

Edited by Marino Cavallo, Daniele Cencioni

Circular Economy, benefits and good practices

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European Union
European Regional
Development Fund

Edited by Marino Cavallo, Daniele Cencioni
CIRCULAR ECONOMY, BENEFITS AND GOOD PRACTICES

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1. ENVIROMENTAL, SOCIAL AND ECONOMIC BENEFITS OF THE TRANSITION FROM LINEAR TO CIRCULAR ECONOMY

Marino Cavallo, Daniele Cencioni, Valeria Stacchini

“Doing more with less” is one of the mottos that best describes the circular economy. This is a thought that should push each share of economic subjects, especially enterprises.

The current financial crisis has inevitably impeached the old mode of economic thought. The crisis has confounded scholars of the private sector and the market mechanism. The failures of the markets on the one hand boosted the area of Keynesian economics associated with a strong criticism of distributive inequality, and they have also opened the doors to new concepts of scarcity of resources, the defence of natural ecosystems, energy renewable.

The ISWA, the International Solid Waste Association, often talk about the dangers of a world where the open sky dumps hosting 40% of the waste produced by man. This is a global health emergency and the care is precisely represented by the circular economy.**(1)**

The benefits of circular economy are clear and from different areas: environmental, social and economic. The success of this economic model depends on how the transition will be managed, how quickly education takes root in cities, but mainly on how quickly we will be able to develop the appropriate skills and necessary to benefit from it. Now we see in detail the main advantages of circular economy.

1.1 ECONOMIC GROWTH

The circular economy will have a positive impact on growth. By 2030, potential growth may be worth 4.5 trillion dollars globally. This was stated by the book *Circular Economy – From waste to*

(1) ISWA (www.iswa.org/media/publications/iswa-annual-reports/).

value written by Peter Lacy, Jakob Rutqvist and Beatrice Lamonica, the sustainability services division executives of the consulting firm Accenture.**(2)**

On the other hand, argue the authors, is no longer sustainable to continue with the current economic model of “take, make and throw” if we do not change the register, we will find ourselves with a devastated environment, a surge in prices and submerged by waste.

According to the European Commission more efficient use of raw materials and resources throughout the supply chain materials could reduce the need for new raw material of 17-24% by 2030, with savings for European industry estimated at €630 billion per year. Several studies on the potential of circular economy indicate that European industry, thanks to substantial savings on the cost of raw materials, could push the growth of European GDP by about 3.9% and create millions of new jobs. The circular economy could save 8% of annual turnover to the industries while also reducing its total annual emissions of greenhouse gases by 2.4%.**(3)**

Translating into reality the current wave of eco-innovations in rapid development in the context of a circular economy, according to a study carried out for the Ellen MacArthur Foundation, the European Union could achieve annual savings of almost €1,000 billion by 2030.

New technologies and business models have already partially realized include car sharing and driverless cars, electric vehicles, advanced materials such as graphene, precision farming, the modular processes in construction and highly efficient passive housing energy.

According to the report, one can in any case provide that these technologies will reduce costs in three broad areas, namely mobility, food and built environment, from €900 billion annually by 2030. If such

(2) Lacy P., Rutqvist J., Lamonica B., “Circular Economy – From waste to value”, Accenture (<https://newsroom.accenture.com/news/the-circular-economy-could-unlock-4-5-trillion-of-economic-growth-finds-new-book-by-accenture.htm>).

(3) European Commission ([http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52014SC0206R\(01\)](http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52014SC0206R(01))).

improvements will be implemented in the framework of a circular economy rather than linear, the savings could double to €1.800 billion, according to estimates of the report.⁽⁴⁾

1.2 A GREATER SYSTEM AND COLLABORATION BETWEEN COMPANIES

The best definition of circular economy is perhaps that of Ellen MacArthur: the circular economy is “industrial economy that is conceptually regenerative and reproduces nature in actively improving and optimizing the systems through which it operates.” The waste do not exist. The biological and technical components of a product are designed with the assumption of fit within a materials cycle, designed for disassembly and re-purposing. The organic nutrients are non-toxic and can simply be composted. The technical nutrients – polymers, alloys and other artificial materials – are designed to be used again with a minimum energy expenditure.

The circular is therefore a form of economy that is more collaborative, which focuses on the property and not so much the product as such, but its function and its use. The circular economy is an economy in which waste of a process of production and consumption are circulating as a new entry in the same or a different process.

All this inevitably leads to greater collaboration between companies, but also between the public administration, research and companies themselves to find new operational solutions. Companies cannot think only about their business, but they have to assess the impact of their actions on the surrounding environment confronting all other economic actors.

⁽⁴⁾ Ellen Macarthur Foundation, “Delivering the Circular Economy”, 2015 (www.ellenmacarthurfoundation.org/assets/downloads/publications/ElleMacArthur_Foundation_PolicyMakerToolkit.pdf).

1.3 IMPROVING OF PRODUCTS AND SAVINGS ON PRODUCTION COSTS

Working for a circular economy means focusing on products of longer duration, developed for the upgrade, aging and repair, considering strategies such as sustainable design. Different products, materials and systems, with many links and measures are more resilient in the face of external shocks, compared to only systems built for efficiency.

Implement the circular economy approach in the manufacture of durable goods of life expectancy is estimated to result in savings of between €340 to €630 billion per year in the EU alone, approximately 12-23% of the actual costs incurred for production materials in these areas. For some consumer goods, such as food, beverages, textiles and packaging, the savings potential for the material is even estimated in €700 billion per year. Another study, however, estimates the benefits of reducing the costs of production/waste disposal, providing annual savings ranging from €245 billion to €604 billion.⁽⁵⁾

Obtaining benefits from the adoption of circular economy also depend on how well and quickly the necessary skills and education to the basics will be implemented and developed. Among the first goals reached there is definitely a greater self-sufficiency in relation to raw materials: already the consumer a share today between 6% and 12% of matter – including fossil fuels – is currently avoided through recycling and reuse, and careful design. Percentages that can arrive with the right efforts to 10-17%, giving a cut of almost a quarter import of raw materials by 2030.⁽⁶⁾

⁽⁵⁾ European Parliament, “Circular economy: Revision of waste legislation” ([www.europarl.europa.eu/RegData/etudes/BRIE/2016/573291/EPRS_BRI\(2016\)573291_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/BRIE/2016/573291/EPRS_BRI(2016)573291_EN.pdf)).

⁽⁶⁾ Rinnovabili.it (www.rinnovabili.it/green-economy/economia-circolare-benefici-sfide-666/).

1.4 ENHANCING THE BUSINESS COMPETITIVENESS

Prolong the productive use of materials, reuse and increase its efficiency leads to an increase in competitiveness for companies that operate in this way. The companies included in a circular economy context have an important competitive advantage over competitors with consumers. Consumers are becoming increasingly aware of how a product is made and what impact it has on the surrounding environment. So consumers prefer to buy a consumer product circular rather than linear.

1.5 REDUCING IMPACT ON THE ENVIRONMENT

Many experts think that the basic commodities (oil, copper, cobalt, lithium, silver, lead and tin) are likely to run out between 50-100 years. But between the increasingly scarce resources there is also the water: in 2050, more than 40% of the world population (almost 4 billion people) will live in areas afflicted by a severe water shortage. Human intervention, such as the increase in greenhouse gases and the use of fertilizers in cultivation, are threatening planetary absorption reservoirs like forests, atmosphere, oceans.

Then there is the issue of waste. If we continue with the current model of growth by 2025, municipal waste will increase by over 75% and industrial ones by 35%. And so far, we arrived at 11 billion tonnes of waste generated in a year. Experts predict tensions on commodity markets and volatility, as well as stressful situations related to water and food safety, which would create geopolitical tensions and instability.⁽⁷⁾

1.6 CREATING JOBS

Concretely, walk the streets of circular economy means closing some production lines and/or services and opening others. The balance re-

⁽⁷⁾ Csa Impianti (www.csaimpianti.it/it/default/1423/Economia-circolare-recuperare-rifuti-puo-valere-fino-a-4-500-miliardi-di-dollari.html).

mains positive, however: according to the European Commission's assessment, in the only area of waste management – says the agency – you could get even to the creation of 178,000 new direct jobs by 2030. This figure as a whole could up to 580,000.(8)

1.7 ADVANTAGES FOR FAMILIES

A report of Ellen MacArthur Foundation has also tried to quantify the savings resulting from the implementation of circular economy. This would produce savings in the form of lower costs of primary resources, those related to the use of the products (for example, for the maintenance of the vehicles, if these were shared) and those associated to external effects such as congestion and gas emissions greenhouse, which should be reduced drastically.

The report found that the savings would accumulate mainly in favour of families, which would enjoy an average of 11% of disposable income in more thanks to the efficiency of circular economy. This would allow an increase in expenditure of at least 7% of GDP by 2030.(9)

(8) Green Report (www.greenreport.it/news/economia-ecologica/tutti-vantaggi-del-leconomia-circolare-ambientali-sociali-ed-anche-economici/).

(9) Green Report (www.greenreport.it/news/economia-ecologica/tutti-vantaggi-del-leconomia-circolare-ambientali-sociali-ed-anche-economici/).

2. IDENTIFY RELEVANT STAKEHOLDERS

Marino Cavallo, Daniele Cencioni, Valeria Stacchini

To identify relevant stakeholders for Circular Economy we must refer to the model of Triple Helix.

The concept of the Triple Helix of university-industry-government relationships initiated in the 1990s by Etzkowitz (1993) and Etzkowitz and Leydesdorff (1995), encompassing elements of precursor works by Lowe (1982) and Sábato and Mackenzi (1982), interprets the shift from a dominating industry-government dyad in the Industrial Society to a growing triadic relationship between university-industry-government in the Knowledge Society.

The Triple Helix thesis is that the potential for innovation and economic development in a Knowledge Society lies in a more prominent role for the university and in the hybridisation of elements from university, industry and government to generate new institutional and social formats for the production, transfer and application of knowledge. This vision encompasses not only the creative destruction that appears as a natural innovation dynamics (Schumpeter, 1942), but also the creative renewal that arises within each of the three institutional spheres of university, industry and government, as well as at their intersections.

Through subsequent development, a significant body of Triple Helix theoretical and empirical research has grown over the last two decades that provides a general framework for exploring complex innovation dynamics and for informing national, regional and international innovation and development policy-making. **(10)**

The first workshop of the Triple Helix movement, launched by Henry Etzkowitz and Loet Leydesdorff, was organized in Amsterdam to discuss the Triple Helix model. It brought together of 90 researchers and

(10) Ranga M., Senior Researcher, H-STAR Institute, Stanford University (https://triplehelix.stanford.edu/3helix_concept).

attracted participation from Latin America, Europe, North America, Australia and Asia. The workshop was subsequently referred to as the first international conference on the Triple Helix.

The London event in 2012 brought the issue of open innovation and invited participants to challenge the Triple Helix model, while extending and deepening the application of the conceptual apparatus, created as part of the evolution of the Triple Helix academic community. The considerable number of participants (over 300) from 35 countries indicated the emergence of a Triple Helix movement, anchored by the TH Association and spinning into numerous academic and practitioner domains.**(11)**

The Triple Helix innovation model focuses on university-industry-government relations. The Quadruple Helix embeds the Triple Helix by adding as a fourth helix the “media-based and culture-based public” and “civil society.” The Quintuple Helix innovation model is even broader and more comprehensive by contextualizing the Quadruple Helix and by additionally adding the helix (and perspective) of the “natural environments of society.” The Triple Helix acknowledges explicitly the importance of higher education for innovation. However, in one line of interpretation it could be argued that the Triple Helix places the emphasis on knowledge production and innovation in the economy so it is compatible with the knowledge economy. The Quadruple Helix already encourages the perspective of the knowledge society, and of knowledge democracy for knowledge production and innovation. In a Quadruple Helix understanding, the sustainable development of a knowledge economy requires a coevolution with the knowledge society. The Quintuple Helix stresses the necessary socioecological transition of society and economy in the twenty-first century; therefore, the Quintuple Helix is ecologically sensitive. Within the framework of the Quintuple Helix innovation model, the natural environments of society and the economy also should be seen as drivers for knowledge production and innovation, therefore defining opportunities for the knowledge economy. The

(11) www.triplehelixassociation.org/.

European Commission in 2009 identified the socioecological transition as a major challenge for the future roadmap of development. The Quintuple Helix supports here the formation of a win-win situation between ecology, knowledge and innovation, creating synergies between economy, society, and democracy. Global warming represents an area of ecological concern, to which the Quintuple Helix innovation model can be applied with greater potential.**(12)**

Let's look at the main stakeholders in detail.

2.1 UNIVERSITIES AND RESEARCH CENTRES

Universities and research centres are very important for the development and growth of circular economy. For instance, Pioneer Universities are an international network of higher education institutions developing truly pioneering and innovative circular economy-orientated research or teaching programmes. Ellen MacArthur Foundation work with them to have a vision of a global network of higher education institutions that explore, develop and critique key ideas and priorities in a transition to a circular economy. To bring this about, the Foundation is working with leading universities around the world, as they themselves work with business to find solutions and to educate and inspire future leaders, to address emerging economic realities. As non-fee paying members of the CE100 programme they have a formal agreement with the Foundation and commit to drive and support relevant and beneficial knowledge exchanges between business and HE**(13)** furthering the collective understanding of the circular economy through insights and skills development. Many of these research and teaching programmes focus on Ellen MacArthur Foundation target disciplines – business, education, design and engineering. The

(12) Carayannis E. G., Thorsten D. B., Campbell D. F. (<https://innovation-entrepreneurship.springeropen.com/articles/10.1186/2192-5372-1-2>).

(13) www.ellenmacarthurfoundation.org/assets/downloads/higher-education/HE-programme-overview_10-04-15_2.pdf.

Pioneer University programme offers bespoke input from the Ellen MacArthur Foundation’s team and facilitated links with regional networks around the world.(14)

2.2 GOVERNMENT

Government plays a key role in advancing the circular economy. By setting legislative agendas, developing strategic programs and public services, and making smart decisions regarding internal agency operations, government can drive the demand for circular products and influence the way businesses operate. Large municipalities especially, have considerable influence over the public and commerce, far-reaching purchasing power, and the ability to impact millions of stakeholders through policies and programs. For example, it’s interesting to analyse the five ways government drives the Circular Economy in New York City (NYC), the city is shaping the circular economy through its waste policy and practices.

2.2.1 Public commitments

Two of Mayor De Blasio’s biggest public commitments impacting the circular economy are 0x30 and 80x50. 0x30 aims to achieve zero waste by 2030 and 80x50 calls for the reduction of GHG emissions by 80% by 2050. Ambitious public policy commitments set the stage for shifts in collective thinking around waste, resources and sustainability and open the floor for business to invent new and unique solutions.

2.2.2 Regulations

NYC has several laws that lay the foundation for closed loop material systems. Recycling has been a legal mandate since 1989 here, and was expanded over the past decade to include a wide variety of materials

(14) www.ellenmacarthurfoundation.org/programmes/education/pioneer-universities.

(most recently rigid plastics). The next innovation in convenience is single stream recycling, which is slated to occur within the next few years. Second, several state laws govern Extended Producer Responsibility (EPR) for various products, some of which are accompanied by disposal bans. For example, manufacturers are required to take financial responsibility for the collection and reuse/recycling of their electronic products at the end of the product's useful life. But not all product stewardship is mandated; companies are increasingly offering stewardship options for their products to customers on their own accord. Voluntary product stewardship allows companies to define the terms themselves – at times by collaborating with their competitors – and find the best business model for doing so. Third, in his vision for the city, One New York, Mayor de Blasio calls for the development of “an equitable blueprint for a Save-As-You-Throw program to reduce waste.” While EPR programs incentivize producers to make products that are longer-lasting, higher quality, and made from recovered/recoverable materials, a Save-As-You-Throw program might incentivize consumers to buy longer lasting products to offset disposal costs.

2.2.3 Collection programs

In addition to curbside recycling, collection programs that target specific materials, like organics, electronics (e-cycleNYC), textiles (re-fashionNYC), reuse programs (ReuseNYC), and household hazardous waste (SAFE Events) help to recover materials that might otherwise follow the linear path to the landfill. Together, these programs provide a systemized way to reintroduce unwanted “waste” materials back into markets as renewed products or raw commodities.

2.2.4 Procurement

Environmentally Preferable Purchasing (EPP) sets minimum environmental standards for the products that agencies, companies, and organizations can buy. Like many EPP rules, purchasing standards in NYC

government address energy and water efficiency, hazardous materials, and recycled content. Any purchase or contract meeting minimum price thresholds must abide by a precise set of environmental rules. EPP policies are a simple tool that any entity can implement. With examples like reprocessed latex paint, minimum recycled content for paper and plastic goods, energy efficient appliances, and minimum warranties, EPP provides a direct demand for closed loop systems and products.

2.2.5 Long-term processing contracts

NYC leads a 20-year contract with Sims Municipal Recycling for the processing of recyclables collected from NYC's residents, agencies, and institutions. While specific and not feasible in all situations, the tactic of entering into a long-term contract with a materials processor can guarantee the viability of a recycling or recovery program by bringing financial stability to a marketplace notoriously characterized by fluctuating commodity prices and market volatility. As we have seen of late, recycling is not a self-sufficient business with the luxury of relying on the revenue from commodity sales alone. Instead, recycling programs are a public service that must be treated and funded as such. Long-term contracts that pre-define cost and revenue sharing agreements serve to mitigate financial risk while also providing the industry with the material supply assurance it needs to invest significant upfront capital into infrastructure development.⁽¹⁵⁾

2.3 ENTERPRISES

Social and green entrepreneurship is considered as one of the main engines playing a relevant role within the complex systemic process enabling a more circular economy. Its key drivers, the social and green entrepreneurs, accelerate the transition anytime they convert their ide-

⁽¹⁵⁾ Adler M., Senior Consultant, Resource Recycling Systems (<https://recycle.com/5-ways-government-drives-circular-economy/>).

as into feasible and viable enterprises. The core business of their enterprises is mostly environmentally and socially oriented rather than purely economic. They offer products or services to reduce environmental impacts and create social values using innovative, effective and efficient business models and natural resources. Their work concentrates on sustainable sectors such as renewable energy, waste management, recycling, organic food or eco-tourism.(16)

In general, circular economy is a great opportunity for SMEs. However numerous barriers can hamper the implementation of “circular” and “green” economy practices by SMEs that can originate, for example, from the SME enabling environment, such as culture and policy-making, from the market chain in which the SME operates, such as behaviour of suppliers, and from lack of technical skills and finance. One key barrier was found to be a lack of technical and managerial knowledge, skills and information, including on the usability of new business models. This limits the options for SMEs to adjust to a circular economy as new or adopted ways of doing business may not be known or staff may not be able to (easily) pursue new activities.

In addition, a lack of long term scenarios in the top management’s mind-set – which may result from a lack of time, lack of awareness of the relevance of a circular economy or aversion to change – may also hinder the implementation of a circular business model, including insufficient retirement planning for succession among business executives. Furthermore, the organisational structure and culture of an SME may limit the exchange of information between different departments, e.g. between accounting, marketing and engineering. Thus, relevant opportunities may go untapped or the SMEs response mechanisms

(16) Culcasi F., Responsible for the organization and implementation of Sustainable Entrepreneurship and Sustainable Consumption projects and activities that SCP/RAC undertakes under the UNEP/MAP and Stockholm Convention framework along the Mediterranean region (www.inclusivebusinesshub.org/the-circular-economy-and-opportunities-for-small-businesses-3/).

may be too slow to exploit opportunities. Furthermore, lacking access to funding and high up-front investments costs vs. long-term pay-back times puts a brake on SMEs' ability to "greenovate".⁽¹⁷⁾

2.4 CIVIL SOCIETY

The development of a circular economy allows citizen-consumers to have access to better quality eco-designed products. Sustainable sourcing and local distribution channels lead to better traceability of products, especially food, with significant environmental and social benefits (local economy, jobs, health, etc.).

In addition to environmental benefits, extending the life of products makes it possible to limit citizens' expenses and benefit from additional sources of income by selling their goods second-hand. Social economy structures specialized in reuse and donation platforms help optimize the use of resources while generating significant economic and social gains.

The functional economy proposes reforming the dominant sales model by disconnecting consumption from ownership. Such a model allows citizens to break away from the purchasing process and all its related imperatives such as maintenance, storage, repair and end-of-life. Providing use as an integrated service is a win-win situation: the producer obtains consumer loyalty and saves on resources; the consumer no longer buys the product but pays only for its function and performance.

Setting up local collaborative consumption networks reduces the costs of acquisition and use of the products while encouraging social cohesion among citizens.⁽¹⁸⁾ But the main lever to move citizens to the circular economy is education, starting with schools. So, new gener-

⁽¹⁷⁾ Rizos V., Centre for European Policy Studies (www.researchgate.net/publication/283121970).

⁽¹⁸⁾ Jay V., Chef de projets (www.economiecirculaire.org/static/h/circular-economy-challenges-for-citizens.html#page1:local).

ations can apply good practices in the circular economy as naturally as possible.

2.5 THE ROLE OF FINANCIAL/ECONOMIC SYSTEM

The Quintuple Helix Innovation Model should consider also financial/economic system as Carayannis and Kaloudis write. This area requires “sustained action,” political and economic leadership “or “empowerment,” and “intelligent use of technology.” The area of financial and economic system refers to financial and economic aspects of the effects of climate. The following question arises: how should the two systems effectively change or adapt with-each-other in order to reduce or exclude crises in consequence of climate change (see for example: Barbier, 2009; Barth, 2011a; Green New Deal Group, 2008; Hufbauer, et al., 2009; Meyer, 2008; OECD, 2010; Sen 2007)?

The economic system comprises industry, banks and services and the political system represents the public authorities and their plans, laws, ideas and so on. The five helices work as “subsystems” in which knowledge moves from subsystem to subsystem in a circular manner. If knowledge is input into one subsystem, a process of knowledge creation leads to new knowledge or innovations. That does not mean that the fifth helix is an actual actor but rather a driver for new knowledge and innovations in response to environmental challenges.(19)

2.6 BUSINESS MODELS TO MAKE SME'S CIRCULAR BUSINESSES A REALITY

The stakeholders work together, each with its role in the application of the circular economy. To do this, however, requires business models. Below we list five business models that allow SME's circular economy to become reality.

(19) Carayannis E. G., Thorsten T. D., Campbell D. F., “The Quintuple Helix innovation model: global warming as a challenge and driver for innovation”.

2.6.1 Products as services

In products as services, goods vendors embrace the idea of themselves as service providers: leasing access to and not selling ownership of a service. In some cases, this has led not only to an effective hedge against cost volatility but also to a stickier customer relationship and increased upsell. Vodafone's Red-Hot plan is a good example. You can rent the latest phone for a year and keep on exchanging it for a newer version. Assuming Vodafone is engaged in collecting the old phone, not only does this act as material collection and pooling but from a business standpoint also creates deeper customer relationships.

2.6.2 Next life sales

Next life materials and products work when a company can efficiently recover and re-condition its products after use and then put the same products into the market to earn a second or third income. Tata Motors Assured is a good example here. It's more than a second-hand car dealership. Cars are handpicked and refurbished in Tata workshops and then undergo a certification process. Customers are even offered financing options and warranty.

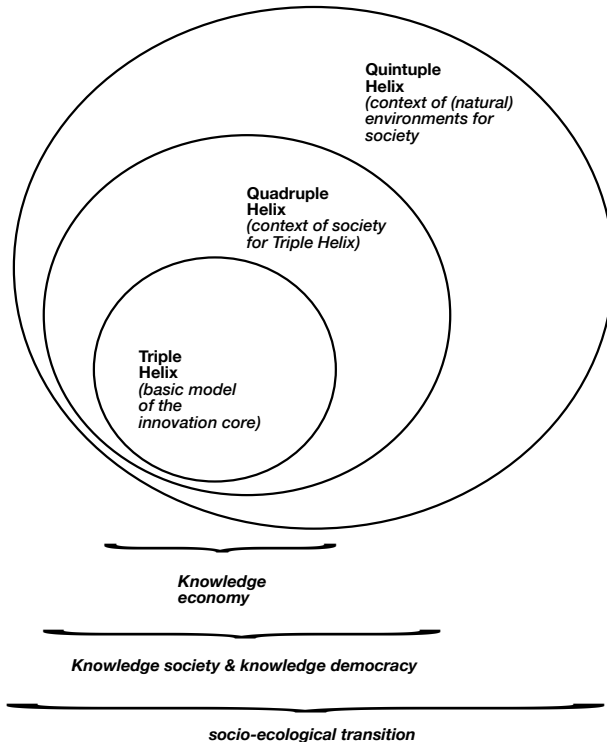
2.6.3 Product transformation

Not all products can be reconditioned in their entirety but most products have certain components that carry a high value. Not just products, but often materials themselves have an embedded energy component that makes them even more valuable than their virgin source. With the right design and remanufacturing capabilities, they can be put together to form new products. This is product transformation. For BMW, it can mean a 50% cost saving for customers buying remanufactured parts as compared to new ones. You get exactly the same quality specifications as a new BMW part subject to the same 24-month warranty.

2.6.4 Recycling 2.0

Not to be forgotten is that innovation in recycling technology (Recycling 2.0) is rapidly evolving and enabling production of high-quality products with fantastic sustainability performance. Starbucks, for example, is actually aiming to turn thousands of tons of its waste coffee

KNOWLEDGE PRODUCTION AND INNOVATION IN THE CONTEXT OF THE KNOWLEDGE ECONOMY, KNOWLEDGE SOCIETY (KNOWLEDGE DEMOCRACY), AND THE NATURAL ENVIRONMENTS OF SOCIETY



Source: Carayannis E. G., Thorsten T. D., Campbell D. F., "The Quintuple Helix innovation model: global warming as a challenge and driver for innovation".

grounds and food into everyday products by using bacteria to generate succinic acid which can then be used in a range of products from detergents to bio-plastics and medicines.

2.6.5 Collaborative consumption

Lastly, social media exchange platforms are rapidly transforming industries by collaborative consumption. Airbnb (the online service that matches people seeking vacation rentals with hosts who have space) now has over 200,000 listings in 26,000 cities. Check out ThredUP the next time you need new clothes for your kids, you can browse like-new clothing at significant reductions from families whose children have outgrown their old clothes. Of course, moving to a truly circular economy could require a mixture of all these five business models and a great deal of product and service innovation. Consumers and policymakers have a significant role too. But what these business models demonstrate is that it is possible to rethink how we make and use things. The companies that are starting now may well define the future of sustainable business, enabling global prosperity on a crowded planet with finite resources.**(20)**

(20) Peter Lacy is Managing Director of Accenture's Strategy and Sustainability Services businesses for Asia Pacific, based in Shanghai. David Rosenberg is CEO of Aerofarms, based in New York.

3. BUSINESSES' GOOD PRACTICES

3.1 INTRODUCTION

Elettra Agliardi, Marino Cavallo, Daniele Cencioni

The current financial crisis has inevitably impeached the old mode of economic thought. On the one hand, the failures of the market mechanisms boosted the area of Keynesian economics associated with a strong criticism of distributive inequalities; on the other hand, they also opened the doors to new concepts of scarcity of resources, defence of the natural ecosystems and renewable energy (see, e.g., Agliardi, Spanjers, 2016) to provide potential solutions to the current environmental challenges.

One concept that has been developed to resolve some crucial market failures is the circular economy.⁽²¹⁾ It is defined as “an industrial system that is restorative or regenerative by intention and design. It replaces the end of life concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse and return to the biosphere, and aims for the elimination of waste through the superior design of materials, products, systems and business models”.⁽²²⁾

EU 2020 highlights that the EU and the Member States should enable SMEs to turn environmental challenges into opportunities. Of course, green growth can offer significant benefits. However, as stated in the Small Business Act (EP 2014/2209 INI), policy makers need to fully understand the potentials of the green economy, whilst being aware of the barriers that SMEs face regarding the greening of their products, production processes, business practices and services.

⁽²¹⁾ ISWA (www.iswa.org/media/publications/iswa-annual-reports/).

⁽²²⁾ World Economic Forum, Ellen MacArthur Foundation, McKinsey & Company, “Towards the Circular Economy: Accelerating the scale-up across global supply chain”, 2014.

To this purpose, the EU CESME project**(23)** addresses SME inclusion in the circular economy, by interregional meetings identifying good practices aiming to examine how best regional and local authorities and business development agencies can improve relevant policy instruments and design support packages to assist SMEs to enter the circular economy.

Although the benefits of a circular economy are clear and from different areas – environmental, social and economic – the success of this model depends on how the transition will be managed and how quickly the appropriate skills which are necessary to benefit from it will be developed. In order to investigate how much the concept of circular economy is understood and applied in practice by different organizations, a project run by a group of students of the Master Degree in Resource Economics and Sustainable Economics of the University of Bologna has built up a questionnaire and sent it through email to a sample of firms (103), which participated in the 2016 Ecomondo.**(24)** The questionnaire is available in the Appendix. Although it represents a biased sample and is not totally representative of all firms, the experiment helps us to have an idea about the situation. Moreover, the experiment will be regularly updated and extended to a larger number of firms, and with a larger sample it can be repeated for different disaggregated subsets, registering the answers for different regions, industrial sectors, and how they evolve over time.

Based on their current sample, they found that almost 43% of respondents have a clear idea of what a circular economy is, about 43% have only a general idea, and the remaining 14% have no idea. Basically, most firms heard about circular economy but an unambiguous concept is still missing.

Furthermore, they found that 57% of the firms that answered is applying one or more measures of circular economy, while 29% is not doing

(23) www.interregeurope.eu/CESME/.

(24) www.ecomondo.com/elenco-espositori/espositori-ecomondo-2016.

it. High costs to comply with laws and standards is among the main difficulties faced in implementing these measures, indicating that there is need for better public governance, followed by lack of expertise and lack of human capital. Moreover, nearly 72% of the respondents know that there are funding and grants from the European Union, governments, municipalities or other organizations to implement circular economy measures but they never used them. They found that almost all the initiatives have been financed through standard bank loans or by self-financing. This information is useful since the European Union is strongly boosting the transition towards a circular economy and it would be crucial to develop new tools of green finance.

There are several examples of firms succeeding in applying the circular economy model and in their sample the mostly undertaken activities are reduction of produced waste, recycled materials use, product or services designing to reduce material use, use of renewable energy and re-planning of energy use to minimize consumption.

In what follows three case studies at firm-level will be presented, that in our opinion are interesting also because they are related to different industrial sectors and geographical areas (see the articles in Sections 2.1, 2.2. and 2.3). One is EcoPneus dealing with tyres, giving them a second life and thus reducing the impact of these products. LoWaste, instead, is a project experimenting a pattern of circular economy in Ferrara, while SQUARE027 is a little and innovative start-up from San Mauro Pascoli (Forlì-Cesena).

The tool for implementing the circular economy at the industrial level is represented by industrial symbiosis and the realization of Eco-Industrial Parks (EIPs). Within industrial ecology, industrial symbiosis investigates the relationships between industrial systems and their natural environment (Chertow, Park, 2011).

In particular, the term industrial symbiosis identifies resource exchanges between two or more dissimilar industries, meaning not only material resources (by-products or waste), but also thermal waste, services, and skills. This is a strategy for closing the resource cycles and optimizing their use within a specific spatial economic sphere (Cutaia,

Morabito, 2012) through collaboration between the different companies based on the synergic possibilities offered by their geographical/economic proximity (Chertow, 2000; Lombardi and Laybourn, 2012). The article in Section 3 will be devoted to the applicability of EIPs as an industrial paradigm.

In substance, the following articles explain the importance of the circular economy and eco-industrial parks, in particular to illustrate best practices worldwide and the various implementation opportunities.

3.2 THREE CASE STUDIES

Sara Nicosia, Federico Pinato, Barbara Zancarli

3.2.1 LoWaste (Local Waste Market for second life products)

In the municipality of Ferrara, the production of urban waste decreased from 102.233 tons in 2010 to 92.678 tons in 2015. Separated collection increased from 48.2% (49.305 tons) to 54.35% (50.370 tons) in the same period. Production of pro capita urban waste reduced from 755 kg/ab/year to 696 kg/ab/year.**(25)**

The LIFE+ LOWaste represent a model of circular economy based on prevention, reuse and recycling of waste using private-public partnership. It was implemented in the municipality of Ferrara together with the cooperation of Hera Group, Impronta Etica, La Città Verde, RREUSE and and co-funded by the European Commission through the LIFE + fund. The project lasted from 11th September 2011 to 30th June 2014. The total project budget was €1.109.000, with €554.500 financed with EU Co-financing.**(26)**

(25) <http://servizi.comune.fe.it/7319/raccolta-differenziata>.

(26) www.minambiente.it/sites/default/files/archivio/allegati/life/progetti_mese/life_progetto_mese_maggio2014_lowaste.pdf and <http://www.lowaste.it/files/pdf/lowastepteng.pdf>.

The objectives of the project were:

- reduction of urban waste through the development of a local market for recycled or reuse materials promoting a closed local waste management cycle focusing both on the supply side (creating the conditions to intercept and adding value to the materials that can be reused, recycled and put back in the market) and the demand side (creating the demand of these products through the green public procurement policies in public bodies and green buying procedures in companies, firms and cooperatives);
- development of the existing green public procurement schemes in local authorities with a cradle to cradle approach, linking buying procedures to eco-design of goods and products;
- promotion of waste prevention, encouragement of the recovery of waste and usage of recovered materials in order to preserve natural resources with a focus on life-cycle thinking, eco-design and the development of recycling markets;
- development of a system for the creation of the Local Waste Market for second life products that can be applied in other local contexts;
- spreading the knowledge of reused/recycled products to consumers, retailers, producers and public authorities;
- raise awareness of consumers, retailers, producers and local bodies about the possibility to decrease waste through the reuse or purchase of recycled products.

The supply chain for collection, recovery and disposal of waste has been analysed during the project in the territory of Ferrara, identifying some fractions with high added value potential but currently disposed or recovered with low added value. Several pilot projects have been carried out using the following materials as starting waste:

- textile from operating room/medical textile;
- materials resulting from the demolition and construction of buildings;
- street furniture and playground equipment;
- oil and food waste.

In the first pilot project, the starting waste material was textile from operating room and they were recycled to produce gadget for fairs, bags, cases and pouches, furniture (chairs and cushions), technical clothing (sea and mountain). The subject involved (Servizi Ospedaliери Spa, Social cooperative La Piccola Carovana, Social cooperative La Città Verde) produced a total amount of 90 tons per year of medical textile savable from disposal and it allowed to save up to 67 tons of CO_{2eq} for the non-disposal. Moreover, up to 2.159 tons of CO_{2eq} have been saved using secondary raw materials.**(27)**

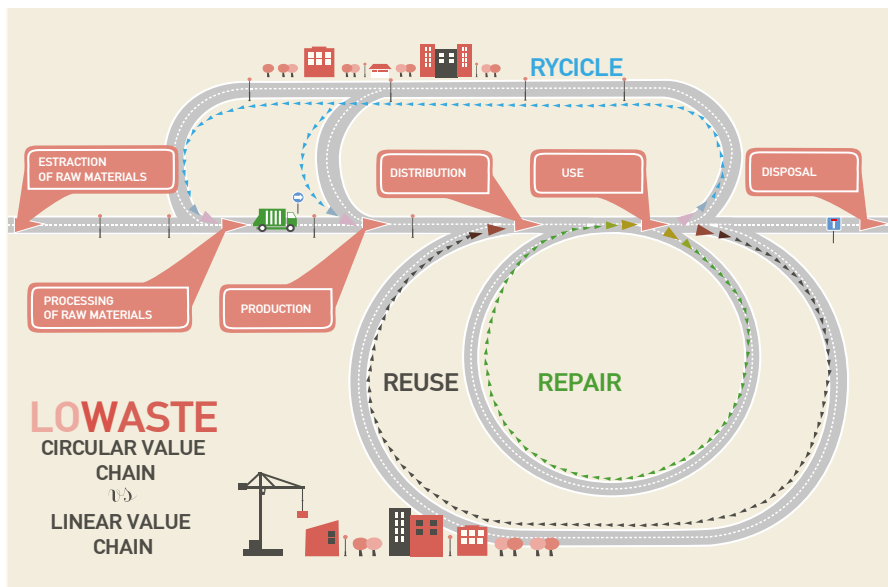
The pilot project created using materials resulting from the demolition and construction of buildings involved several local construction companies and Social cooperative la Città Verde. The starting waste has been used to road foundations, fills and panels for cladding facades. Through this, 1.5 km of roads have been built in the municipality of Ferrara, amounting to 4.090 cubic meters of aggregates. Each year 11.200 tons of aggregates was recycled, with up to 107 tonnes of CO_{2eq} avoided preventing landfill and up to 486 tonnes of CO_{2eq} avoided by not using aggregates produced in quarries.

The pilot conducted using street furniture and playground equipment as starting waste material led to the production of up to 90 tons per year of reconditioned furniture, up to 67 tons of CO_{2eq} saved for the non-disposal and 90 tons of raw material not used for the production of new products.

The one regarding the recycling of food scraps and cooking oils from fairs and festivals allowed to produce compost, biodiesel and glycerin. This project allowed to avoid 30 tons of food waste per year and 4.500 kg of compost was produced. Moreover, up to 1.4 tons of CO_{2eq} have been avoided per year due to non-disposal of the waste, made using one large compost machine. In this pilot project the subject involved were the social cooperative la Città Verde, school canteens and organizers of fairs and festivals. LOWaste has created a network of individuals, businesses, recovery and know-how able to grow and give birth

(27) www.lowaste.it/files/pdf/layman.pdf.

LOWASTE CIRCULAR VALUE CHAIN VS LINEAR VALUE CHAIN



Source: www.lowaste.it/files/pdf/layman.pdf.

to a real model of district of green circular economy based on waste. Experimentation in Ferrara allowed to verify the applicability of the theoretical model that was designed to LOWaste.

3.2.2 SQUARe 027

SQUARe027 is an innovative fashion luxury brand that, according to its ethic principles, designs and produces an Eco-Friendly and vegan shoes line. Between its strengths, the entirely Made in Italy handmade production. The main goal of this start-up is to provide new products able to satisfy the needs of people concerned about animal wellness and sustainability. To achieve this result, its designer Marco Zanuccoli came up with these shoes that meet these requirements providing at the same time a high quality and trendy product. This firm, founded in 2016 in San Mauro Pascoli (Forlì-Cesena,

Emilia Romagna), declares as its mission that it wants “to be able to adapt to the environment and to create something having at the same time a positive impact on the whole ecosystem”. Too many times the environment we live in has been excessively depleted: therefore, as they say, nowadays “a successful firm should act respecting the needs of our planet.”

In order to be such a firm, SQUARe027 applies some of the main principles of circular economy. First, circular economy requires to modify the concept of waste: what once was seen as something to be thrown away, should now be considered as a whole of biological, chemical and material components that must be recovered. Every unit of matter has an intrinsic value that does not disappear as the product which it is part of arrives at the end of life. This principle implies that the products’ life should be stretch as much as possible, and then the matter should be recovered and a new life should be given it. In turn, products should be a priori designed to allow large use of recycled materials and to simplify the decomposition once the product is dismissed. SQUARe027 makes large use of these materials, and declares to have appositely designed its products to do this.

Second, circular economy has a very different relationship with the environment with respect to classic linear economy. One of its fundamental principles is that it is necessary to respect and preserve the complex equilibrium of the planet. Climate change is maybe the most evident proof that, until now, we did not apply this principle at all. Indeed, the too high concentration of CO₂ and other greenhouse gases has begun to cause changes in this equilibrium, as well as other human activities did. SQUARe027 is aware of this problem, and therefore avoids the use of PVC (that is one of the most dangerous materials for the environment) and uses low-impact materials, such as a completely biodegradable gum and synthetic leather. This special gum allows a 50% reduction of the emissions during the decomposition, while the use of synthetic leather reduces CO₂ emissions by 35%, organic solvents use by 99% and waste water production by 70%.

However, we submitted a questionnaire to SQUARe027 in order to understand what are the main problems that a firm willing to apply the principle of circular economy faces. What resulted from the analysis of its responses is the following. The most difficult challenge to face is the high cost of the recycled materials, that implies higher costs of the product and therefore difficulties in entering the market. This problem, in our opinion, arises essentially for one reason: externalities are not correctly internalized. In fact, in dealing with environmental issues, market fails. In particular, what is not taken into account by market prices is the social cost of pollution, emissions and depletion of natural resources. Instead, a firm that undertake circular economy activities chooses to use materials that reduce such social costs, but this reduction comes at a price. The price is paid by the firms, that are in competition with other firms that are not requested to bear the social costs of their activity. A government intervention is therefore needed, in order to internalize the externalities. Thus, circular economy firms will receive the competitive advantage that their way of producing generates.

Another interesting fact is that SQUARe027 is self-funded, and even if it declares to know that some financings exist, it never used them. A policy that could be undertaken to boost the development of circular economy is to promote these financings and to make their access easier. The development of such activities is very important because, according to recent studies, they would bring benefits both the population (in terms of job creation, health, growth) and to the environment.

Finally, SQUARe027 find it difficult to receive answers or materials from its suppliers, because it is a relatively new and small-size start-up. As SQUARe027, maybe other firms are facing this problem. A possible solution to it, that could be implemented both by the government and by the privates, could be the creation of joint purchasing groups or networks for recycled materials provision. In this way, the bargaining power of the small firms would be increased and, probably, the problem would be solved.

3.2.3 Ecopneus

Ecopneus SCPA is a non-profit limited company for the traceability, collection, treatment and recovery of End of Life Tyres (ELT), set up by the leading tyre manufacturers operating in Italy and based on art. 228 of Legislative Decree 152/2006, which obliges tyres producers and importers to manage a quantity of ELT equal to how much tyres they have introduced on the market the year before.

Ecopneus was born from the cooperation of the most relevant tyres producers and importers in order to permit the right management of ELT on all our national territory, guaranteeing their collection, treatment and recovery. Ecopneus' founders are very important companies, such as Bridgestone, Continental, Goodyear-Dunlop, Marangoni, Michelin and Pirelli. The procedure for the participation to the initiatives of this company would be enlarged also to other important subject in tyres' production and importation.

In the past years, Ecopneus collected an amount of ELT higher than law-defined target. Some data (measured in tonnes) are available about that:**(28)**

ELT COLLECTED PER YEAR

2011	2012	2013	2014	2015	2016
+6,015	+12,462	+19,982	+32,864	+18,371	+15,000 (estimate)

In Italy, the production of ELTs amounts to 350.000 tonnes per year (corresponding to 38 million of tyres) and up to now about the 20% of them had been collected and sent to specific plants for material recovery. About the 50% is destined to energy recovery, while the 25% to uncontrolled circuits in order to drop out of the grid.

Ministerial decision 82/2011 imposes to participant producers and importers the duty to restore the 25% of the number of tyres sold during

(28) www.ritiropfu.it/.

FY2010. The final objective of this Italian source of law is to intercept (starting from 2013) the 100% of ELTs, in order to eliminate uncontrolled and abusive flows that represent a huge damage both for the environment and the landscape and a considerable risk for citizens in case of fire. In addition, it allows ELTs complete collection and restoration, thus managing the environmental contribution associated to new tyres purchase, which is checkable and trackable in each of its steps through specific (permanently unincorporated) denominations at the invoice. Environmental contribution has as main and unique function to cover all system's direct and indirect collection, transport and treatment costs. This it is effective and efficient ELT's management that guarantees to both society and territory benefits and advantages, such as:

- struggle against speculations and illegal practices;
- struggle against illicit and uncontrolled ELT landfills, reducing also recovery costs of contaminated areas, that have a negative impact on citizens;
- risks reduction of uncontrolled fires of illegal ELT depositories. These blazes are usually indomitable and cause the dispersion of both harmful substances in the air and particulate matter in the soil;
- creation of a new industrial system and promotion of reuse economy that would lead to economic development and new employment possibilities.

Among Ecopneus' objectives, there are those about the ELTs free collection from all tyre specialists over the entire national territory (that thus generate ELTs) through qualified collectors, in order to reach the aim fixed by the source of law. In this way, there would be a relevant flow of material to work for many operators, starting from tyres specialists, to collection/transport and storage firms. All of this will open different downstream possibilities and create an incentive to regularity at every stage.

Thanks to the direct relationship with tyre dealers, Ecopneus prevents the flow and stock of ELTs in towns' landfills. Environmental con-

ENVIRONMENTAL CONTRIBUTION PER VEHICLES

Class Vehicles	Weights min-max (in kg)	Environmental contribution (euros/pneus)
A Scooter and small motorbike (moped, scooter, motorbike and three-wheeler van)	A1 (2-8)	1,50
B Motorized vehicles and their trailers (cars, motorcars with trailer and mixed transportation, roulottes)	B1 (6-18)	3,00
C Truck, bus (tractor trailer, articulated lorry, articulated vehicle, truck, etc)	C1 (20-40)	12,10
	C2 (41-70)	23,50
D Tractor, operating machinery, industrial machinery, (tractor, excavator, digger, etc)	D0 (<4)	0,90
	D1 (4-20)	4,00
	D2 (21-40)	9,80
	D3 (41-70)	18,80
	D4 (71-110)	29,00
	D5 (111-190)	55,00
	D6 (191-300)	120,00
	D7 (beyond 301)	326,00

tribution is not a new tax required to citizens, but its function is for paying ELT treatment procedure. It is included in new tyres' purchase and assembly price and it is due to recovery costs that will be faced at the end of their life for restoration. Thus, in every fiscal document for tyres trade environmental contribution is always visible and valuable. It is important to distinguish ELT and a tyre that is going through a procedure of reconstruction. In fact, the former would deal with an extraordinary maintenance that will lengthen its life and new purchasers will support the costs of this process. Once the restored tyre is defined, as at the end of its life (ELT), it will face the process described above using the environmental contribution obtained by the first buyer.

The Ministry of the Environment defines the amount of the contribution every year, based on costs estimation defined by producers and importers or by their associated enterprises, according to different tyres typologies and to weight categories.

The main focus is on the fact that Ecopneus is a non-profit compa-

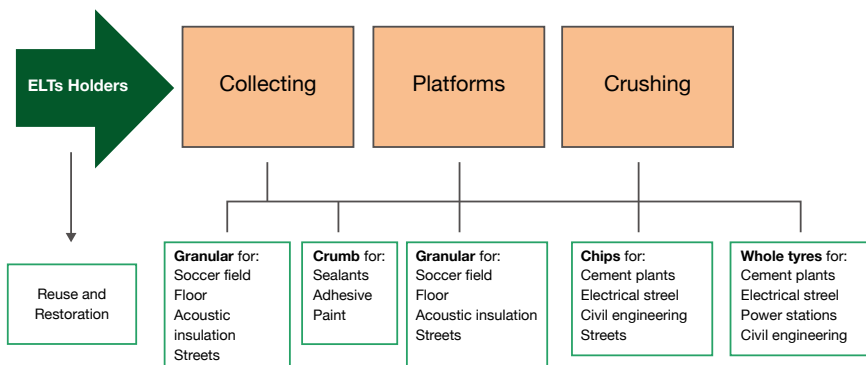
ny and therefore environmental contribution covers all costs for ELTs collection from tyres specialists, their transportation to specific plants, and their restoration treatment. Thus, surpluses from a resource management model like this will not represent economic advantages for shareholders; instead, it is transferred as resource for the following year and the 30% of these resources will be used in operations for the restoration of these materials from old stocks along all national territory.

Strict controls and detailed in information accountability give the certainty of the correct management of ELTs. In addition, the existence of heavy sanction for producers (controllo forza dell'ordine) helps the ministry of the environment and of Territory and Sea Protection to be sure that every producer will recover 100% of the share of its responsibility.

This company's mission is oriented to:

- identify where all wastes of pneumatic tyres are generated. It is possible to determine where waste is generated by mapping all tyre dealers, service stations, garages and so on;
- optimize the logistic path of the system. Ecopneus guarantees that the picking up of ELTs and their transport to storage and recovery centres – fundamental step – works in an integrated and efficient way;
- guarantee a constant support with all operators: the ELTs collection must be constant and spread in all national territory to support the local economy and to have a positive effect on national one;
- Oromote new uses for ELTs: Ecopneus promotes R&D for applications and markets that can take advantage of materials derived from ELTs. This company deals also with the diffusion of correct information with the objective to enlarge the use possibilities, both in known sectors and in innovative applications;
- realize monitoring and auditing. It is extremely important to Ecopneus following continuously ELTs flow for avoiding their dispersion in illegal channels; therefore, it makes clear every step of its system and favours a correct auditing.

The entire system is financed by an environmental contribution that every tyres buyer pays acquiring new tyres (proportioned value for every type of tyre, basing on its wage) and it is exclusively used to ensure the correct management of ELTs substituted by new ones. The company adopted an innovative management model, using and coordinating a net of qualified companies that deal with collection and the ELTs conferment to centres specialised/skilled in the restoration. All of this is for ensuring the respect of environmental standards and the best service at least costs.



The benefits from Ecopneus’ system, coming from transparency both to citizens and to operators of tyres sector, are:

- in favour of consumers: environmental contribution that covers ELT management costs denominated transparently in the invoice. Ecopneus gives the certainty that the entire process is realized in an economically efficient way;
- in favour to tyres specialists: Ecopneus monitors the whole system in order to avoid speculations and the application of illicit solutions, guaranteeing an efficient, precise and uniform service over all national territory, ensuring a high level of legal accuracy;
- in favour to all operators in the recovery sector: Ecopneus guarantees a constant flow of waste material to be treated and a help in the development of new applications also cooperating with University and Research Centres.

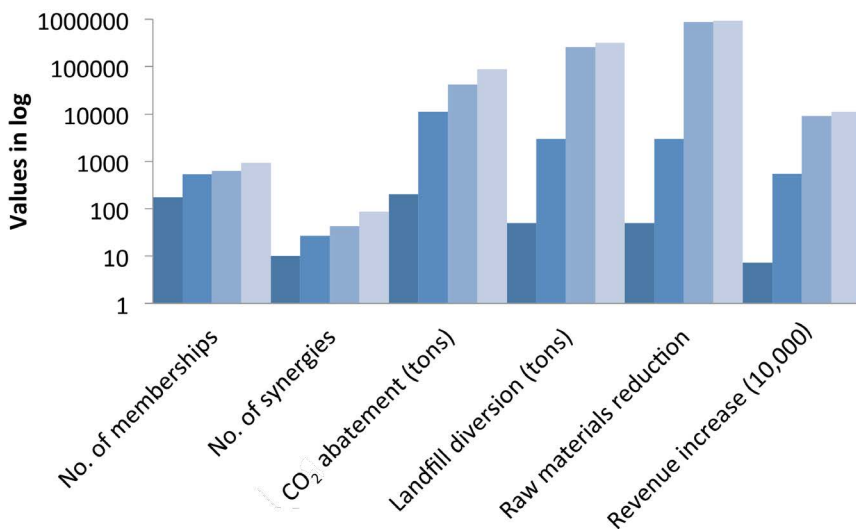
3.3 ECO-INDUSTRIAL PARKS (EIPS): A PROMISING SOLUTION... BUT NEEDS GOOD CHEMISTRY

Felipe Bastarrica, Carlo Cerruti

At face value, the idea of an Eco-Industrial Park is straightforward, as it involves firms in a region cooperating to produce synergies among their operations and match inputs and outputs in order to reduce costs, resource use, waste and emission impacts. This form of “industrial symbiosis” is often compared to an ecosystem in which different species of enterprise share nutrients or pass them down along the food chain. While this is a compelling image, a different analogy is perhaps needed to capture the complexity of this industrial organization. When two or more firms interact, they behave in a manner resembling a chemical reaction: they combine reagents to give a product (e.g. releasing energy or, in the case of companies, generating revenue) and some residue in the form of waste and emissions. A reaction requires some amount of activation energy and, to be considered worth it while, should be exergonic, that is it should release more energy that it took to kick-start it. The reasoning behind EIPs is to find reagents that are highly reactive to one another, that is to locate firms with compatible inputs, outputs and procedures that would allow them to operate jointly in order to generate more products (chiefly revenue, but potentially also knowledge, job positions and other socioeconomic goods) than they would if they were to act separately, as well as reduce negative externalities (read: adverse impacts) on the local environment and communities. This article will explore the main features of Industrial Symbiosis, and EIPs in particular, outlining the benefits promised by their formations as well as their range of application. It will also cover some of the suggestions and concerns raised in the relevant literature: is the cost in terms of organization and investment (the aforementioned activation energy) feasible for firms looking into integration? Given complementary production chains, will the reaction be exergonic? Is the process spontaneous, or can it be favoured and expedited by local or national authorities, or even private consultants acting as catalysts?

EIPs could provide a silver bullet of sorts, addressing a number of issues through a replicable form of industrial organisation. Through the sharing of transportation and stocking facilities and the implementation of industrial symbiosis, firms participating in an EIP would achieve rates of factor efficiency and waste reduction otherwise inaccessible if they were to operate in isolation. If they were to operate effectively, the benefits of creating an IS network would be twofold: an increase in economic performance (in terms of revenue and potentially job creation) and a reduction in material impacts. In a best-case scenario, firms involved might achieve a degree of absolute decoupling, i.e. an increase in efficiency greater than economic growth, which would lead to a net reduction in raw material use and emissions. Spearheaded by initial success, EIP projects attracted attention as well as criticism, mainly regarding the possibility of expanding the initial instances of integration in the absence of the quite specific conditions that allowed their inception, namely close relations between managers, the presence of a recognised industry leader, mutual trust between firm representatives, sharing of information and best practices, opportunity for technical improvement and normative pressure from local or national legislation (e.g. strictly sanctioned limits on emissions). Eco-Industrial Parks have been introduced on the international stage through the notable example of the Danish municipality of Kalundborg, which received extensive coverage in academic and business literature (see e.g. Gertler, 1995). They are first and foremost a form of organisation between firms developed in the framework of Industrial Symbiosis, in which “traditionally separate industries [engage] in collective approach to competitive advantage involving physical exchange of materials, energy, water, and/or by-products” (Chertow, 2000). Crucial in this approach is the collaboration between actors in the region aimed at leveraging synergistic possibilities offered by geographic proximity. After gaining traction amongst proponents of sustainable production and Industrial Ecology in particular, several attempts have been made in implementing the EIP solution to existing and prospective industri-

AN EIP IN FIGURES: TIANJIN ECONOMIC AND TECHNOLOGICAL DEVELOPMENT AREA (TEDA)



Source: adapted from Lei S., Bing Y., 2014

al clusters in order to address issues of resource use and waste generation. A non-exhaustive account includes the Humber project in the UK (part of the National IS Programme), the Paracambi and Santa Cruz initiatives in Brazil (under the umbrella of the Rio de Janeiro state ECOPOLO), the project for a Synergy Park in the Brisbane area of Queensland, Australia, and a pilot project launched by the Danish State Energy Agency in Avedøre Holme. Of the various initiatives, most have been met with mixed success, some did not pass the planning phase while others were discontinued after some years of trial (Roberts, 2004; Veiga, Magrini, 2008).

Deferring considerations of anecdotal evidence, if an Eco-Industrial Park were to perform optimally it would provide several benefits. First and foremost, it would allow the firms themselves to address the issues associated with externalities they produce. “Externalities” were formalised by A. Pigou as costs or benefits (not necessarily expressed

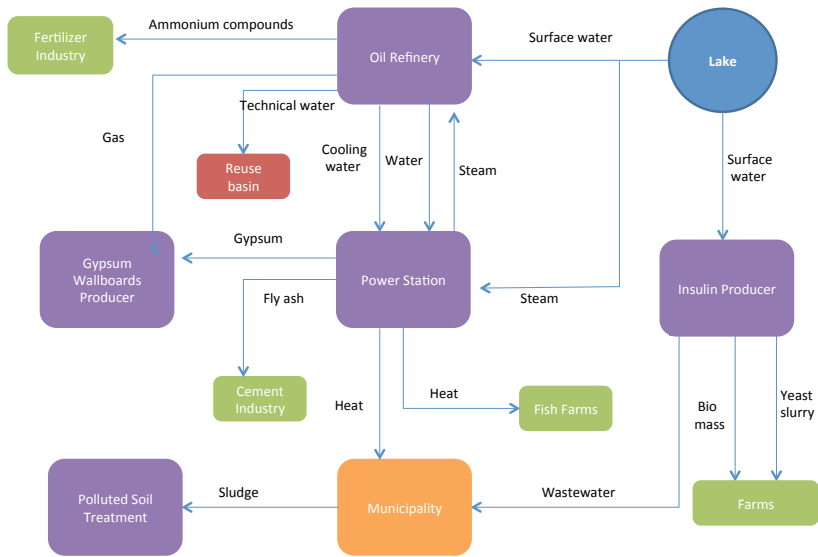
in monetary terms) related to an economic activity of transaction that affect otherwise uninvolved parties, usually generating inefficiencies in unregulated markets. In the case of industrial companies, these take the form of socioeconomic and environmental impacts that affect the social welfare of neighbouring communities as well as other businesses that do not otherwise take part in the operations of relevant firms. Discharge of pollutants through various pathways (from groundwater to food chains), deterioration of environmental services, overloading and consequent reduction of an ecosystem's assimilative capacity, but also changes in social cohesion, research and innovation (also known as knowledge spillover, when not restricted by patenting and intellectual property) are all "producer-to-producer" or "producer-to-consumer" externalities.

In order to eliminate or internalise the less desirable impacts, firms can engage in collusion or merging, which would lead to the companies to act not as separate entities but as a single enterprise producing different commodities, thus restoring significant feedbacks on impacts along with efficiency conditions. This option is often dismissed in environmental economics literature, as it is fundamentally driven by bottom-line considerations and "collusion to maximise joint profits will only occur if both firms believe that their share of maximised joint profits will be larger than the profits earned separately" (Perman, et al., 2003, p. 140).

This is where EIPs come in: their establishment is meant to bring producers to collaborate in managing environmental and resources issues including energy, water and materials, so as to accrue "a collective benefit that is greater than the sum of the individual benefits each company would have realised if it optimised its individual performance only." (Mirata, 2004). Firms operate by accessing and managing stocks (reserves, usually physical, of a given asset, that can accumulate or be depleted over time) and flows (i.e. dynamic variables, such as investment or emission rates, that can change or affect stocks). Such stocks and flows include capital, input of production factors and output of goods and services; the industrial ecology approach extends

these to include natural assets and environmental impacts (e.g. emissions and waste) in the firms' operations. Participants to an EIP then operate as members of an ecosystem, in which the outputs of a company become the inputs for one downstream, that is at the next step in the production chain. This crucial reliance on flows is not devoid of issues (more on this later), but it enables firms to accrue substantial benefits by reducing the need for raw materials and semi-finished products while transforming waste from a purely negative cash flow to a source of revenues capable of partially offsetting the cost of provisioning and managing waste; in other words a rebate.

The issue (and business) of waste management and resource supply is very much a matter of scope: from the perspective of a single firm, raw materials and emissions are exogenous and extraneous, respectively: the supply of the former is not decided by a firm's production function, while the latter does not factor in as anything except an unusable asset with, at most, an additional cost. In other words, outside the extractive industry and discounting particular contract practices, firms are price- and volume-takers when it comes to raw materials, and waste, while being a controllable variable, is almost always of no use and must simply be disposed of. However, if the scope is expanded, as with the original vision in the Kalundborg industrial district, new synergistic opportunities emerge as resources and waste are no longer considered at the level of a single firm but rather as a pool of assets shared among coordinated companies. This approach enables participants to adjust their production processes to minimize resource use and waste through solutions which are almost invariably industrial or logistical in nature, developed *ad hoc*: technical water (not fit for human consumption) can be reused in multiple successive applications, up to its final consumption; by-products from fuel refining can power generators for adjoining plants, substituting oil and coal; otherwise unused chemicals become reagents for other reactions or pre-processed raw materials (e.g. ammonium thiosulfate for fertiliser or gypsum for joint compounds used for construction with drywall) (Ehrenfeld, Gertler, 1997).



Source: adapted from Anderberg S., 2004

By combining and organizing their flows, participants reduce their use of virgin materials and minimise their recycling and disposal of waste, which is highly desirable from an ecological perspective: avoidance and reuse are in fact much more desirable than the aforementioned alternatives in terms of the mitigation and waste management hierarchies. In addition to this, and providing the strongest driver for companies to collude, is the reduction in costs granted by the reduction in material use and emissions, the latter often encouraged and reinforced by the presence of local or national legislation on environmental discharges. The use of resource in relation to economic output is described in terms of material intensity, i.e. the amount of material (normally measured in mass) needed to produce a dollar or equivalent in real value, or its inverse, material productivity. In addition to its economic relevance, this dynamic could provide a way towards a long sought-after goal of sustainable economics: absolute decoupling.

Decoupling refers, in general terms, to the separation of economic growth and environmental pressure, including resource consumption; it is measured by comparing the growth rate of economic output (on any scale from individual to global) to the rate of change in material intensity. Relative decoupling is observed when productivity increases (reducing resource use), but at a rate slower than economic expansion: the total amount of materials consumed still increases. Absolute decoupling, on the other hand, sees material intensity decreasing faster than the economy can grow, leading to the overall (absolute) resource consumption to diminish/scale down. As noted by Tim Jackson, sustained and replicable absolute decoupling is, in almost any context, only achievable through unimaginable bounds of technological improvement, but EIPs could offer a workaround: for integrally symbiotic firms, an increase in productivity and profits is not only favoured, but *conditional on* a direct reduction in material use.

The compound effect of successful symbiotic integration between firms should result, assuming optimal conditions are met, in an overall increase in Net Genuine Savings, a measurement of economic and environmental wealth which extends National Accounting to include several indicators for variations in assets (also interpreted as cash flows) that go beyond production capital to capture a more comprehensive measure of wealth accumulation (Hamilton, 2000). Thus, genuine savings include investments in human capital, environmental services, renewable and exhaustible resources and damage from emissions, restoration and protection of natural assets. Firms colluding in an EIP would be mainly concerned with emissions, resources and revenues, and symbiotic initiatives would produce beneficial swings in all three areas. It is worth restating that the crucial role played by private actors introduces an additional clause in the stipulation: when it comes to Genuine Savings, scholars distinguish between weak and strong sustainability by either allowing or disallowing any of the addends in the equation to be negative, with the common condition that the overall trend of savings is non-decreasing. Strong proponents of ecology would not accept a negative change in environmental assets

or even resource stocks, but for firms, the one factor that must be positive is revenues: even in the foundational experience of Kalundborg, “companies agreed that any activity that would be implemented had to be at least cost neutral; in other words, companies did not want to invest in activities without being certain that return on investment would be guaranteed, and would not result in additional operational costs” (Boons, Janssen, 2004, p. 241).

The idea that geographic clustering opens up the world of “Economies of Scale” (a fancy term economists use to say the more you produce the cheaper it is to do so) to small companies dates back to Marshall in the late 19th century. Clustering scale provides a wide set of benefits including but not restricted to economic: by-product vs raw materials, and shared services (e.g. storage, transportation, value chain; organisational: pooling human resources (e.g. security, maintenance, IT, accounting); technological: spillover effects and innovation (the Silicon Valley effect); political: bargaining power (e.g. local government and suppliers).

Assuming EIPs are indeed the silver bullet of sustainable industrial organisation some argue to be, what role should governments and policy-makers play in their development? On the one hand, lead examples like Kalundborg and Styria have been developed spontaneously. On the other, evidence supports companies locating in parks or planned areas when they believe they will be close to suppliers and consumers. Empirical evidence for UK suggests that public policy aimed at the creation of new formal networks is less efficient at generating cooperation than intervention in already existing informal networks (Huggins, 2001), and an empirical study of public sector led EIPs in the USA vs private sector led EIPs in the Netherlands found the latter to be more successful in terms of participation and cooperation (Heeres, et al., 2004).

Despite the fact that academic literature has yet to provide a satisfactory answer to the question of whether EIPs can be deliberately created or not, evidence leans towards a focus on the enhancement of natural self-organizing conditions rather than publicly planning new EIPs (Lowe, 1997).

3.3.1 Eco Industrial Parks, opportunities for expansions and obstacles to implementation

The question begs to be asked: are EIPs a discrete, situational solution conjured by particularly favourable conditions to address some firm-to-firm externality (a “happy accident,” as American painter Bob Ross would have it) or can their implementation be extended to become a new paradigm for sustainable industrial organisation? The literature has stressed that for a EIP plan to come to fruition, whether it is initiated by local firms or by a government agency, several conditions need to be met at least to a degree. These can be roughly divided in technical and strategic circumstances. The former includes accurate information on the industrial area’s stocks and flows, technical feasibility, especially in terms of compatibility between waste and input flows of the different firms and, crucially, a clear opportunity for economic improvement, both in terms of increased profitability of operations and in reduced waste management and resource supply costs and potential shocks. Strategic or organisational requirements boil down to motivation and organisation on the part of managers and industry leaders, an existing relationship of trust and cooperation between participating firms (a catalyst, in the form of either a leading figure from a local business or a public agent, can greatly bolster this and may be indispensable), the presence of regulatory standards to provide both a benchmark and a direct incentive for private initiatives (as was the case for Kalundborg) and awareness and participation from the local community.

So how do these conditions factor in when evaluating the potential for developing EIPs? Here again a distinction should be made, this time between well-established firm conglomerations being approached for an EIP or looking to form one and industrial districts that are yet to develop and are meant to be formed under the principles of Industrial Symbiosis right out of the gates. The latter are more likely to overcome technical hurdles as they do not need to invest in rebuilding their infrastructure, rerouting their utility lines and retraining their

workforce in order to implement changes: symbiosis will be built in from the start. New plants will, however, lack the organisational connective tissue consisting of interpersonal relations between managers, established practices between co-workers, long-lived relations with communities and their representatives and accumulated know-how, requiring these to be fed in by planners and locally embedded agents until they take hold. Existing enterprises, on the other hand, can use their existing relations and human capital to facilitate or even autonomously start an integration process (both processes have occurred in several instances), but they lack the first mover advantage in terms of physical adaptation: in fact, the initial investments required for a shift towards industrial symbiosis may render the participation to an EIP unattractive to potential members, especially if the returns are not immediately evident.

The distinction between firm behaviour and conditions is relevant because it gives an insight into the opportunities to expand the EIP agreement to other industrial realities and understand the challenges that existing or prospective EIPs are facing. To give just one example of the latter for each group of requirements (strategic and technical), as firms merge and expand their business (often across national boundaries), decisions concerning them are taken away from the local area of activity; this creates an additional layer between site managers and executives, and the latter may not be as willing to engage in integration with different companies, especially in light of the growing tendency of firms to focus on their core business while outsourcing the rest, which makes them sensitive to reliance on external actors (Boons, Janssen, 2004, p. 242). Furthermore, the success of an EIP might be strongly dependent on the compatibility between the plants' flows, which can be tested by shocks in supply and demand on any part of the production chain (Ibid.).

A compelling case for the applicability of EIPs as an industrial paradigm comes from China where, according to researchers at the Beijing School of Environment, concerted efforts have been made to implement Industrial Symbiosis as the “mainstream strategy [towards] a

circular economy” (Lei, Bing, 2014, p. 6325). This led to the deployment of a regulatory framework including standards and guidelines and, in 2014, 23 EIPs have been approved for operation. In order to facilitate technical integration, specific synergies were developed, including recycling iron-containing sludge, recycling cellulose through a special pulp, and a recycling to recover copper from wastewater. The authors report important reductions in several waste and resource use indicators achieved in the Fuzhou Economic and Technological Development Area (FEDA): “The industrial water that was consumed in 2012 was 0.21 million tons, decreasing by 94% compared with the maximum 3.48 million tons in 2006, wastewater emissions also decreased by 96% [...] solid wastes decreased from 3,785 tons in 2005 to 1,727 tons in 2012, down 46.0% in total, hazardous waste generation decreased from 1,110 tons in 2005 to only 7.65 tons in 2012.”

At face value, EIPS do constitute a very promising solution to achieve sustainability in the sectors of heavy industry and manufacturing, and are especially appealing for their potential to integrate plants with high environmental impact, for which there would be few alternative solutions outside decommissioning, but they require careful action on the part of managers, local authority and planners in order to guarantee their effectiveness and stability. Several examples of success, as well as some downfalls, attracted the attention of government agencies and the academia around the world, and the extensive studies that followed seem to point to some key factors that would go a long way in ensuring the EIP model produces positive results: public agencies are often needed as an enabler (either through regulation or financial aid, or both) but should avoid overbearing on a project that should proceed spontaneously (Lei, Bing, 2014, p. 6330); participants need ample room for experimentation and research, in order to capture opportunities to strengthen their integration, develop best practices and share know-how; path dependency, in particular technical specialization and clustering, should be considered carefully, as it may render the firms involved more susceptible to demand shocks (Boons, Janssen, 2004) and technological shifts; finally, an EIP cannot exist outside the social

reality they are embedded in, including the communities involved by their operations, affected impacts (however minimized) and reliant on them for job security and expanded economic opportunity.

SFRIDOO, THE DIGITAL SERVICE FOR THE CIRCULAR ECONOMY

Andrea Cavagna

According to the report “No Time to Waste – Global Waste Primer” prepared by Bank of America, Merrill Lynch, 11 billion tons of waste are produced every year, only 25% is recycled and the remaining is destined for landfill. The current consumption habits of the current company are such that products are quickly outdated, even before they have finished their useful life. This behavior dramatically increases waste production as well as requiring a constant flow of virgin raw materials to produce new goods. The solution is not to consume less, but to consume differently. When we buy a new cell phone we are not interested in the object itself but in its performance, so why not focus on buying only these? Why not circulate circular systems that will allow you to return the old product and replace it with a new one? The companies would then be encouraged to produce rebuilt, easy-to-remove objects in order to recover their raw materials. Who better than the same companies can know how the object they produced has been made?

Introducing circular economy mechanisms into consolidated systems seems difficult but always develops Win-Win relationships where all involved parties have advantages and act in symbiosis with each other.

The team of young architects composed by Marco Battaglia, Andrea Cavagna and Mario Lazzaroni has decided to contribute to the theme of the circular economy by creating an innovative startup: Sfridoo.

Sfridoo aims to reduce demand for raw materials, clearing waste production and providing the best business matchmaking service for sharing.

The genealogy of corporate naming comes from the Italian word “sfrido” included in the Italian technical vocabulary: sfrido, is the waste of material, which proceeds by a cutting process. It is a wood batch that ends up laying a floor, is the slab advanced by cutting a marmist, is the half brick pallet advancing from the construction of a wall.

This is how the Sfridoo platform is born: the first online marketplace developed entirely in Italy for the sale of company production waste. Based on the principles of the circular economy, Sfridoo aims to reduce demand for raw materials and to zero the production of waste. Companies can sign up for free at the platform and publish their waste material to share it with other companies, who can use it as raw material. The company will be able to view all the ads on the platform and look for the material of its own

interest. It is possible to determine the distance of the product through the dedicated geolocation service, thus optimizing transport costs.

To purchase the material you can contact the company directly through the chat room and conclude the sale.

Sfridoo offers multiple benefits for both sellers and buyers: finding low-cost materials, managing your online store, selling and buying stock surpluses at the best price, expanding your customer base, as well as user safety certified and reduced disposal costs. Sfridoo intends to become the Italian reference point for all companies wishing to become part of the circular economic model, offering sustainable and innovative raw materials.

There is a revolution in progress and Sfridoo wants to contribute to this paradigm shift.

We are waiting for you at www.sfridoo.com.

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4. EDUCATING TO SUSTAINABILITY BETWEEN GREEN ECONOMY AND GREEN SOCIETY⁽²⁹⁾

Paolo Tamburini

The thesis I will try to argue is the following: green economy, green society and education to sustainability are three innovation labs, three cultural, social and economic processes closely linked and complementary. They share science, ethics of responsibility, open organization and weighted action.

4.1 THE NEW ECONOMY OF THE 21ST CENTURY

The environmental, social and economic crises emerged in the last decades have stimulated strategies, methodologies and applications going beyond the common economic conception diffused since the first industrial revolution to date.

We do not know how the economy of the 21st century will be called. It is possible that it will become a mix and something more than the sum of green economy, circular economy, low carbon economy, civil economy, light economy, smart cities, knowledge economy, corporate social responsibility, sharing economy, etc.

At the moment, “green economy” is the world’s most well-known expression and for this reason it has to be used to indicate not the single doctrine and methodology, but the entire constellation mentioned above.

Trying to give a definition to this complex idea and practice, we could point to a new enterprise strategy and management model, and a set of support tools promoting:

- process and product innovation (life cycle, eco-design, eco-efficiency, material regeneration);

(29) Synthesis of author’s contribution to the Festival of Creative Sustainability, Ravenna, September 22, 2017.

- a technological and organizational innovation, in the logic of environmental, economic, social, and institutional sustainability;
- relationships between enterprises (open, collaborative, networked, linked to the territory), citizens and consumers (new lifestyles and consumption), territory, institutions (new governance).**(30)**

Considering the prospects of the so-called “happy decrease” and “technocracy” not desirable, ideological and too simplified, green economy (and green society) can be seen as a way out of the economic, social and environmental (for the climate change) crisis. Something beyond the traditional economy (and society), promoting:

- new eco-efficient and circular production models
- resocialization of the productive sphere and new “open” organizations
- internalization of the limit and socio-environmental quality in production processes.

So, is it possible to re-socialize the productive sphere? To reconcile solidarity and competition? The new ideas and economic and social practices make us consider this possibility and change of paradigm. In fact, we are witnessing the emergence of new production and consumption models, business cultures, forms of social, ethical and practical cooperation, knowledge-sharing practices (the “open source” logic) unknown and unpredictable until recently. When a company works at the service of a community – according to Carlo Formenti**(31)** – the economy is partially absorbed within a wider social relationship. The company builds sociality and trust together with its customers/partners. Producers and consumers’ roles change. The economy may no longer be a zero-sum game (one wins, the other loses), but a virtuous game (we win together).

(30) Multiple Authors, *Wikibook green economy*, Emilia-Romagna Region 2011 (www.regione.emilia-romagna.it/infeas/documenti/pubblicazioni/quaderni/wikibook-green-economy).

(31) Formenti C., *Mercanti di futuro*, Einaudi, Torino 2002.

4.2 TOWARDS THE GREEN SOCIETY

If we approach the social development dynamics, starting from the economy, we need new interpretations of the phenomena. In this sense, Manuel Castells's analysis of identities and conflicts in the age of globalization and digitization(32) can be particularly helpful. He describes three prevalent profiles of the social identities:

- *legitimizing identities*: they rationalize the domain on social actors;
- *resistant identities*: the enclave against the system, in defensive position;
- *project identities*: the social actors build a new identity that redefines their position in society, and thus transforms it into the whole.

The social identity evolving in the “project” sense is the category closest to the nascent green society spoken, theme of the recent homonymous book by Vittorio Cogliati Dezza(33) and of that on Emilia-Romagna *Civic Cities*.(34)

It is difficult to give an univocal definition of a process in becoming. Cogliati Dezza proposes the following: “The whole set of civic and social attitudes shared by groups of citizens moving towards a society and economy friendly to the environment and the future – living with less matter, less energy and fewer kilometers – constituting a new community dimension.”

The more than one hundred good practices analyzed and categorized in the above-mentioned publication have also in common the ability to create:

- communities: on specific and limited objectives, but in a transversal

(32) Castells M., *The Power of Identity*, Wiley-Blackwell, London 2003.

(33) Cogliati Dezza V. (edited by), *Alla scoperta della Green Society*, Edizioni Ambiente, Milano 2017.

(34) Multiple Authors, *Civil Cities*, Emilia-Romagna Region, 2014 (www.regione.emilia-romagna.it/inefas/documenti/pubblicazioni/brenda/cittacivili).

and intersectoral perspective (in the fields of waste, mobility, tourism, agriculture...);

- social innovation: responsible change, participation, social and territorial cohesion;
- new lifestyles: emerging needs and desires creating new markets and new ways of consuming that go beyond the “use-dispose” model in favor of sharing, exchange and reuse.

The good practices collected by Legambiente and those described in the *Civil Cities* of Emilia-Romagna are very important but they are not yet systematic and consolidated. It follows that the sustainable, solidarity, intercultural communities are often born to self-organize, but to growth they need to be cultivated, educated, supported (a long-term work for political, social, educational, cultural, business, religious organizations).

4.3 EDUCATING TO SUSTAINABILITY (WHY AND HOW)

About the processes of cultural and social change related to the great world issues, Ulrich Beck’s theory is enlightening.⁽³⁵⁾ The rules and imperatives that led past actions – in Beck’s opinion – are revised starting from the image of a future that threatens us. “The risk of climate change, from an announced catastrophe can turn into the awareness of a global and cosmopolitan dimension (...); through cultural work it can emancipate and produce a better (sustainable) world.”

This is the task of education to sustainability, a process that not only conveys concepts, but also connects knowledge (of systems, their components and relationships) in a recursive cycle, with the awareness, ethics of responsibility, participation and action. The aim is to encourage a positive coherence and feedback system between these different and complementary dimensions. A complex, non-linear link, which takes long time.

⁽³⁵⁾ Beck U., *The Metamorphosis of the World*, Polity, Cambridge 2017.

An awareness that we find also in the Decade of Education for Sustainability 2005/2014**(36)** documents: “The development of a sustainable society should be understood as a continuous learning process.”

Those promoted by education to sustainability – as reported in the final Document of the UNESCO Decade in Italy, dedicated to Education to Sustainability**(37)** – are skills such as:

- the ability to consider facts and events in a systemic and integrated way;
- the ability to recognize and appreciate diversity, both cultural and biological;
- the ability to recognize the intrinsic uncertainty of complex systems and to act paying attention to the unexpected;
- the ability to imagine the future and be prepared to build it;
- the ability to face complexity and compare values;
- the ability to think in a critical and transformative way;
- the ability to act responsibly, to collaborate and participate.

These skills – as highlighted by the researchers Michela Mayer and Giovanni Borgarello – are not built just through the transmission. They are “in-action skills” to be acquired by learning from experience in significant situations. Not by chance, today it is believed that educational activity has to be developed in “formal” (transversal to the programs of educational institutions of every order and degree), “non-formal” (through the educational agencies of the territory) and “informal” (through old and new media) setting. A multi-mode, close to people’s needs and lives, more transformative than transmitting.

(36) United Nations Economic Commission for Europe (UNECE) in documents for UNESCO DESS 2005/2014.

(37) Final Document of UNESCO Decade in Italy dedicated to Education for Sustainability (2014).

4.4 CONVERGING CULTURE AND ACTION

I would like to draw some provisional conclusions from the above-highlighted elements and from the connection between green economy, green society and educational processes.

There is an ongoing, fruitful convergence process between green economy, green society and education to sustainability.**(38)** They have many elements in common, they interact reciprocally in a game where everyone enjoys benefits.

For example, the productive world and innovative and sustainable social relationships are becoming the environment where education takes place, where you can learn from the experience and sustainable good practices concretely realized. For example, the enterprise (green, digital, open...) produces also knowledge, sociality and trust. For example, the green lifestyles of a local community stimulate the development of new products and services (and the consumer also becomes a producer).

So, a logic of co-evolution and co-determination is developing – between green economy, green society and education to sustainability. Shortcuts and simplifications should be avoided. If lifelong education can play a connection role, acting as a transversal element and a connection structure (between green economy and green society), a mistake to avoid is to assign to green economy, rather than to green society, the role of exclusive driver, able to determine every phenomenon. There are no sectors that drag all the rest, neither the digital technology that has this claim. A multi-vision, an ecology of ideas and actions is better than the unique model.

Currently, the opportunity is that to emancipate themselves from the paralyzing catastrophism (the rhetoric of “ever worse”) and from the technocracy (the illusion that everything is possible), in favor of a

(38) Tamburini P., *Eco-knowledge for Sustainability*, Quaderno Arpae 2016 (www.regione.emilia-romagna.it/infeas/documenti/pubblicazioni/depliant/ecosa-peri-per-la-sostenibilita).

possible and necessary sustainability. About that, to conclude, I would like to remember the last words of hope, lucid and passionate, simple and deep, written by the great and cosmopolitan European intellectual, Ulrich Beck: “Sustainability can be established today because it is convenient for everyone, even for those who are against it, and so we will have a better environment, society, businesses and organizations.”

5. EDUCATING TO THE CIRCULAR ECONOMY

Paolo Tamburini

*Regeneration is the heart of life, the guiding
principle of every sustainable society
V. Shiva*

5.1 THE GENESIS OF AN IDEA THAT BECOMES A CULTURAL, POLITICAL AND ECONOMIC STRATEGY

The circular economy is a strong key idea, a paradigm shift from the predominant economic development model in recent centuries that can inspire and guide the choices of businesses, organizations and citizens.

Great thanks to the Foundation created by Ellen MacArthur in the last decade, but so many environmentalists and economists have been involved since the '60s including Barry Commoner (the circle to close), Nicholas Georgescu Roegen, Kenneth E. Boulding, Herman Daly, Amory Lovins, Laura Conti, Mercedes Bresso, Ernst U. Von Weizsacker, Jeremy Rifkin, Gunter Pauli...

Today, it is possible, as a result of the effects of climate change, to bring about a new convergence between ecology, economy, new digital technologies, expectations and social and cultural needs. Green economy and sharing economy, smart cities and resilient cities.

If linear and dissipative economic models based on energy sources derived from oil and the irreversible production of raw materials and energy have prevailed so far, the circular economy is proposed as a resilient, thought-out and managed economic system in order to regenerate, guaranteeing the reproducibility and availability of natural resources over time.

The circular economy is a model, which is based on the principle of "bioimitation," which models the economic process on the functioning of living systems, their open and non-linear nature, which structures

and organizes the production of goods and services such as a “regenerative cycle” tend to not leave any scraps but to re-enter everything in circles.

Of the utmost importance for the circular economy are therefore designing and designing products and services, life cycle analysis in terms of sustainability, building long-term assets and preventing waste. To replace more and more the individual production and purchase of objects in favor of equivalent services (sharing economy).

A “double pilot” strategy, as Edgar Morin says, leads us to “follow and guide nature.”

Finally, the circular economy, along with a new business strategy and new management, requires the formation of new consumers and the adoption of new lifestyles, hence an investment in culture and education for all citizenship, also throughout the life cycle.

5.2 THE EDUCATIONAL, COMMUNICATIVE AND PARTICIPATIVE NEEDS OF THE CIRCULAR ECONOMY

The UN Economic Commission for Europe (UNECE) documents in the DESS Unesco 2005/2014 say that “the development of a sustainable society should be seen as a continuous learning process that explores difficult topics and choices where responses and appropriate solutions could change with the growth of experience, which requires education that provides critical capacity, greater awareness and strength to explore new visions and concepts and to develop new methods and tools.”

The final UNESCO Decade document on Sustainability Education in Italy indicates some of the “key competences” that are deemed to be necessary:

- know how to look at events and events in a systemic and integrated manner;
- know how to recognize and appreciate diversity, both cultural and biological;
- know how to recognize intrinsic uncertainty about complex systems

and know how to act with the unexpected attention; imagine the future and prepare to build it;

- address complexity and compare values; think in a critical and transformative way;
- act responsibly; collaborate and participate.

The competences indicated have a peculiarity, according to researchers Giovanni Borgarello and Michela Mayer, are not built through the single transmission, they are “skills-in-action” that they acquire through learning from experience in significant situations. It is therefore necessary to design and set up educational contexts and paths that will make people protagonist and active.

The epistemological assumptions, methodologies, tools developed and experimented over the last twenty years in the field of education to sustainability appear consistent with the circular economy and its propedeutics. The dominant paradigm of elaborated and transmitted *ex cathedra* for separate blocks of disciplines shares with the linear economy the same reductive and penalizing logic for the functioning of living systems. Conversely, education for sustainability is proposed as a pro-active and pro-active research-action of the learning process, and is one of the engines of “evolutionary competence” indispensable to the human species and the planet earth.

The key concepts that underpin the educational goals of education in the circular economy include: the limit of resources and their origin, the resilience of natural, man-made and social ecosystems; production processes and product innovation (recycling, regeneration and reuse processes), conscious and sustainable consumption education through tools to analyze the degree of sustainability of products and services.

In other words: circularity as an interpretative key to the sustainability of our way of producing and enjoying goods and services by polluting and dissipating as little as possible, the degree of resilience, reuse and sharing of the resources and objects of our everyday life. And in that sense we should abandon the concept of “consumer” typically of the

dissipative and linear economy by defining otherwise the new role that we can play in social and economic systems.

Like all sustainable development policies, the circular economy also needs a unified and effective communication and education strategy, using appropriately and synergistically, and differentiated with respect to different objectives and targets, all communication, educational, educational tools and participative (or re-invent) available. In particular, an approach is deemed necessary:

- systemic and interdisciplinary: to understand the complexity of relationships between phenomena;
- relational and participative: to facilitate the encounter and the alliance between producers and consumers;
- pedagogical and training: to integrate “formal,” “non-formal” and “informal” education;
- communicative: for a simple and engaging language that generates desirability, but not trivial or simplistic;
- experimental: to put the actors of the territory at work (measuring the results).

5.3 THE CIRCULAR ECONOMY IN THE EMILIA-ROMAGNA REGION

The European Union has in recent years referred to its strategic documents for the circular economy under the program for a zero waste Europe (2014) and in 2016 launched a package for the circular economy by putting in place all the instruments which it has to turn its economy into a key to sustainability, thus sending a clear signal to economic operators, national, regional and local decision-makers, to citizens.

But it is also at the territorial levels and in their industrial districts that play the challenge of the circular economy. In this sense, Emilia-Romagna has a specific law for the promotion of the circular economy, L.R. n. 16/2015, proposing targets that are even more challenging than those of the European Package and Waste Directives.

The aforementioned rule has generated a waste plan based on the pre-

vention and reduction strategy at source, to reach 25% of the per capita waste production by 2020 and bring separate collection and recycling to more than 70%, together with the introduction of punctual tariffs across the country, incentives to virtuous municipalities, support for reuse centers, chain agreements with businesses and associations.

There are today the conditions for making the Region a European protagonist of the circular economy as there are a set of factors that are mutually influencing and mutually reinforcing:

- a strong economic fabric for sustainable innovation in different industries and districts (documented by Sustainable Vetrina and Green Economy Observatory, Technological Poles and Innovative Startups, from various Sector Reports);
- environmental and territorial, training and industrial policies, research and development, which is increasingly integrated, cross-sectoral and coherent with European strategies at different territorial levels;
- a wealth of non-formal education agencies (Education Centers for Sustainability: Environment, Mobility, Power, Energy, Health...) that provides schools and citizens services, which makes a system with universities and research, associations and local authorities;
- a cohesive social fabric and civic tradition that finds new forms of implementation over the last twenty years with the Agenda 21, the Time Banks, the Pact of Statutory Auditors for Clean Energy, intercultural and solidarity networks, telematic plan...

On the subject of participation, the “Permanent Forum for the Circular Economy,” provided by L.R. 16/2015, and activated by the Region through the participatory pathway “close the circle,” and the virtual square on the e-democracy platform IoPartecipo + with the aim of promoting the culture of the circular economy and allowing the various stakeholders to provide its contribution to regional action.

On education, the “Sustainable Education Program 2017/2019” should be highlighted, focusing on the goals of UN Agenda 2030. Circular Economy and Climate Change are the two key interdisciplinary

tools that transversally guide the ten areas of integrated education that the program develops over the three years, including: Sustainable Resource Management and Biodiversity, Mobility and Sustainable Energy, Nutrition and Health, Citizenship and common goods, etc.

A preview of the regional system action on education in the circular economy, which will continue throughout the three years, involving dozens of Centres of Education on Sustainability in the Territories, took place last November in Rimini – Ecomondo. Twenty operators of the Sustainability Education Centres were involved in a workshop facilitated by Paul Martinez, and a preliminary to future educational actions. In the first part (world cafés) they reflected and expounded the shared meaning of circular economy and related educational needs. In the second part they worked for groups to bring out ideas for education to the circular economy (the report of the workshop is published on the IoPartecipo + circular economy forum). It is the promising start of a new action-research.

5.4 FOR FURTHER INFORMATION

- www.ellenmacarthurfoundation.org.
- monographic number of Arpae “Ecoscienza” magazine with two large circles on the circular economy and sustainability education (www.arpae.it/dettaglio_notizia.asp?id=8598&idlivello=1504).
- The Circular Economy Forum of IOPartecipo+ (<http://partecipazione.region.emilia-romagna.it/iopartecipo/economia-circolare/chiudi-il-cerchio>).
- National Conference on Environmental Education and Sustainability at the initiative of the Ministries of Environment and Education. Rome, 22-23 November 2016. Among twelve thematic working groups, the one on the circular economy.
- The portal has been run by the Arpae Emilia-Romagna Education Department (www.regione.emilia-romagna.it/infeas) where the INFEAS Program is located and extensive documentation and materials are available.

6. APPENDIX

Questionnaire on “Circular Economy”

We are a group of students of the Master Degree in Resource Economics and Sustainable Development of the university of Bologna and cooperate on a project on the notion of Circular Economy. Our results will be published in the review *Materia Rinnovabile/Renewable Matter* and presented at Ecomondo 2017. The objective of this questionnaire is to gather information about some selected firms on the principles of circular economy.

Please, answer the following questions:

E-mail address

- 1) When was your firm founded?
- 2) Where is the legal entity of your firm?
- 3) How many full-time employees do you have?

Between 1 and 9

Between 10 and 49

Between 50 and 250

Above 250

- 4) You are selling

Products to consumers only

Products to other firms only

Services to consumers

Other: Both consumers and producers

- 5) Which activity was run by your firm during the last three years?

Specify whether it has already been completed/it is under completion/
it is planned/not planned/other

Plan for water to minimize its use and increase its reuse

Use of renewable energy

Renovation of plans to minimize energy consumption

Reduction of waste through recycle, reuse and sales to other firms

New plans of products and services to minimize materials or use of recycled materials

Use of recycled materials only

6) Average percentage of revenues employed to develop these activities in the last three years

0

Between 1% and 5%

Between 6% and 10%

Above 11%

7) Do you know the meaning of “circular economy”?

Yes, exactly

Yes, I have got an idea

No

8) Do you think your firm employs one or more principles of the “circular economy”?

Yes

No

I do not know

9) Which of these problems were incurred while implementing circular economy activities?

Insufficient human resources

Lack of skills

Complexity of administrative or legal procedures

High costs to satisfy laws and standards

High costs of materials

Difficulty in obtaining financial resources

None

Others:

10) Are you aware of funds (by the government, European Union, municipalities, counties, etc) to be allocated in order to implement circular economy activities?

I do not know, I never looked for this piece of information

I know there are, my firm used this opportunity

I know there are, but my firm never used this opportunity

I know there are, but since we know it is very difficult to be selected, we never applied for them.

Myself (or others in my firm) tried to look for them, but unsuccessfully

I am not aware of their existence

Other:

11) The level to access financial resources in order to develop circular economy activities was:

Very easy

Easy

Hard

Very hard

My firm did not use external financial resources

Other:

12) In which way did you finance the circular economy activities?

Standard bank loan

Green loan

European funds

Governmental funds

Alternative resources (for example, crowdfunding)

Self-financing

Others:

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This volume is based on the experience of the Metropolitan City of Bologna in the European CESME project on the Circular Economy for small and medium-sized businesses (SME) and the collaboration between the Metropolitan City of Bologna with the Department of Economics of the University of Bologna.

During the last decade the European Union had started elaborating the transition from a linear to a more circular economy. In particular, the European Commission presented a new circular economy package on 2 December 2015. The package contains an action plan in order to promote circular economy. It also maps a series of actions planned for the coming years and four legislative proposals on waste setting targets for landfill, reuse and recycling to be met by 2030.

To achieve these goals it is necessary for companies to follow the examples of good practices that can indicate concrete ways of applying the Circular Economy. The heart of this volume is what are the advantages of adopting the Circular Economy for Business and some significant good practices as well as explaining who are the actors in the field that can work to achieve European goals.

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