolution to middle of 900, industrial model is based on LE as cultural and economic engine of our civility. Figure 2, simplified illustration of linear economy, represented four macro areas: take-make-use-dispose of linear production.

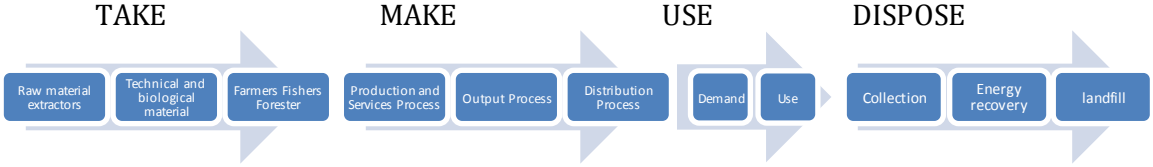

Figure 2: Illustration of linear economy

In Fig. 2, showed as from industrial revolution to middle of 900 the industrial evolution have been characterized by a one-best way or linear model of production and consumption in which goods are fabricated from raw materials, sold, used and then discarded as waste. The waste in many Country of south Europe are dumped in open landfills. The quest for a substantial improvement in resource performance across the economy has led businesses to explore ways to reuse products or their components and restore more of their precious material, energy and labour inputs. As show before, LE and production has been characterized for Companies that collect natural and agricultural products and extract materials , use them for the manufacture of a product that sell to a consumer who then discards it as waste when no longer needed. Infact in terms of volume, some 65 billion tons of raw materials entered the economic system in 2010, and this situation is expected to grow to around 82 billion tons in 2020. So, for how many time will be possible to sustain this economy based on one shot? A plenty of economic, cultural, social signals, underline that linear economic model is in a deeply crises. On the other hand, some relevant elements are underlines from some companies as strong crisis signals of LE, particularly:

- increases their exposure to risks;
- higher and volatility resource prices;
- supply and energy disruptions;
- Rising prices and the lack of predictability of resources puts in great difficulty also because of competition and low demand in some sectors;
- strategic sectors, (example) food and non-food agricultural output are characterized from low quality and high price of product.

Other trends indicate that the power of the linear model is reaching its limits: companies gives more attention to financial trends than production. The increasing presence of literature analysis about limits of LE, regards all these different aspects. Particularly, about financial crises linked to linear production crises, some focal points are developed in literature. In the meanwhile also the literature on economic crises and linear economy, has

underlined some focal points. Either approaches point up that linear economy and production are reaching its limits. The convergence of two different approaches is clear: the circular economy business model naturally involves a deep transformation in the organization in terms of production and implementation of consumption patterns in order to allow free movement of materials in the economy for longer industrial systems ,through instruments such as the re-design and stimulating a cascade use of materials and waste. An opportunity to rethink our economic future should be built realizing circular economy as written in Europe 2020, pointed literature, as recalled in some reports foundations [CE]. Particularly literature starting from cradle-to-cradle approach, following with industrial ecology, natural capitalism. Many other correlated concepts include sustainable design, radical resource productivity, bio-mimicry, by-product synergy, technological food webs, industrial symbiosis. All these critics and economic perspectives have pointed out the necessity to pass from linear economy to circular economy.

2. From linear economy to circular economy

Take, make, use, dispose is linear economy: in the value chain, along these four steps, there isn't communication, upstream downstream decision makers, connect producers, recyclers link, as said before. Circular economy [CE] strategies are schemes ensuring that upstream decisions in the value chain are coordinated with activities (upstream - downstream) and actors. CE has realized the projection of products completely recycle in many economic sector, see paragraph 5. They connect producers, distributors, consumers and recyclers, link incentives for each of these actors, with an equal distribution of costs and benefits. CE, goes beyond the approach of waste prevention and waste reduction. It aims to inspire innovation in the whole value chain, rather than on waste recycling at the end of value chains. The work, starting from circular economy concept, is based on two pillars. First pillar is composed two routes:
- the 'cradle to cradle', linked to product design and regenerative forms of consumption: particularly for product design for durability, disassembly and refurbishment: businesses should apply the principles of eco-design to all their products, use as little non-renewable resources, (at or below their rates of regeneration), increase the life and reuse potential of products, and facilitate, at the conception stage, the sorting and final recovery of products;
- regenerative forms of consumption, from anaerobic digestion of household waste to product recovery.
Second pillar is composed one route, industrial symbiosis:
- A cross-sector approach and cooperation between actors unaccustomed to cooperate (e.g. between product designers and recyclers), along the whole supply chain of a product, in order to optimize its life-cycle, creating synergies between businesses for economies of scale and scope. CE resources can be distinguished into two categories:
- technical materials like minerals, metals, polymers, alloys and hydrocarbon derivatives (e.g. plastics), which are not biodegradable and are based on finite resources;
- biological materials from biological origin such as agricultural and forestry goods/commodities, bio-based wastes and residues, which are generally non-toxic and renewable to an extent as they are limited by the availability of land, water and nutrients and can be returned to the biosphere, where they act as nutrients.
The distinction between technical and biological materials as defined in the literature, is not always clear (e.g. biodegradable plastics). However, one of the founding principles of a CE is that garbage should be minimized or virtually eliminated as it is designed out of economic activities: the biological and technical components of a product are designed by intention to fit within a materials cycle, for disassembly and repurposing.

3. Circular economy: technical and biological nutrients

According to the literature, circular economy is based on four means of achieving technical nutrients which are set out below in descending order of the value of the outcome:
- Reuse of goods (design);
- Product refurbishment or component remanufacturing;
- Cascading of components and materials (distribution, consumption, collection);
- Material recycling.
Below explain the meaning of the four steps:
- Reuse of goods (design);

a. A product (final or semi) is used again, for the same purpose as in its original form or with little enhancement or change (e.g. refillable wine bottles being reused for the same purpose).
b. A product (final or semi) is used again for a different purpose than its original form with few or negligible improvements (e.g. using tires as boat fenders).
- Product refurbishment or component remanufacturing;
Product refurbishment:
a. A process in which it tends to bring a product to good working condition through the replacement or repair of the main components that are defective, and making 'cosmetic' changes to update the appearance of a product in line with the market trends.
Component remanufacturing:
b. A process in which components of a product can be disassembled and recovered for subsequent reuse in a new product.
- Cascading of components and materials (distribution, consumption, collection):
a. Successive uses of a material across different value streams. For instance, in the textile sector, paper, clothing, fashion accessories, footwear, packaging, textile finishing, weaving, for example in detail: classic clothes woman and / or man: shoulder-heads; vests; waterproof; skirts and / or sportswear pants, jeans, casual; child; shirts; technical clothing: jackets; work clothes; ski pants, can become furniture and then insulation material. It involves user-friendly, cost-effective, and quality preserving collection systems; as well as treatment/extraction technologies that optimize volume and quality. Cascading use keeps materials in circulation for a longer period of time.
- Material recycling:
a. Any recovery operation by which waste materials are processed again in order to obtain products , materials or substances that may be used for the original or for other purpose. Literature reports distinguish: upcycling: converting materials into new materials of higher quality and increased functionality, functional recycling: recovering materials for the original purpose or for other purposes, excluding energy recovery, downcycling: converting materials into new materials of lesser quality and reduced functionality.
According to the literature, circular economy is based on four means of achieving biological nutrients which are set out below in descending order of the value of the outcome:
- Extraction of biochemical (design);
- Anaerobic digestion (remanufacturing);
- Composting (distribution, consumption, collection);
- Material recycling.
Below explain the meaning of the four steps:
- Extraction of biochemical (design);
a. applying biomass conversion processes and equipment to produce low-volume but high-value chemical products, or low-value high-volume liquid transport fuel—and thereby generating electricity and process heat fuels, power, and chemicals from biomass.
- Anaerobic digestion (remanufacturing);
a. process in which microorganisms break down organic materials, such as food scraps, manure, and sewage sludge, in the absence of oxygen. This process generates biogas and a solid residual. The solid residual can be applied on the land or composted, while biogas can be used as a source of energy similar to natural gas.
- Composting (distribution, consumption, collection);
a. biological process during which naturally occurring microorganisms, organic materials into a soil-like material called compost. Composting is a form of recycling, a natural way of returning biological nutrients to the soil. Compost can be used as a non-toxic ingredient in agricultural fertilizers.

The figure 3 below, illustrates how technological and biological nutrient can create circular economy.

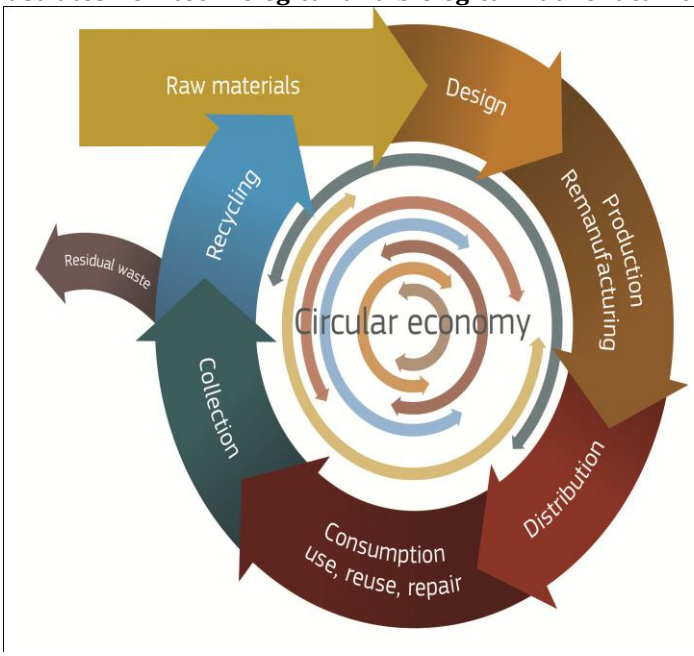

Figure 3: Technological and biological nutrient and circular economy.

Steps have first been described and analyzed for the general framework conditions necessary to move towards a circular economy, but barriers to a circular economy exist and is important how they can be overcome.

4. Barriers to a circular economy and how they can be overcome

Drivers and barriers have first been described and analyzed (Figure 3) for the general framework conditions necessary to move towards a circular economy, starting from raw materials, we have considered: design, production remanufacturing, distribution, consumption (use, reuse, repair), collection, recycling, these different steps strictly interconnection create the value chains/supply chains. Drivers and obstacles are stemming from policy, regulation or the legal framework, or linked to social, cultural, economic, technological and infrastructural contexts, there is rarely only one driver in one sector. Typically several factors are in play and often the factors influence each other. These factors can be heavily influenced by various levers: policy instruments and new business models. The policies which enable business models and value chains to be more circular, in every sector, are the ones which:

- Encourage manufacturers to design products with asset recovery in mind and to take into account the true cost of materials;
- Encourage the development of product lines that meet demand without wasting assets;
- Incentivize businesses to source material from within regenerative loops, rather than from linear flows;
- Enable businesses to develop a revenue model that generates value at all parts of the value chain; and
- Get customers/ consumers to change their consumption and ownership patterns.

Many research report have identified the following gaps which currently act as barriers to the development and research question of a circular economy linked to:

- Metrics;
- Economics and labour markets;
- Material flows;
- Business;
- Marketing and sales;
- Productions and operations;
- Industry/overall;
- Environmental footprint;
- Financial and resilience.

This list is non-exhaustive but covers the main barriers to the development of a circular economy. From a policy standpoint, addressing these barriers means:

• Encouraging economic players to take into account the economic value of their environmental externalities, particularly for regulatory requirements such as the ones posed by the Extended Producer Responsibility (EPR) principle and Economic incentives and tax measures strong enough to change business behavior and to encourage the recovery of more secondary raw materials;

• Encouraging the development of skills, awareness and investment in circular product design and production, as well enabling to improve cross-cycle and cross-sector performance, particularly for support programs for investment in R&D and eco-innovation, support integration of circular design concepts and reusable parts through investment support, The development of an extensive raw materials information service, the promotion of cleaner production (CP) methods in SMEs;

• Encouraging the improvement of cross-cycle and cross-sector performance, particularly for, The development of a free-to-business advice and networking program at a regional level to identify resource exchanges between companies for sustainable resource management solutions, The development of local networking for industrial symbiosis opportunities, the availability of (public or private) planning agencies who would perform, in a given territory and for the industries of this territory.

• Encouraging a change in consumption patterns, particularly for, the support and promotion of innovative leasing and rental contracts, the support and protection of the peer economy, the development of consumer knowledge/ awareness on perishability of products and on origins of products, the development of incentives such as a system of differentiated tariffs where citizens are charged according to the amount and type of waste they generate, regulation to separate food and packaging waste collection at source, the development of obligations for public-sector agencies and government departments to purchase resource-efficient and cradle-to-cradle products.

• Encouraging investment and innovation in recycling and recovery infrastructure and technologies, particularly for, Investment support in regional infrastructure and for companies seeking to develop innovative recycling and recovery technologies, the set-up of Business parks, Business Improvement Districts and other clusters of SMEs to facilitate collective long term contracts for recyclable waste collections, the harmonization of the quality criteria of the end-of-waste status across the whole of the EU, the removal of a number of regulatory obstacles to the use of biotic waste streams, developing understanding of the feedstock base, competing uses and consequences for upcycling, incentives for suppliers and retailers to establish mandatory take-back arrangements if a product remains unsold;

• Encouraging the harmonization of transport flows systems between municipalities, which currently often leads to confusion among shippers and transporters, particularly for, streamline transport flows and urban distribution through business-to-business concepts, inviting shippers to develop concepts for city logistics through innovative tendering and supply chain-transcending cooperation.

A list of main barriers to the development of a circular economy and a policy standpoint, does not hinder the development of circular economy in many States in strategic economic sectors, starting from some priority materials. Below we explain some of these experiences.

5. Priority materials and relevant experience

Table 1 shows the priority materials identified, alongside, where available, their outcomes against each of the core assessment factors. The key opportunities and challenges column explores sub-priorities along with feasibility issues for each of the materials tabulated. Water and land were additionally identified as priority resources; these are not included in the table, but considered where relevant in the environmental impact factor.

Table 1: Priority materials identified, outcomes, assessment factors

Material	Scarcity and dependence	Environmental impact	Potential Savings	Key opportunities and challenges	Identified as a priority?
Agricultural products & waste	**High**	**High**	**High**	Need and some scope for improvement - some feasibility issues	**Priority**
Wood & paper	Medium	**High**	Medium	Need and scope for improvement	**Priority**
Textiles	Low	Medium	Medium	Scope for improvement: collection rates	**No info**
Plastics	Medium	**High**	**High**	Need and scope for improvement: purity (PET and polymers) and collection rates (polymers)	**Priority**
Metals	**High**	**High**	**High**	Need and scope for improvement: purity, material efficiency and value recovery	**Priority**
Phosphorus	**High**	**High**	**High**	Need and scope for improvement: substitution and improved practices	**Priority**
Rock	Low	Medium	**High**	Scope for improvement: reuse and recycling	**Priority**
Glass & ceramics	Low	**High**	**High**	Scope for improvement: purity of recycled material	**Priority**
Fossil fuels	**High**	**High**	**High**	Substantial existing policy coverage; feasibility issues	**Priority**
Other chemicals & compounds	**High**	**High**	Embedded in savings from improved recycled quality of other materials	Need for improvement: contamination and material purity repercussions for other materials and products (e.g. paper and plastics)	**Priority**

Source: (our elaboration) 2011 – 2016 World Economic Forum: Circular Economy towards the world
Table 1 Legend: **Material, High, Priority, No Info**: Not addressed in sources reviewed; or due to lack of availability of comparable information**.**

- Agricultural products are highly critical both globally and in the EU due to the rising levels of demand and food price volatility anticipated. Food waste isn't linked to create compost and energy, which promise savings in the billions. Emerging technologies can play strategic role, (to displace virgin

material consumption, large-scale farm yields) so productivity opportunities are considered readily achievable. Not only these action warranting policy intervention.

- Wood and paper, while high collection rates have already been achieved, there is both need and scope to improve some operation management (the purity of recovered and recycled materials). These strategic decision can be important for a significant savings to be made
- Plastics are a priority material flow due to the long-term durability of waste plastic and the costs of petroleum, from which most plastics are derived. Rates for PET are already high, and instead the priority focus is on improving the purity of recovered and recycled materials (as for wood and paper) in order to best retain value and minimize the environmental and economic costs of production and at end-of-life.
- Metals are identified by multiple studies as a priority area for circularity, have a high environmental impact, the iron and steel sector is the largest industrial emitter of CO2, twelve metals reaching the top 20 non-energy. There are already high collection rates for steel, but there is scope for and a need to improve purity for and in the reverse cycle. Iron and steel energy efficiency and end-use steel efficiency are key sub-priorities where opportunities are readily achievable. There are policy decision from take in sector
- Phosphorus – Also identified as a critical raw material, phosphorus use in agriculture (more than 90% of phosphorus extracted annually) has undergone some substantial reductions but should be changed with alternative nutrient sources such as sewage, animal and food waste.
- Textiles, although collection rates are fairly low across Europe (25% of clothing for example is currently collected at end-of-use), and there remain some opportunities: clothing donations, repair services, leasing of clothes, use in other sectors; textiles were identified as having lower potential for circular business practices as product design, reverse logistics and feasibility.
- Rock, glass and ceramics – Priorities include improving the purity of glass for recycling and further promoting the recovery and reuse of secondary (recycled) aggregates.
- Fossil fuels have both high significance for the economy and high environmental impact, but also substantial existing policy coverage, regulation, and policy feasibility issues.

In particular, metals and agricultural products and waste are the most commonly identified by existing studies. Chemicals and compounds are particularly notable for their cross-linkages and connection with purity issues for several of the other materials categories, such as paper and plastics. To put priority materials identified, outcomes, assessment factors efforts into a wider context, it is useful to note that policies to support the circular economy are being implemented in countries across the globe – see below, some examples of international approaches to supporting a circular economy.

- China: A law on the promotion of the circular economy was adopted starting from 2009 which focuses on the 3Rs (reduce, reuse and recycle) and a number of resources (water, energy, raw minerals etc.). A Circular Economy Development Strategy and Action Plan (2010-2015) has also been adopted and a system of 'Circular Economy Evaluation Indicators' set up to assess progress at different territorial level: provincial, municipalities and business level: energy consumption, recycling and reuse of resources, pollution and social development. Action Plan underlines that Circular Economy Offices have been set up at the local level to provide advice to businesses and citizens. Linked to fiscal policy, several fiscal measures have also been introduced to foster the use of recycled products and the development of industrial symbiosis (CGDD, 2014). Action Plan efforts at different levels: business, industrial parks, regions, townships, urban systems, seek to support the transition through inter alia resource recovery, cleaner production methods and public facilities (Swiss Academy of Arts and Sciences, 2014).
- Japan is considered an interesting experiment, with important results in supporting the development of a circular economy. Japanese approach is underpinned by several pieces of legislation including on the circular economy: resource efficiency, waste; several sectoral pieces of legislation. These policies set objectives and targets and have been complemented by a number of supporting policies, measures and approaches (e.g. top-runner program, eco-towns, 3R awards, green public procurement). Furthermore, there is an emphasis on 'eco-conception' (products are designed to reduce the use of resources in production, repair and maintenance), a focus on substituting non-renewable resources with renewable resources, preference for local consumption, cyclical reuse of biomass and revitalization of local

communities. Cooperation between stakeholders such as local communities, NGOs and companies is also emphasized (CGDD, 2014).

- South Korea: The Government has adopted a Food Waste Reduction Policy which contains different food waste reduction program, COWI, 2011). The program also has pay-by weight food waste management system where rubbish receptacles are updated to contain RFID scanners with disposal fees billed based on the weight of the food waste a family generates (Legislative Council Secretariat, 2012).
- United States: While there is currently no formal policy objective on the circular economy at the federal level, several actions have been taken at the State and local levels in this area. For example, in Madison (Wisconsin) the 'Construction Recycling Ordinance' requires new constructions and remodeling above a certain cost to reduce the amount of waste sent to landfill and has a 70% target for recycling concrete and steel debris. Chicago has a 'Construction and Demolition (C&D) Debris Recycling Ordinance' which sets a recycling target of 50% for all C&D waste (with an exception for wastes containing lead, asbestos and other hazardous materials). Contractors are also required to control and track the total amount of C&D debris produced and submit a 'recycling compliance form'. In Boulder (Colorado), the 'Green Building and Green Points Program' requires at least 50% of construction waste to be recycled and for at least 65% of total 'material by weight' generated from demolition to be diverted from landfill. San Jose (California) has a 'Construction, Demolition, Debris Deposit Program' which refunds fees paid by contractors/remodelers where they can show appropriate documentation of avoided landfilling of construction materials (The Delta Institute, 2011). Moreover, in November 2013, the New York City Council approved local law 2013/142, which banned the use single plastic-foam food and drink containers from restaurants and food stores in the city (NNC, 2013).

Conclusion as Research Agenda

LE may be described as model composed by four macro areas: take-make-use-dispose. LE goals is economic: obtain a revenue. The relationship between input and output don't takes into account how the material has been utilized and how many of that material can be reutilized. The relationship is only economic. It is economic model of '900. LE has been the engine of our economy and culture. The European economic and social deep crisis it could be overcome with a new economic model that is calls CE. The European Commission adopted an ambitious Circular Economy Package, to stimulate Europe's transition. In many world areas, China, Japan, South Korea, United States, towards a CE which will boost global competitiveness, foster sustainable economic growth and generate new jobs. CE represents a development strategy that enables economic growth while aiming to optimize the chain of consumption of biological and technical materials. Several policies has addressed and realized CE model linked to different industrial sector particularly linked to: design; production remanufacturing; distribution; consumption; collection; recycling. Steps have first been described and analyzed for the general framework conditions necessary to move towards a circular economy, but barriers to a circular economy exist and is important how they can be overcome. Many reports have identified the following gaps which currently act as barriers to the development and research question of a circular economy particularly linked to:

• Metrics;

1. Could one prepare national-account metrics to determine quantitatively key aspects of the circular economy?
2. Could one prepare company-level metrics to determine quantitatively key aspects of the circular economy?
3. Should the parameters of circular economy business models are considered in the accounting formal requirements at the company and national levels?

• Economics and labour markets;

1. Is possible to adopted current economic modeling approaches, based largely on extrapolations of past correlations, to accurately model the impact of a circular economy? If yes, how?
2. The European and global trade flows would suffer impact with a shift to the circular economy?
3. What are the detailed labour demand implications of a shift to the circular economy, per sector and per qualification level?

4. What are the key investments required to shift some World areas, for example, (China) towards a circular economy?
5. A change to the circular economy that would produce effects at the level of international competitiveness?

• Material flows;
1. What should be shaped the future European material flows, divided into sector and total?
2. How it should be an ideal European recycling system?
3. How it can be avoided avoided disposal of valuable materials and products?

• Business;
1. What are the key drivers for the industry structure to shift to the circular economy? Value-chains integrated, capability to capture new markets from new or presents players through a better position?
2. What should be shaped the organizational structures in a circular world, and what could companies do to manage this change?

• Marketing and sales;
1. What business opportunities could be directly linked to new business models of circular economy for your company ?
2. What is the value of the products that your company has sold or disposed of in the last five years?
3. What your company could help its customers to increase lifetime and utilization of products?

• Productions and operations;
1. How your company can reclaim from sale of products designed for take-back and how to influence this design?

• Environmental footprint;
1. How much could the environmental footprint of your company improve with a full approach to a circular economy business model?

The analysis in this article highlights a unequivocal reflection in which it is appropriate to consider that the circular economy business models offer both strategic benefits, feeding efficiency and eco-innovation, both excellent prospects in terms of independence and durability of resources, innovation and employment. Similarly you have to reflect on issues related to the introduction of such business models as barriers related to specific technologies (for recycling technologies), the complexity of the legislation, difficulties in accepting companies such revolutionary models in a period of crisis, reluctance recognize the end of the linear model.

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