Chapter 1

PP1 Lombardy Region

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1. Overview

The selection of the regional sectors of interest was carried out considering their relevance for the regional economy and their potentiality in CE. Moreover as Lead partner Lombardy region decided to work on other PPs' sectors, in case a PP was alone to analyse a specific sector.
Currently Lombardy Region is working on all the project sectors.

Lombardy Region collected the information and data needed to identify CE opportunities thanks to a good and in-depth dialogue with the project Stakeholders, thanks to several units of the Regional Government, the Regional statistical offices, the association of the regional Chambers of Commerce, the regional environmental protection agency (ARPA) and through the important support of the technical assistance, ITIA-CNR.

In order to increase the knowledge of the regional contests, to understand the regional readiness to develop Circular Economy and to discover the local performances concerning Circular Economy:

- a significant number of Actors-Stakeholders (more than 100) has been identified, who have developed CE good practices or who can be interested and technologically/structurally ready for developing CE opportunities in their activity.
- more than 70 European projects have been identified, having issues related with the CircE topics. These are projects from different EU programme, such as LIFE, H2020, Interreg. The selected projects (past or ongoing) can provide CircE with technical and policy solutions or good practices or can show the usefulness of developing links and networks with ongoing projects.

1.1. Smart specialization strategy

Concerning the Smart specialization strategy, the most strategic innovation areas in the Region in view of supporting the transition to circular economy and developed a SWOT analysis have been identified.

Circular Economy topics may be found in different areas of S3. Specific areas and industrial sub-sectors has been identified, where, in order to apply the S3, CE has been developed, can be developed or will be developed.
The 4 main areas of specialization identified are:

- Advanced Manufacturing
- Environment and energy - Green chemistry
- Agribusiness
- Creative & Cultural Industries

The advanced manufacturing specialisation area focuses on the innovation of manufacturing and on the shift towards environmentally sustainable and smart production systems. The area has plenty of potential of technological applications to manufacturing plants and processes with the introduction of innovative technologies to increment sustainability of processes, and products, and to stimulate new business model and supply chains models for manufacturing sustainability, leveraging the potential of new technologies.

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The environment & energy – green chemistry area of specialisation crosses several sectors, and offers circularity potential through the innovation in the management and consumption of energy and renewable resources. The area of specialisation is concerned with technologies for energy and resources management, including electricity, air and waste. The area also sees the presence of capabilities for production of resources starting from waste and biomasses.
The agribusiness area spans sustainability of production and processes across the sustainable use of bio-resources, sustainable inputs for a competitive agrifood industry, and safer and nutritional products from the agricultural sector.
The creative & cultural industries (CII) area has been considered really important for CE because it includes sectors with an high potential of circularity, such as Design and Fashion and Advanced textile.
This consideration is even more significant if we consider that in the "vocational" creative and cultural industries of the Lombardy Region (fashion, design, architecture, publishing), there are currently broad margins of further growth, especially considering the design in its widest dimension. Moreover the Lombard cultural and creative industry is ranked third in the ranking of the top 25 European regions by number of jobs in cultural and creative clusters after Île-de-France (Paris) and Inner London. In particular, there is a very important position of the Lombardy Region in Europe in the fields of design (1st place), publishing (3rd place), advertising (4th place) and artistic and literary production (4th place).

The SWOT analysis has provided a kind of overview of the peculiarity of the regional playground.
In terms of circularity of the region, the SWOT analysis reports that the Lombardy region can count on some specific assets. First, there is a concentration of high-tech manufacturing and enabling technologies industries, which have the potential to sustain material and energy related business. Waste management systems are consolidated and involve all municipal waste. The region possesses many plants for treating urban and industrial waste. Both the education, and research capabilities are fully developed, and homogeneously available across the regional territory.
The simultaneous presence of knowledge and research capital assets, high-tech processes and capabilities, and the diffusion of innovative companies is a suitable mix for fostering a sustainable and competitive manufacturing industry. The current unemployment rate offers a stock of human capital with good competences which is ready to be employed in innovative initiatives, hopefully stimulated by the regional regulations to encourage the development of circular economy.
The region states to need knowledge exchange to share best practices, especially on the side of financial plans and investments in circular economy to support investments in innovation by SMEs. SMEs compose the largest share of companies in the regional economy, but show a low capacity and tendency of investing in R&D.
The region faces the threats of volatility in prices and availability of raw materials and energy imported from outside the region. Furthermore, the perseverance of a high unemployment rate (though below the average of other Italian NUTS2 region) presents the treat of a drain brain and of a loose of competences in human resources to be potentially employed.
Even if at a macro-scale, this analysis already highlighted some specific opportunities and barriers. For instance for the food saving activities, in the food waste sector, the main weakness is the presence of laws that based all the activity on volunteering actions; or, among the economic weaknesses, the fact that companies that recover industrial waste are commonly small-sized, with low R&D investments and using consolidated recovery technologies, thus not very innovative. These factors represent a barrier but also an opportunity.

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1.2. Sectors

In order to help the analysis and the data collection, the following NACE sectors have been used to represent the CircE sectors:

- built environment:
  - F41 - Construction of buildings
  - F42 - Civil engineering
  - F43 - Specialised construction activities
  - E38 - Waste collection, treatment and disposal activities; materials recovery – Just for built environment waste sector
- plastics:
  - C22 - Manufacture of rubber and plastic products
  - E38 - Waste collection, treatment and disposal activities; materials recovery – Just for plastic waste sector
  - E38 - Plastic recovery process
- food waste:
  - A1 - Crop and animal production, hunting and related service activities FOOD WASTE
  - A3 - Fishing and aquaculture
  - C10 - Manufacture of food products
  - C11 - Manufacture of beverages
  - E38 - Waste collection, treatment and disposal activities; materials recovery – Just for food waste sector
- Textile
  - C13 - Manufacture of textiles
  - C14 - Manufacture of wearing apparel
  - E38 - Waste collection, treatment and disposal activities; materials recovery – Just for textile waste sector
- WEEE - strategic metals: E38 - Waste collection, treatment and disposal activities; materials recovery
- Tourism:
  - I55 - Accommodation
  - I56 - Food and beverage service activities
  - R93 - Sports activities and amusement and recreation activities
  - E38 - Waste collection, treatment and disposal activities; materials recovery
- Biomass (wood, paper, biomass):
  - C16 - Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
  - C17 - Manufacture of paper and paper products
  - E38 - Waste collection, treatment and disposal activities; materials recovery – Just for biomass waste sector
- Raw materials:
  - C23 - Manufacture of other non-metallic mineral products
  - C24 - Manufacture of basic metals
  - B7 - Mining of metal ores
  - B8 - Other mining and quarrying

The analysis carried out on the sectors was aimed at broadening the understanding of the status of industrial sectors to identify specific Circular Economy opportunities in the Region.

2. Good practices

The project activity identified several good practices in several sectors. They are described below.Alsocross-cutting good practises are provided. In the mapped good-practices also social aspects are significantly present, as a key factors and further added value of those activities-practices. The good practices identified concern educational, policy or technical aspects.

2.1. Food waste

Food Waste donation - Actor: Lombardy Region, Directorate Environment, Unit Waste planning

Lombardy Region has carried out a Working Group regarding "Food Waste" in collaboration with F.L.A. (Fondazione Lombardia per l'Ambiente) and Cattolica University of Milan, in order to promote donation of unsold food (or food that is about to expire/near its expiry date) by the "Large-Scale Retail Trade", aimed at identifying a series of practical initiatives, such as tax breaks and the creation of sanitary guide line.

Food Waste in school – Actor: Lombardy Region, Directorate Environment, Unit Waste planning

Lombardy Region has realized a formation activity to teachers in collaboration with Ufficio Scolastico Regionale, aimed at introducing "Food waste" item into regional study programmes.

Food Waste Preventing – Actor: Lombardy Region, Directorate Environment, Unit Waste planning

Lombardy Region has set up criteria for bids for the creation of centres aimed at handling and processing products before it goes to waste. This kind of bid wants to enforce and spread all over regional territory centres able to collect products before they become waste.

Ortomercato: fruit and vegetables for people in need – Actors: Lombardy Region, Directorate Environment, Unit Waste planning – NGO Banco Alimentare

In order to provide the people in need with a proper diet integrated with fresh products such as fruit and vegetables, since May 2012, Banco Alimentare has opened an operational centre within the Ortomercato of Milan. In this very large area over 150 stands of wholesalers operate from midnight to 11 am. At the end of the exchange time, many operators find generously the time and energy to set aside the surplus goods to donate it to volunteers of Banco Alimentare, who select the recovered products on Tuesdays, Wednesdays and Thursdays. Fruits and vegetables are transported immediately to a dedicated warehouse where they are delivered to charity facilities on the same day of withdrawal or the next morning. Some figures: in 2016, 426

tons of fresh fruit and vegetable have been collected and ri-distributed to people in need instead of goingto the trash.

Dispensa sociale – Actor: CAUTO

The Company distributes over 3,000 tons of food a year free of charge to local charities. This food isrecovered from food items discarded from the large-scale retail trade, from the market and companies, thanks to the fact that Food companies, canteens, hypermarkets and supermarkets can donate unsold goods, no longer tradable (law 155/2003).

Territorial Network for recovering and re-distribution – Actors: Lombardy Region, Directorate Environment, Unit Waste planning – NGO Banco Alimentare

It is a network of territorial resources (GDO outlets, shops, distributors, canteens). Banco Alimentare manages a hub for collecting and recovering surpluses in delimited territories in Lombardy and then redistributing them to charitable structures in the same territory. The benefits of the network are: 1) to ensure a better dietary mix for the assisted people; 2) to maximize the collection from mid/small groups leveraging on the local presence; 3) optimize the recovery of fresh food and cooked meals by improving the efficiency through the creation of local food bank warehouses; 4) to activate networks of relationships on the territory that can create links and implications in terms of inclusion and social cohesion.

Food and Beverage Industry wastewater bioremediation – Actor: Cluster CATAL

Implement and demonstrate at large scale the long-term technological and economic feasibility of an innovative, sustainable and efficient solution for the treatment of high salinity wastewater from the F&D industry is the aim of the SALTGAE project. Working for making it feasible is a good practice and also a perspective of opportunity in a medium, long-run. SALTGAE wants to implement innovative technologiesfor each step of the wastewater treatment that will promote energy and resource efficiency and reduce costs. Amongst these, the use of halotolerant algae/bacteria consortiums in HRAPs for the elimination of organic matter and nutrients stands out for its high added value. This use will not only provide an effective and ecological solution for wastewater treatment, but also it will represent an innovative way of producingalgal biomass, that can have subsequently a valorisation in different by-products, reducing the economic and environmental impact of the treatment. Moreover, the project will also address cross-cutting barriers to innovation related to wastewater by developing a platform for the mobilization and networking of stakeholders from all the different sectors related to wastewater, and for the dissemination of results, enabling the development of a common roadmap for the alignment of legislation, regulation and pricing methodologies and promoting financial investment and paradigm shift in perception from 'wastewater treatment' to 'resource valorisation'.

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Fill up the tank, new life for frying oil – Actor: Lombardy Region, Directorate Environment, Unit Waste planning

This good practice concerns the food value chain waste. “Fill up the tank, new life for frying oil" is a pilot project consisting in the collection, refining and re-use of vegetable oil by domestic users. The objectiveisto prevent the release of oil fraction into drainage system, reducing purification costs to the purifiers, and transforming refuse into fuel. The project has involved 6 municip ality of Martesana area (Est Milanoutskirts). The actors were mainly families of the municipalities participant. Concretely, a tan was distributed tocollect the oil from kitchens (from frying, topping, dressing) to be delivered to the ecological pitch of their municipality. The oil was then brought to a refining plant and transformed into biodiesel to be used on the same means of harvesting. A specific course of environmental education was then set up in the local schools with a visit to the consortium cleaner.

2.2. Built environment

EU Construction & Demolition Waste Management Protocol - European Commission – ANPAR took part in the development

European Commission is introducing a new protocol on construction and demolition due to C&D Waste is the largest waste stream in the EU (https://ec.europa.eu/growth/content/eu-construction-and-demolition-waste-protocol-0_en).

Based on independent research, the Commission is introducing the non-binding guidelines as a proposal to the industry. This Protocol fits into the Construction 2020 strategy, as well as the Communicationon Resource Efficiency Opportunities in the Building Sector. It's also part of the Europ ean Commission’s ambitious and more recently adopted Circular Economy Package. Its overall aim is to increase confidence in the Construction and Demolition waste management process and the trust in the quality of Construction and Demolition recycled materials. This will be achieved by:

- Improved waste identification, source separation and collection
- Improved waste logistics
- Improved waste processing
- Quality management
- Appropriate policy and framework conditions.

This Protocol has been developed for application in all 28 EU countries.

Memorandum of Understanding between Lombardy Region in order to promote the use of recycled aggregates - Actor: ANCE LOMBARDIA

On April 11, ANCE Lombardy and the Lombardy Region signed the Memorandum of Unders tanding to carry out activities useful to improve the management of waste from construction and demolition of the products that they recovered.

This is a collaboration from the important premises that refer to the European Waste Directives, the National Action Plans on Green Public Procurement, and to the Regional Waste Management Program.

This collaboration aims to promote, at all levels and at each operators in the chain, the development of knowledge of the inert waste management processes produced by construction and demo lition activities, ie from the waste production phase to reuse it as new material after the treatment process in the recovery.

These objectives concern the analysis of sectorial legislation at European level and the identification of technical, economic or cultural obstacles that do not allow the optimal use of recycled aggregates, the organization of training times (addressed to businesses, designers and public institutions), the development of a web application for the dissemination of information on recycled aggregates present on the market, the evaluation and implementation of incentive, technical, regulatory and / or economic actions for market development.

Infrastructure building system with low environmental impact - Actor: Sirti Spa

Current development of telecom infrastructures for ultra broadband services is pushing deployment of a wide-spread network of civil infrastructures, able to host ducts, cable and devices. This results in heavy digging activities along roads that may have a significant environmental impact. Sirti has engineered a patented system, named One Day Dig - 1DD, that is able to build more than 200 m per day of telecom infrastructures. The systems makes use of concatenated modules (trench saws, suction pumps, backfilling devices) that permit to optimise excavation and recovery activities, minimising work times and resulting materials to be disposed. Using 1DD systems over 1,200 km have been deployed by Sirti staff all over Italy. 1DD has been recognised by UN Agency ITU (International Telecommunications Union) as a best practice for construction of telecom infrastructures.

New Office Building (LEED GOLD) - Actor: VEZZOLA SpA

The Actors worked on the base of a contract concerning the supply of various types of cement conglomerate for the construction of a new commercial building in Desenzano d / G (BS) (2015-2016).

According to the LEED protocol and in order to get Gold certification level, the Company has implemented several solutions including the supply of concrete containing recycled material (artificial aggregate and from recovery). Concrete was then supplied with the highest possible percentage of post-consumer and post-industrial recycled content compatible with the technical construction characteristics.

Road construction site (Cremona province) - Actor: VEZZOLA SpA

The work concerned the realization and modernization of a provincial road in the province of Cremona. The construction yard has been strongly directed to the recovery and reuse of materials from recycling, from the bank structure to the surface package. The intervention is noteworthy because it is characterized by the cold creation of ecobase layer in place of the normal hot base, made with 100% of low environmental impact milled.

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Motor way construction site (VE) – Actor: PRANDELLI SANTO Srl

The company received the assignment also of including demolition and crushing works of 9 motorwayriders, 6 bridges over the river and the complete demolition of the viaduct on the River Tagliamento. These interventions are necessary for the realization of the 3rd lane of the A4 Motorway by Km Progr. 63 + 300 Alvisopoli (Ve) up to Km 89 + 000 Gonars (Ud).

Demolition works will result in a demolition waste production (C.E.R. code 17.09.04), which is equivalent to about 35,000 m^3 (about 70,000 ton); all the materials will be reused (checked their chemical properties) using several crushing campaigns with relative Environmental impact assessment screening procedure.

The treated waste will acquire different sizes according to the type of use, as indicated in the special tender specifications, and will be reused for the formation both of the bank of the third lane and for the formation of the new junction of new motorway riders.

In doing so, the only waste that will result from this recovery process will be the metallic andferrousmaterials that will then be recovered at local recovery centers and / or steel mills.

Strip Out (Milan) - Actor: CORBAT Srl

The contract concerned the redevelopment of a building in Milan through a preliminary strip out operation. The solutions proposed by the company are aimed at eliminating and minimizing impacts generated on the environment by demolition operations. In order to select the most suitable solutions to the case, an analysis of the activities was preliminarily carried out to identify the environmental components that are affectedby the demolition activities.

Isola Ecologica "ELNOS" - Actor: REMED Srl

The selective waste collection system installed by REMED on the IKEA RONCADELLE site has had the privilege of collecting, selecting and compacting all waste, both those from the General Contractor and its subcontractors, as well as those from individual Ikea contractors. On this platform, large quantities of differentiated waste were collected for each individual CER, thus optimizing disposal and thus saving economically for each single waste producer.

CORIN Project - Actor: ROFFIA SRL - ECOMAS SRL

CORIN was born from the idea of 5 Mantuan companies in the construction chain. Through the establishment of a Business Network, experiences and research were shared with the aim of building an integrated system for the management and recycling of materials from construction and demolition waste from the Province of Mantua.

The success of the project is ensured by the participation in the network of companies operating in all the rings of the C & D waste cycle: Construction, Demolition, Collection, Specialized Transport, Selection, Treatment and Recycling, Disposal, Extraction of virgin material. CORIN's main mission is to realize, through a process capable of involving the largest number of stakeholders in the construction chain, a voluntary system of certified procedures and shared behavioral rules to replace and eliminate the need forinspections and ex-post controls by public surveillance bodies.

With CORIN, therefore, affiliated companies voluntarily initiate an operating regulation that aimsatensuring at the same time the quality of the product that has to be recycled and the quality of the recycled product, through standardization (defining protocols) and monitoring of collection processes of the constructionand demolition materials and the certification of outgoing products.

2.3. WEEE

WEEE in Prison - Lombardy Region, Directorate Environment, Unit Waste planning

The goal of the project "WEEE in Prison" is to promote the social and labour inclusion of disadvantagedpeople under criminal prosecution or just released from prison, for whom a professional support connected with the territory is necessary in order to facilitate their complete return to the rule of law and civic life of the community. For this reason, the project promotes the active involvement of the social economy and the alliance with the territorial profit system collaborating with the institutions. Lombardy region hasplannedto carry out part of the treatment/disassembly of WEEE coming from Ecological areas' in this way and thensent to waste treatment plants.

Mobile environmental Center - CdC RAEE - AMSA Milano - Municipality of Milano

The aim of the project is to promote and increase different collection of WEEE, through the implementation of a Mobile Environmental Center, to collect WEEE in different parts of the territory of the Municipality of Milan. The Mobile Environmental Center rotates weekly to permit the service in particular popular areas(for example: university, large retailers, local market).

Extension of WEEE collection - CdC RAEE - CEM Ambiente - Municipalities involved

The aim of the project is the implementation and the extension of WEEE collection, in particular including the collection of some specific equipment and receiving WEEE from distribution. These activities request analysis of technical and normative contest and meetings with distribution operators and authorities, to overcome authorization limits properly and in compliance with law.

WEEE - RAEE@scuola - CdC RAEE - ANCI - Municipalities involved

In the schools of some selected municipalities (classroom of children from 9to 12years old), the designed activities want to inform and communicate to the children what WEEE are, the correct way to collect them and the importance of the recycling. In addition, with the help of the municipalities' collection agencies, children are invited to collect permanently WEEE in the schools, also after the conclusion of the project.

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WEEE - Critical raw materials recovery from electronic waste - Relight

Relight was born from a cooperation project with Philips for the collection and recycling of fluorescentlamps inthe whole Italian territory. Today they are involved in several projects regarding the automatic CRT treatment lines; a lamp treatment plant; the LCD dismantling; an electronic appliances treatment plant; hydrometallurgical plant for rare earths recovery. For example, in the RELUX project they use the glass from fluorescent tubes for the production of tiles. In the HYDROWEEE project they invent innovative hydrometallurgical processes to recover metals from WEEE including lamps and batteries. In the RECLAIM project there is the reclamation of Gallium, Indium and Rare-Earth Elements from Photovoltaics, Solid-State Lighting and Electronics Waste. Finally in the REMAGHIC project new recovery processes to produce Rare Earth-Magnesium Alloys of high performance and low cost are invented.

2.4. Raw materials

Production materials recovery - Actor: Cavagna Group

Cavagna Group produces copper valves for industrial use through classic CNC machining centers. Lubricating fluids are used during the work, then they are collected together with the water reflux and the copperscraps. Then, Cavagna Group has thought to a way in which recover both the copper and the water reflux. In particular, they have built a deposit outside the plant where these fluids flow, employing a systemof3tanks: in the first, a auger wheel pushes all the shreds into a smaller tank; in the second, copper is separated; inthe third, smaller copper corpuscles that still remain into the fluids are pulled through disks that rotate, separating copper from water. At the end copper is separated, recovered and reset, while water containing the lubricating oils is reused in the plant after having undergone some basic chemical treatments.

New concept of surface finishing media for dry process – Actor: Rollwasch Italiana

Rollwasch company is active in the production of chips for vibratory finishing. One main problem of the vibratory surface finishing of products is that this kind of process produces a great amount of wastewater, which has to be subsequently treated as industrial sludge. The solution proposed by Rollwasch consists in the development of a special type of (patented) chips, which allow a dry finishing process andthesubsequent recovery of used chips; in fact, chips are comminuted and destroyed during the finishing proce ss, as usual. The comminuted pieces can be then collected and reprocessed by Rollwasch with an extrusion process, and use this waste in order to produce new chips, allowing a closed-loop cycle. In addition to it, the expecteduse life of this kind of chips is ten times the use life of classical chips. This impacts greatly on transportation as well.

New composite material from production waste – Actor: Rivierasca

Glebanite is a new recycled composite material produced by shredding GRP waste and mixing it with virgin glass resins and fiberglass and invented by Rivierasca company. The material slurry is obtained from scraped grains and from virgin raw materials. Other additives (microspheres of quarries, milled fibers, bentonites,

MgO, ...) are appropriately added to give the slurry itself a viscoelastic behaviour. This property allows to process the material with the most common machines for the clay processing. A pilot plant present at Rivierasca allows to work up to 900 kg / h of material. They use a cold processing, therefore allowing a reduction in energy consumption. They are an example of how the production scrap of the processed raw materials can become secondary raw materials for the Glebanite production.

2.5. Textile

Nylon socks recycling - Actor: CSC - Centro Servizi Calza

A huge business district of lady socks is located in the area of Mantua. The district has been developing an emerging attention to the theme of closed loop recycling of raw material in the socks. The product (lady socks) is composed by nylon textile. The industrial scrap coming from the production process could be currently recycled in a closed loop way, using specific technologies. Today, the scrap material produced within the process is about the 5% of the total mass of raw material.

The further district's challenge is the recovery the raw material once the product (socks) reachs end-of life. The nylon is of course sold through the network of retailers in the form of products (socks), and then currently disposed of by the consumer in the mixed waste stream.

The emerging idea is to involve retailers, not municipalities, in order to put in place a suitable business model to allow the reverse logistics of the end-of-life nylon socks. This should take into account, along with the technical aspects of technologies, supply chain logistic network, and production, the behaviour of the customers, and the economical sustainability and brand value from the point of view of retailers.

R&D support for Circular Economy in all value chain – Actor: Centro Tessile Cotoniero e Abbigliamento Spa/CENTROCOT SPA

The company provides support to the textile sector companies operating in specific sub-sector: Textiles & Clothing, Leather, Personal Protective Equipment, Food contact.

Namely, the company offer consultancy and technical support for: 1. Finishing technologies, 2. Textiles manufacturing, 3. Textiles safety & sustainability, 4. LCA Life Cycle Analysis, 5. REACH regulation, 6. Tests & Certifications, 7. Waste management".

As R&D centre, Centrocot offers its know-how to all kind companies in the whole circular value-chain.

Web platform as a virtual market for textile waste - Actor: Centro Tessile Cotoniero e Abbigliamento Spa/CENTROCOT SPA

A virtual platform is under development for supporting the exchange of industrial waste among the companies of manufacturing districts, in particular in the textile sector.

Clothes from waste textile – Actor: La terza piuma

La terza piuma shop set up a new line of clothes from waste and recovered textile which is created by designers.

Second-end clothes - La terza piuma

La terza piuma shop set up a collection, recovery and sale of second-hand garments for children and adults.

Technology for textile sector – Actor: LAROS S.r.l.

Laros is able to develop and produce a wide range of products for warp sizing. Founded in 1968, it operates in nearly 30 countries across the globe. The company enables its customers in the textile weaving industry to meet their current and future needs of productivity and quality. Their chemical products combine chemistry and technology, quality and environmental protection. They cover three different categories: after-warping waxing agents, sizing agents and additives for sizing process.

2.6. Tourism

Sustainable tourism - Actor: Il Corrazziere

Il Corazziere is a "rural resort", taking care of the surrounding environment in every aspect. This cohesion is supported by the fact that the Resort lies on the Island of Baggero, part of the Merone Municipality, established in 1722 by a group of Benedictine nuns; along with the ancient mill, today a museum is a sign of the change.

Sustainable tourism retailing commerce of food – Actor: Consorzio Agrituristico mantovano Verdi Terre

The consortium links 320 farms now and it covers several kind of items. Each kind of net consider an event and different forms of communications among consumers.

2.7. Plastics

Mixed plastic waste sorting and recycling contracts – Actor: COREPLA

The recover and valorisation of mixed plastics waste is not as advantageous (in terms both of economical and technical factors) as the homogenous plastic waste one, which are quite easily destined to a recycling process; therefore, the destination of this type of plastic is generally the energy recovery. In order to letable that mixed plastic to be processed in a recycling process and so in order to get their valorisation, according to the EU waste management hierarchy, COREPLA has developed (with his customers and suppliers) a mixed plastic waste sorting and recycling contracts, increasing the volume of total plastic packaging waste recycled.

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2.8. Cross-cutting

Innovative paper packaging (Biomass – Plastics) – Actor: Nextmaterials

The theme of packaging is of extreme importance within the life cycle impact assessment of the products. Up to now, most of the packaging for transportation of fragile products is made of plastics and polystirol, in order to absorb potential collisions. Nextmaterials has developed a cellulose-based polymer, which hasthe collision absortion power of such packaging materials, and which can be completely recycled in the paper stream waste. The idea leverages on the substitution of classic packaging materials for transportation with packaging made of that cellulose-based material. This will generate two main breakthroughs: the creationof one-waste stream packaging, allowing to remove the burden (and uncertainty) of waste separationfromthe consumer; to reduce the production of non-recyclable products such as polystirene. In addition to it, the aforementioned cellulose-based material can be granulated and extruded, in order to form wires tobeused in extrusion additive manufacturing processes. This allows the creation of one-piece batch customizes packaging, for special consumer products.

Green Public Procurement mandatory – Actor: Italy

In Italy, as first country in Europe, Green Public procurement became compulsory with the adoption of t he Decree 50/2016. All Public administrations must apply minimum environmental criteria set by the Ministry of the Environment for 100% of the value of all purchases of goods and services. Gpp is an opportunity to increase not only the quantity but also the quality of materials and goods resulting from the recycling of waste and therefore really may stimulate the Circular Economy (as the European Commission also supports in the Circular Economy Package) as the system requires that the public Administration buy only certified products and corresponding to the minimum environmental criteria set by the Ministry of the Environment.

ReMade in Italy certification – Actor: ReMade in Italy association

ReMade in Italy is the first certification in Italy for recycled products, GPP compliant. As a non-profit association involving several manufacturing companies, ReMade in Italy has set a model for traceability of material flows in the production process to ensure maximum transparency and verification of theoperations carried out. The certification, accredited and independent, is an useful tool to ensure high quality ofrecyded products to public administrations. It is recognized by the European Commission as "good practice for the GPP" (February 2017).

Survey for providers – Actor: La terza piuma

LA terza piuma shop developes a specific survey for their providers (10 questions) in order to clarify their environmental and social performances on topic such as resource saving, transport impact reduction, reduction of the packaging, short value chain, clear labelling, sharing of principals and ideas.

Regional platform "Open Innovation" - Actor: Lombardy Region, Directorate University, Research and open innovation

The Lombardy Region's Smart Specialisation Strategy vision, that has an important impact on the regional innovation policies, represents a cultural leap regarding involvement of citizens in policy - decision process through innovative tools, both financial and enabling. Thus, a regional Open Innovation Platform has been built around the key principles of the Quadruple Helix Open Innovation model, where "Government, industry, academia and civil participants work together to co-create the future and drive structural changes far beyond the scope of what any one organization or person could do alone".

The Platform wants to boost the actualization of the Open Innovation (OI) model, a knowledge management model assuming that – in a world of widely distributed knowledge – companies cannot afford to rely solely on their internal resources but should explore a wide range of innovative opportunities and exploit them through multiple channels.

Water Efficiency - Wastewater recycling in industrial applications – Actor: Alkematec

In all production systems water is used: sometimes directly in the production process, sometime as a service (e.g. in heat, air conditioning and vapour systems supporting production facilities, or in indirect cooling of equipment), sometimes in both. The constant challenge is to reuse as much water as possible. This company conducted a study which focused, in particular, in the mechanical sector, where the needs of reusing water arises from the objective of reducing the cost of water catchment and discharge, and from the objective of energy saving. In the latter case, it has to be highlighted that discharged water usually is around 60-70°C, and with its disposal the company incurs in an additional energetic cost. The technology developed by this company allows to design in-plant wastewater treatment systems which allow to recycle of up to 90% of used water, in settings as: all the phases of the process of washing – rinsing – phosphatization - cleaning of metallic pieces; wastewater coming from tumbling; wastewater from the cleaning and rinsing within the degreasing process of metal pieces; wastewater originated during the stages of engine testing in automotive companies, wastewater from fish farming.

3. Opportunities

The project activity has identified several Circular Economy opportunities. We present below the opportunities identified per sector.

3.1. Built environment

In Lombardy both the construction industry and the recovery of inert materials sectors, due to the large quantities of C & D waste produced every year, are priority areas of intervention, which are essential to work on in order to steer the market towards the direction requested by the EC, in its sustainability and circular policies.

1. Reverse logistics in built environment: the traditional flow of materials and products in the Construction Industry has been linear; meaning all the materials comprising a building wouldendup in landfill after the building was not able to meet the requirements in terms of the expected functions. However, demolishing the buildings and sending the pile of debris to landfills would not be the best available alternatives anymore. The ideal flow of materials in the construction industry should act as natural mechanisms using resources efficiently with no waste. Similar to the case of manufacturing context, the ideal supply chain in construction field should be a CLSC (Closed-Loop Supply Chain). In construction CLSC, life of building materials would be extended after the endoflife of the buildings by keeping them in the loop through systematically extracting them from buildings and reusing them in some parts of other buildings or secondary markets. This procedure might include reusing the extracted items directly or after different levels of recovery processes.
2. Waste recover from renovation activities: in Lombardy, a high percentage of the built environment activities and wastes comes from building renovation; in particular the main feature of this activity is the micro-renovation: renovation activities on small buildings or on small parts of them, with a high percentage of historical buildings. Waste materials have to be recovered and reused for other purposes.
3. Standardization on urban regeneration policies: standardize policies on urban regeneration thatwill address the recovery of city areas, which will involve important quantities of construction and demolition waste materials to be recovered. The Lombardy Region has launched a working groupto implement the standardization on urban regeneration policies.
4. Selective and precise demolition: the selective disassembly of buildings should be implemented to facilitate the reuse or recycling of valuable materials. This practice can involve the recovery of materials such as wood, structural brick, and highly functional finished components like windows, doors, cabinets, and decorative materials.
5. Implementation of a web platform: a cross-sectorial web platform should be implemented for the creation of a virtual market containing the description, the volumes and the geographicallocalization of the waste materials coming from different sectors (from construction to textile to other sectors). The management of the platform should be done by the construction plant managers. In the Lombardy Region, both ANPAR (construction sector) and Centrocot (textiles sector) are preparing a similar tool; another similar tool is foreseen by specific regional legislation and protocols.
6. Implementation of the EU Protocol for built environment: opportunities of new technological and industrial practices based on the new protocol on construction and demolition introduced by the European Commission should be implemented. This Protocol complies with the Construction 2020 strategy, as well as the Communication on Resource Efficiency Opportunities in the Building Sector. The aim is to increase confidence in the Construction and Demolition waste management process and the trust in the quality of Construction and Demolition recycled materials. The Protocol consists of 5 components: the first three are based on the C&D waste management chain and two are of a horizontal nature.
    a. Waste identification, source separation and collection;
    b. Waste logistics;
    c. Waste processing;
    d. Quality management;
    e. Policy and framework conditions.

   Widespread the protocol at a national scale is an opportunity. This Protocol has been developed for application in all 28 EU countries and has the following target groups of stakeholders.

7. Increase of secondary raw materials use in the built environment: increase the usage percentage of secondary raw materials in the construction of infrastructure (e.g. binder, milled material, aggregates, concrete, environmental recovery) through mandatory regional laws.
8. Sustainable certification for buildings: as the energy classification for buildings, this opportunity wants to exploit a building classification depending on its sustainability. For example, different degrees of certifications can be released depending on the environmental footprint that the building leaves on the environment. This can be measured either considering the percentage of recycled materials used during its construction (e.g. containing fly ashes) either taking into account the gas emissions into the atmosphere.
9. Increase CAM relevance in the Green Public Procurement: the relevance acquired by the CAM (minimal environmental criteria) in Green Public Procurement policies seems to be a real opportunity: the challenge is to increase CAM relevance and the use percentage of recyded materials through mandatory laws, thus increasing circular economy aspects.
10. Reuse of built environment waste materials in other sectors: an alternative destination and application can be thought for the waste materials coming from the built environment. An example is the use of recycled materials coming from the built environment used as secondary raw materials for the construction of roads, thus providing an effective solution to the associated problem of pollution and disposal of these materials.

3.2. Textile

The textile and clothing sector is an important part of the European manufacturing industry, playing a crucial role in the economy and social well-being in many regions of Europe.

The Italian Textile-Clothing industry generates a turnover of over 52 billion euros, mostly (55.9%) generated over the border. The sector counts more than 46,000 companies, which can handle more than 400,000 employees.

Italy is still the only western country to have a complete chain. All the main phases of the production process of Textile-Clothing, starting from fiber processing (which is mainly imported), are in fact present on national territory, from spinning (predominantly wool) to weaving (all fibers), to ennobling.

In Lombardy Region the Textile sector is also particularly well-developed, with 11,404 local units and 97,147 employees, respectively 17% and 21%, on the national aggregates of the sub-fund. The sector has several specializations spread throughout the Lombardy provinces, covering the cotton textile industry (cotton spinning, dyeing and finishing) (in the province of Bergamo, Varese and Brescia), silk fabrics (Como), textiles (Bergamo, Brescia, Mantua, Cremona, Varese), sportswear and technical clothing (Sondrio), clothing (Como, Lecco, Monza and Brianza), and clothing from the knitwear (Pavia, Varese), the high fashion (Milan) and the accessories (Como).

11. Increase the recover of waste clothes: the Lombardy Region produces 13-15 kg per year per person of wasted clothes, but only 2-3 kg are recovered. This opportunity can be exploited by reusing them or by inserting them into new clothes, thus reducing the amount of generated clothes waste and by creating new sustainable clothes made of recycled textiles.
12. Reuse of waste textiles in other sectors: an alternative destination and application can be thought for the waste materials coming from the textile sector. In fact, it is important to understand that many opportunities can be created through a cross-sectorial approach: a fibre that is not suitable to

be recycled and used in the textile sector, can have valuable qualities in other sectors. An important example is the reuse of wasted textiles as secondary raw materials in the built environment, becoming a material insulator to be used during the construction of buildings.

13. Increase second-hand clothes collection and redistribution: in textile clothing we deal withtwokind of waste: clothes that lost their functionality, due to use; tissues and clothes that are "notsolditems" for market reason. An increased amount of textile waste can go to redistribution and to second-hand collection cycle; what can be done is to increase the reuse of clothes that are still wearable, by donating them to poor people or by reinserting them in the redistribution cycle, maybe also after that a redesign of the clothes has been made. An increase can be obtained also by increasing the social awareness of the problem among the people, thus leading to a reduction in the amount of clothes that is throw away every year.
14. Influencing fashion designer in the use of secondary raw materials (textiles): inducing fashion designers to make clothes from waste textile and recovered textiles is an opportunity that needsto be exploited. Several fashion brands and fashion designer are becoming involved in thisopportunity, but the use of waste textiles into the design of new clothes collection needs to be increased also by law incentives, sustainability-leaded marketing and money if necessary, thus leading to a more sustainable sector and to a less production of wasted textiles.
15. Greater involvement of fashion companies: fashion brands can developed a specific survey fortheir suppliers in order to clarify their environmental and social performance on topic such as resource saving, transport impact reduction, packaging reduction, short value chain, clear labelling and origin of the clothes, sharing of sustainability principles and ideas with their customers in the retail points. Moreover, they can improve the percentage of recycled materials into the clothes and make the sustainability as their first brand paradigm.

3.3. Plastics

Here it necessary to start by saying that the project to date has approached the plastic sector mainly from the municipal and similar plastic waste collection perspective.

Now, following the European waste directive (94/62/CE and 2008/98/CE), Italian regulation set targets for the collection of municipal waste and both for the practices of reuse and recyling of waste materials (D.Lgs. 152/06 and subsequent modifications and additions).

Looking to national data, among the total urban waste production (around 30 million tons), the percentage of selected collection waste in 2015 was 47.5% (14 million tons) which represent an increase of 2.3 % respect to the 2014 (ISPRA – Rapporto Rifiuti Urbani 2016). About the half of total selected collection waste is packaging waste.

With regard to plastic sector, 1,178 million tons were collected during 2015, which represent the 8.4 % of the total amount of selected collection above mentioned (ISPRA – Rapporto Rifiuti Urbani 2016).

It is necessary to underline that part of the quantity collected in the Region, is recycled and recoveredabroad.

16. Increase percentage of recycled plastics into new products: this opportunity can be exploited by collaborating with plastics industries to have a percentage of recycled plastic inside every plastic

product that is new to the market; in this way less plastics will be produced and a greater percentage will be reused into new products.

17. Incentives for biodegradable plastics production: biodegradable plastics can be a solution to the great amount of plastics that pollutes our environment; by giving money incentives for the production of more sustainable and biodegradable plastics, Lombardy can limit the plastics pollution in the region. Plastics made from non-renewable petroleum and natural resources can limit the damages to the environment, to the human health, to the species maintenance, and to the ocean.

3.4. Food waste

Generally speaking, the main objective concerning food waste is to reduce its production along the supply chain, increasing the efficiency of the supply chain.

In particular the Directive 2008/98/EC, also in order to reduce the negative impacts of waste produced on the environment, identifies as a first priority the prevention of waste generation.

However, in the food waste and food surplus issue, their valorization for human consumption has a significant importance, in particular order to support food security.

In particular in Lombardy Region this activity is particular important and developed. However in Lombardy region, the regional activities concerning food waste is oriented both toward food waste prevention and the valorization of food waste for food security.

18. Wastewater: the aim of this opportunity is to further valorise food and beverage industry wastewaters. The food supply chains are large in volume terms, significant in economic and environmental terms and central to the management of many biological materials. These chains currently generate significant amounts of waste and they are associated with high environmental impacts. The waste streams are generated during harvesting, storage and transport prior to primary processing (primary stream), during primary processing within the agro-food industry (secondary stream) and during production or consumption by end users (tertiary stream). This is recognized as a priority sector where accelerating the circular economy would be beneficial and where EU policy has a particular role to play. The main goal of the present opportunity is to further valorise food and beverage industry wastewaters based on the outcomes of the EU H2020 Saltgae project, involving partner Regions in CircE (e.g. Lombardy, Slovenia). To do so, innovative R&D and industrial collaborations within these Regions need to be exploited, starting from Saltgae partners, to ensure further scaling up and future potential industrial implementation of Saltgae outcomes.
19. Increase percentage of food recovery: for what concerning food waste, the current food recovery experience can be really widened and the conditions to do it can be fostered. This can be exploited by improving the general food collection, by increasing the incentives for food recovery in school canteens and by increasing the amount of food that is donable thank to the new law (n. 166/2016), that theoretically paves the way to a lot of initiatives.

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3.5. Sustainable tourism

22. Increase small villages tourism: in Lombardy, there has been a big shift of population from small towns to cities, with a consequent depopulation of small towns that are often beautiful historical villages located in the mountain, over hills or near lakes. These villages have high tourist attraction potential. In the recent years some "rural resort" were settled up by taking care of the surrounding environment in every aspect (e.g. Island of Baggero, part of the Merone Municipality, established in 1722 by a group of Benedictine nuns). An opportunity is to increase the small villages tourism through a communication campaign focused on villages sustainability.
23. Implementation of diffuse hotels in the Lombardy Region: there are great opportunities to create diffuse hotel. In Italy, the diffused hotel is a solution that meets ever more favours, especially in small centers, because it contributes to combining the maintenance and enhancement of the existing village, with the tourist exploitation of the same places, with particular reference to the historical centers. A diffuse hotel is not just a model of hospitality made in Italy, it is also a model of territorial tourism development that is environmentally friendly and sustainable, a model of local development that generates new value chains and represents a contribution to the depopulation of the villages.
24. Creation of rural museums: the valorisation of small uninhabited villages can be done also by setting up rural museums (e.g. Ornica, in the Brembana Valley North of Bergamo). The Rural Museum exists to bring museums of farming and the countryside closer together for mutual benefits.

3.6. All sectors

In this section the opportunities identified as valuable for all the sectors are reported. These results come also from the cross sectorial analysis.

20. Increase the networking of Small and Medium entities: the objective of this opportunity is to gather the attention of small and medium realities through communication and active involvement campaigns and to create a stable regional network of them, in order to go together towards the same direction of a circular economy region. The SMEs need to understand the importance of creating network among them, necessary to create bigger opportunities together.
21. Major relevance to clusters role: the Region should greatly promote the role of the regional clusters as intermediaries through the Region itself and the companies and universities belonging to the same sector of the cluster, in order to create projects and paths to scale-up solutions and networks together.

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