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# D4.5 Circularity Solutions Report

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Dissemination Level:	
PU	Public
PP	Restricted to other programme participants (Including the Commission Services)
RE	Restricted to a group specified by the consortium (Including the Commission Services)
CO	Confidential, only for members of the consortium (Including the Commission Services)

Nature	
PR	Prototype
RE	Report
SP	Specification
TO	Tool
OT	Other

Synopsis:	This is a description of the circular solutions developed in the first round of C-Voucher. The report includes individual case descriptions.
Keywords:	Circular Solutions; inspiration cases; circular building blocks

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## LIST OF ABBREVIATIONS AND DEFINITIONS

DoA	Description of Action
EC	European Commission
H2020	Horizon 2020
GA	Grant Agreement
CA	Consortium Agreement
KPI	Key Performance Indicator

## LIST OF FIGURES

Figure 1: Wastewater turned into irrigation water and concentrate suitable for biogas production

# 1. Introduction

C-Voucher (acronym for “Circularizing Value Chains across European Innovation Strategies) is a project funded by the European Commission’s Horizon 2020 programme<sup>2</sup>.

The core of C-Voucher is development of new, technology enabled solutions to accelerate the circular economy in large industry domains - food, manufacturing, textile, maritime and health - across Europe. During the project, a total of 12 circular solutions will be developed with SMEs and a wide network of stakeholders.

A “circular solution” in this respect could be different things: A digital solution enabling a textile company to manage leasing of their products; or engineering a facility that not only treats wastewater but catalyses local bio economy leverage; or developing an intelligent reusable food container for urban food service.

Though very different, the shared traits of all solutions are:

- They have a strong technical component - either digital, engineering or hybrid technologies<sup>3</sup>
- They support and are anchored in circular business models
- They represent relevant concepts that can inspire and guide other companies

C-Voucher is inspired by the concept of circular building blocks<sup>4</sup> which is a framework to build circularity into businesses.

The starting point of C-Voucher is that the circular solutions answer to challenges that have been identified with industry and regional innovation system involvement across several European regions, in order to ensure that the circular solutions have broad market relevance and potential. As such, the C-Voucher supported solutions should serve to example and push forward services and products that are future fit.

The companies who are developing their circular solution in this first round do so by engaging in a 9 months programme where the solution is defined/ refined by intense use of design processes and involvement of partners and ecosystem stakeholders. Then, its technical elements get specified and one or more technology providers develop and support the implementation of the tech solution. C-Voucher thus provides over the 9 months both design-, technical- and business support for the company to realize and leverage the circular solution.

These circular solutions, deriving from C-Voucher, are exemplary in the sense that they represent sector and market relevant solutions that can inspire more companies to adapt and thus impact wider value chains.

To this end, the solutions will be showcased at the C-Voucher online marketplace (accessible via [c-voucher.com](https://c-voucher.com)) and also the C-Voucher project will directly facilitate further adaption of the technical solutions with more companies - 42 in total.

The solutions that are developed are further stimulating market for circular solutions with the technology/ solution providers as key promoters and stakeholders. The suppliers of digital platforms, of wastewater treatment technology, of sensor technology etc. will be able to further commercialize solutions that they have been providing in C-Voucher<sup>5</sup>.

## 1.1. About this document

This report will describe the first round of circular solutions being developed in c-Voucher, 6 projects in total. It is to some extent a description of both the business case surrounding the project and, as possible, a detailing of the technological component or driver for the circular solution which is still in the making in most cases.

As basis for the description, each of the 6 projects have provided a thorough use case with details about the solution from which we extract concrete, non-confidential information. The purpose is to be able to inspire and provide guidance to other companies that may be interested to develop their business and look for concrete solutions to implement. The level of detail in the solution descriptions may still be considered 'inspiration case' due to both the fact that solutions are still in the making and due to protecting the interest and rights of the companies developing them.

In order to further animate the descriptions, each of the companies have produced a short video which will be posted along the description on the C-Voucher marketplace.

## 2. Circular solutions in round 1 of C-Voucher

### 2.1. Nordphos – Water technology crossover to agro-food sector, powered by engineering and big data

Industry Domain: Water/ Agro-food

Circular building block: Biological products/ Renewable energy and energy efficiency

Technology focus: Engineering (Water filtering)

Region: Denmark

### Idea and background:

Nordphos develops and delivers system solutions, which put humans back into the centre of the biological cycles – by turning wastewater treatment plants into providers of resources for bio production. Globally, we need water and nutrients for growing food, while we locally have both resources in our wastewater – if we can make them available in an environmentally safe and economically feasible way. The Nordphos take on this matter, is to use advanced membrane technology to separate wastewater into a thick fraction containing the organic matter and a pure water fraction containing nutrients.

Contrary to current water treatment praxis, this separation is done before the biological digestion of the organic matter takes place. Hence, Nordphos calls the process Direct Membrane Filtration or DMF.

The pivotal point of the DMF process is that all contaminants that are not wanted in the water, are withheld by the membrane and are left in the concentrate of organic matter, while most of the nutrients pass through the membrane with the water. Hereby, safe irrigation water is produced, which at the same time can fertilize crops. Since the organic matter is not digested by bacteria, the thick fraction has a high concentration of fresh carbon, making it very potent for production of biogas and/or refining into a variety of valuable bio products – eg. bio plastic.

The technologies needed for the DMF process already exist. Nordphos puts them together in new ways and make them work in integrated circular systems. The benefits of Nordphos' DMF system summed up:

- It produces resources as opposed to solving a wastewater problem
- It is considerably cheaper than conventional wastewater treatment systems
- It produces energy instead of costing energy
- It is modular and can be scaled to create the appropriate waste water handling capacity (up to 20.000 PE (Person Equivalents))
- It is flexible; it can be used as a temporary solution to provide extra capacity

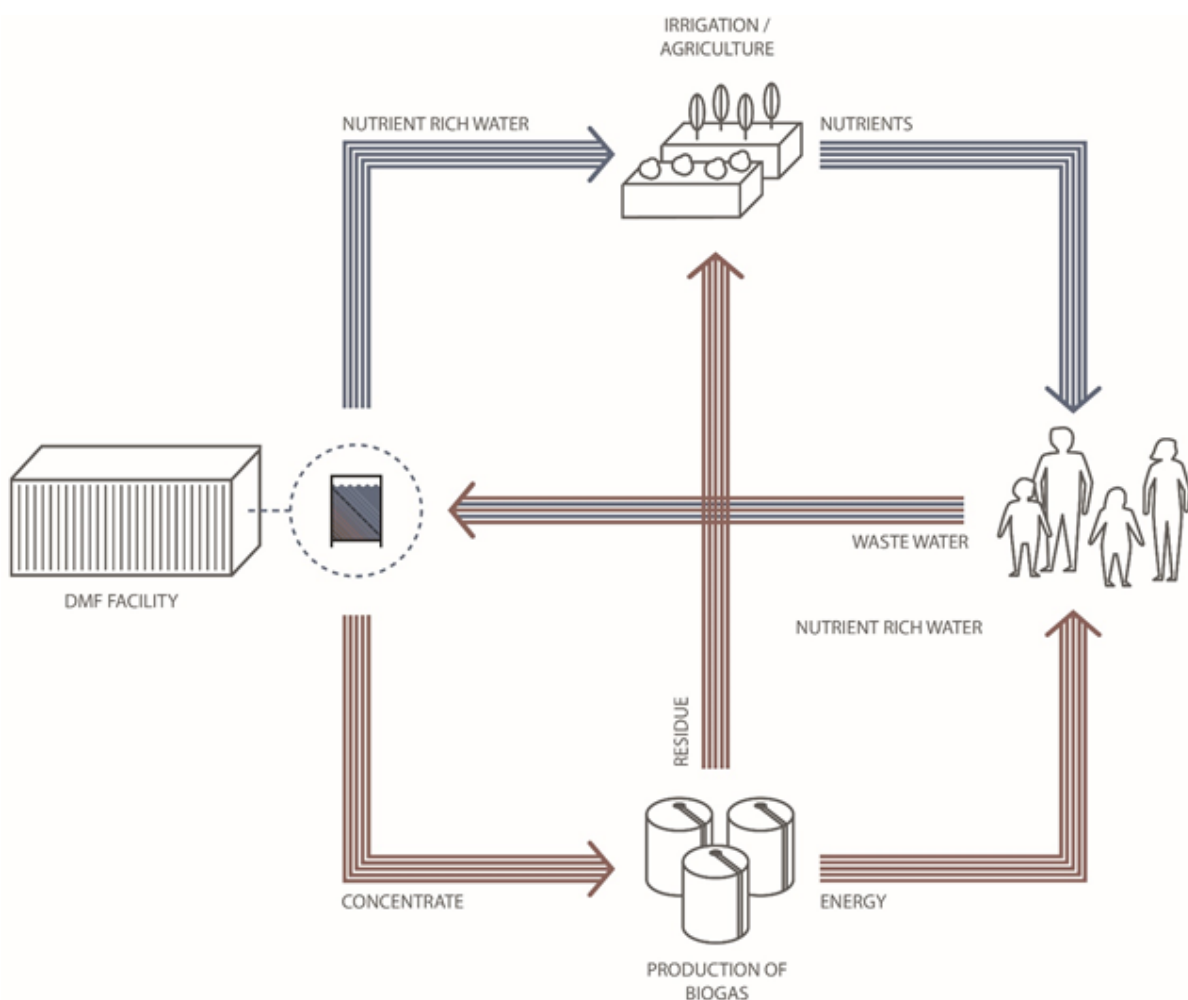


Figure 1: Wastewater turned into fertilizing irrigation water and concentrate suitable for biogas production

### Solution Development

Nordphos' solution is to build and test the actual solution. Though the technologies that Nordphos' solution applies are known, they have not been assembled and used in such a way before.

The solution needs three parallel phases: (1) tests of a mini DMF test-bed, (2) project engineering of a DMF unit for full-scale production and (3) technical analysis of resource flows and scenarios based on test results for designing the DMF system and the related software model to different resource flow scenarios. The test results contribute to the project engineering of the DMF unit and operation of the membranes. The technical analysis of resource flows and scenarios are input data for a future data model for a software platform for predicting the production capacity related to the market needs and capacity of wastewater. The engineering of the software platform will not be carried out within the scope of the Circularity Programme.



### C-Voucher:

Through C-Voucher Nordphos is able to carry out the solution development. The DMF solution will be implemented as a mini-scale test bed in Vejle, Denmark, for investigating the filtration performance of the unit before designing a DMF unit for full-scale production. Also, the operation and service of the DMF facility will be tested and optimized within the 9 months of C-Voucher participation.

The technical system of the full-scale DMF facility with its different components and processes will be designed. A technical diagram and a description of the manual operation of the DMF facility will be developed, including 3D drawings and descriptions for fitting the components in a standard unit. Process descriptions can be optimized based on analysis of results from test runs of the mini-scale DMF test bed.

Test results from operating the mini-scale test bed provides input on resulting fertilizing irrigation water volumes and serves to inform different use case scenarios necessary for the commercialization of Nordphos' solution.

## 2.2. Imse Vimse – Leasing - new business model for textile company, powered by digital B2C solution

Industry Domain: Textile

Circular building block: Product lifecycle extension/ Performance economy

Technology focus: Digital/ Software

Region: Sweden

### Background/ idea:

Textile products are an everyday necessity. Yet, the way many textile products are produced and used is extremely wasteful. The industry's current take-make-dispose model is the root cause of many environmental impacts and leads to substantial economic loss. According to Ellen MacArthur Foundation, an estimated USD 500 billion value is lost every year due to clothing that's barely worn and rarely recycled. If nothing changes, by 2050 the textile industry will use up a quarter of the world's carbon budget.

ImseVimse offers a range of textile products for babies and women many of which are reusable, for example diapers and menstruation pads. ImseVimse's vision is that sustainable consumption should be the norm, not the exception. ImseVimse offer functional and reusable products for children and women worldwide. For the sake of the environment ImseVimse has chosen to use cotton that is organically cultivated to ensure safe products. Production takes place mainly in Europe, primarily in Latvia, but also in Turkey, among others. ImseVimse impose strict demands on suppliers and manufacturers, and carry out annual checks on the conditions in their factories. ImseVimse also requires that they meet our quality standards, environmental requirements and working conditions. The aim is that all products meet the OEKO-TEX® Standard 100 for textiles.

ImseVimse's current business model doesn't guarantee that products are used so as to maximize their inherent value. The use period of many products is shorter than the actual lifetime of most products, meaning that the opportunity to enable further use cycles aren't utilized. It also means that ImseVimse cannot guarantee that products at the end of life are recycled and materials enabled to circulate into new products.

The aim of the project is to pilot a new leasing business model, based on circular economy principles, to increase the use of products, and ultimately turn old products into new. ImseVimse's products are already designed to have a long lifetime and produced with non-harmful materials, but new rental offerings will open new opportunities to resell and recycle all products. This will enable that products are kept at their highest value during the use period and re-enter the economy afterwards, never ending up as waste, resulting in benefits for both the business, society and the environment. As a first step, the project will explore the opportunity to develop new rental offerings for diapers. The project will explore how cross-selling can be developed to grow the business, for example to also offer customers to buy washing powder or storage solutions and when buying diapers.

### Solution Development

Many of ImseVimse's products can often be worn and used for a longer period than a customer is able to do. A rental model could therefore provide an appealing business opportunity. ImseVimse therefore needs to develop new service offerings that make already used products an attractive alternative for customers. New rental offerings will allow customers to rent either new products or second hand products. ImseVimse will develop a 'product quality evaluation system' in order to guarantee the performance and hygiene of all rental products. New rental offerings need to provide a user friendly 'take back mechanism' for ImseVimse to regain products from customers. For products such as diapers where practical needs change over time, rental offerings will make sure that customers easily and timely can upgrade to a new product.

## C-Voucher

Through C-Voucher ImseVimse is able to progress the solution, both with digital . The technical specifications for the solution that will be contracted are yet to be defined in detail, but as of today we know that a realization of the circular use case described in this report will require the development of:

1. New back office system – providing us with the services to keep track of the products and customers actions.
2. Digital platform – a new site, perhaps an app, where new service offerings can be launched and managed.
3. CRM system – to keep track of the customers actions, give them the service they need, and remind them of important issues, such as sending back products when customers can no longer use them.
4. Forecast and production system – to keep track of stock, origin of products, times of use and up or down cycling activities.

### 2.3. Lopyanko – from agro-waste to high-value product – bioeconomic value chain in the making

Industry Domain: Agro-food

Circular building block: Biological products/ Industrial symbiosis

Technology focus: Engineering (New processing)

Region: Bulgaria

#### Background/idea:

The production of silk in Bulgaria has a long history, with the country being the largest European producer for a long time. However the sector faded some decades ago, but is being revived among others with Bio Company Lopyanko. This is a young innovative company in the agricultural sector in Bulgaria with high caliber team of experts, established in 2013.

The main business activities during the last 4 years were in the agricultural fruits & vegetables sector together with harvesting mulberry yields and polycultures. The Business development team of the company is focusing over research and development of a new concept in the field of organic, 100 % pure agricultural production. This process led us to the idea to develop and

build a new technology, based on silkworm – derived products for feed and food industries and selling them on global markets.

The overall objective is to build an industrial plant with fully automated manufacturing process of organic silk, followed by re-manufacturing of waste materials into high quality proteins. Project will be managing the life cycle of organic resource – cocoon from Bombyx Mori, from extraction of the raw silk through the design and manufacturing of new products, using the waste materials from the silk production process and receiving new by-products with re-manufacturing and recycling operations, the so-called “Industrial symbiosis approach”. The silkworm of Bombyx mori is the only unique insect, which is giving value added to many industries. It can be used as a natural fiber in the textile industry, as a high quality protein for the food and feed industries

### Solution Development

The technical elements of establishing an automated manufacturing of silk and re-manufacturing of waste materials into proteins are many. The crucial new element is the re-manufacturing and creating a new product from the waste (pupae).

To enable this, both technological process development, clinical tests and documentation is needed. The solution will include the following actions (among more specified):

- Design/lab scale production of the raw material - in our case - silkworm pupae. Laboratory equipment – requirements for the finest raw material.
- Design/lab testing the necessary grinding equipment for silkworm protein powder - equipment to grind, technical characteristics, desired outcome of the finest powder according particular purposes for the food supplement.
- Lab testing of the silkworm pupae for its biological, chemical and technical characteristics
- Development of various options of the enrichment of the silkworm flour with biologically active probiotic bacteria in order to optimize the development of the microorganisms.
- Pre-clinical lab testing biological activity of the mixture between protein powder and the selected already bacteria that is going to be.
- Clinical test/lab testing of the final selected bacteria with the protein powder and the achieved results to be able validated.

Validation of the achieved results according the task of making a dietary supplement for animals will include (among more) the following steps:

- Laboratory experiments with selected components indicate that there is a synergy effect

- Exit criteria established for the final product
- Technology demonstrates basic functionality in simplified environment
- Draft conceptual design have been documented
- Key manufacturing processes identified
- Mitigations strategies identified to address the manufacturability/productability shortfalls/risks
- Preparation of product technology documentation together with recommendations for good manufacturing practices and hygienic conditions for the production of the new product as well as information on the recommended shelf life of the product, ways and conditions of its storage, packaging of the product against the requirements for such products.
- Produce quantitative calculations for the production of the new product as part of the technological documentation.
- Preparation of a list of laboratory and production equipment necessary for the production of the new product outside the laboratory.

The solution of Lopyanko has a highly specified set of actions which is also given by the nature of the product (feed) which requires the said tests.

#### C-Voucher

During the 9 months of C-Voucher, Lopyanko will be able to progress on a range of technological processes needed, particularly the lab tests. Further to this, the shaping of the product and the establishment of the value chain for the production of silk (including private farmers, suppliers of silk worms etc.) is being supported by C-Voucher design and business support.

The progress that Lopyanko will obtain in the C-Voucher project participation is thus both technological progress and wider engagement of business partners and shaping the communication of a circular solution for the silk production.

## 2.4. Commown – from e-waste to HaaS – technology design for prolonged life cycle

Industry Domain: ICT

Circular building block: Product lifecycle extension/ Performance economy

Technology focus: Engineering (Design for disassembly)

Region: France

#### Background/ idea

The report from the Shift Project – Lean ICT, published in October 2018, shows the threats caused by an unbalanced development of the digital technologies and their penetration into contemporary society and economy. The “smartphone & laptop phenomenon” –the fact that everyone holds multiple electronic devices- is considered as one of the main reasons for the increased share of digital industry in the Green House Gas Emission (from 2.5% of the total of GES emissions in 2013 to 4% in 2018). Indeed, the report shows that for a laptop used 3 years by its owner (which is the current average for the frequency of renewal in Europe), 80% of the energy used during the whole life of the product is consumed during the production phase.

Therefore, there is a need for a new way of owning electronic devices in order to prevent three main challenges:

- Disastrous ecological impact of electronics
- Planned obsolescence, both on software & hardware
- Difficulty to repair laptops (the user is powerless).

While recycling electronic devices is extremely complicated, due to the fact that smartphones and laptop are composed of a variety of different metals very difficult to separate, Commown aims to bring a solution to the ecological weight of electronic devices by focusing on Hardware as a Service (HaaS) to reduce the number of devices produced.

Commown is a French SCIC (Société Coopérative d’Intérêt Collectif, roughly translated a “Cooperative for collective interest”) a specific legal status that grants to the employees, beneficiaries (clients, suppliers ...) and other associates (private SMEs, funders, associations, public bodies ...) a participation to the governance of the enterprise. This type of SME is therefore deeply rooted into the main principle of Circular Economy – to involve all the stakeholders of the value chain to cooperate in the design of a eco-friendly solution.

The goal of Commown is to fight against planned obsolescence in the field of electronics (both hardware and software) in order to increase the lifespan of electronic devices. Therefore, its goal is to promote functionality economy as a way to reduce the weight of producing electronics devices. From this perspective, Commown has developed a “HaaS” offer for a variety of electronic devices. Services offered by Commown include for instance optimization of the laptop, assistance for repairing, complete check-up, theft-warranty, (...), with thorough customer service.

Currently, Commown already offers a wide set of products.

- Smartphones, with the “Fairphone”. The fairphone is an eco-designed smartphone designed to be easily repaired by the user

- A set of PC (including different models made for basic or more advanced uses)
- A set of laptops, aiming at various users.

Although the electronic devices offered by Commown are eco-designed, there is a need to go beyond and to bring a truly repairable/ modular laptop to the market, thanks to C-Voucher.

### Solution Development

The aim of the project developed by Commown is to develop the functionality economy by focusing on two aspects:

Firstly, to develop a truly repairable, modular laptop. The main objective is indeed to bring to the market a laptop with a potential life expectancy of 10 years, allowing a better amortization for Commown. A parallel with the “fairphone” can be made as this laptop aims at being easily repaired, with a system of spare parts and push/press buttons to simplify the manipulation of the device. Moreover, the project is to go beyond by designing a software able to self-evaluate the “health” of the parts,

Overall, the objective of this laptop is also to empower users of electronic devices. On the one hand, Commown helps “reassuring” the customer by providing a complete customer service, helping users with their electronic device. On the other hand, users are given the opportunity to manipulate the devices (when they first assemble it or repair it) and to have a basic understanding of its whole functioning. Finally, collectively owning a device (instead of buying one and being the only responsible of it) helps developing a sensibility, where users are more aware of the need to extend the lifespan of their electronics devices.

Secondly, to develop the HaaS offered by Commown by modernising the software currently used to manage the stocks and running devices. The aim of this software development is to pave the way for a new line of services proposed by Commown: to offer the development of “HaaS” for other enterprises, where Commown would promote functionality economy.

### C-Voucher

C-Voucher contributes to the realisation of technical activities to bring the circular laptop to life and to improve the HaaS offer. This would imply to contract two suppliers for two distinct missions:

The open/modular laptop - to bring the proof of concept for the laptop in order to start a crowdfunding campaign and to launch the modular laptop at a European level.

Three major points have been targeted for the laptop:

- “Repairable (with the possibility to dismantle it and to change parts thanks to spares). One key element to be taken into consideration is the design of the motherboard, which must allow an easy replacement of the parts without damaging the whole set.
- Modular (thanks to a system of “mods”, allowing the laptop to evolve following technological advances and to have a laptop specifically adapted to each user’s needs).
- With a specific software designed to self-evaluate the status of the parts that compose the laptop and give advises when it needs an update.

In terms of software development Commown needs a technical support to develop a modern and Open Source ERP dedicated to Hardware-as-a-Service. Commown needs to:

- Add functionalities to the current back office to smoothly manage all internal and external stakeholders of the circular economy project.
- Reinforce the current modules of the back office to be able to publish them, and to allow other companies to use them for their own circular economy projects.
- Modernise the current back office by making it compatible with a state-of-the-art Open Source ERP.

These software developments aim to provide a software product that Commown will be able to monetize by offering its expertise to other companies.

In the end, the aim of this software development is for Commown to sell it to other companies aiming to develop a service offer.

## 2.5. Pyxo – how smart packaging creates new incentives and value in the professional food service

Industry Domain: Food service

Circular building block: Material resource efficiency/ Performance economy

Technology focus: Digital/ Software

Region: France

### Idea and background:

The use of single use packaging for take-away food today is both expensive and creates waste. For many employees in large cities it is frequent to take away lunch and there is a large food service market.



PYXO is a French company that changes that picture, offering a service solution to single use plastics and paperboard takeaway containers. By creating smart packaging (digital) and a logistical bridge between restaurants and companies/offices - where the customers work - PYXO offers an attractive alternative.

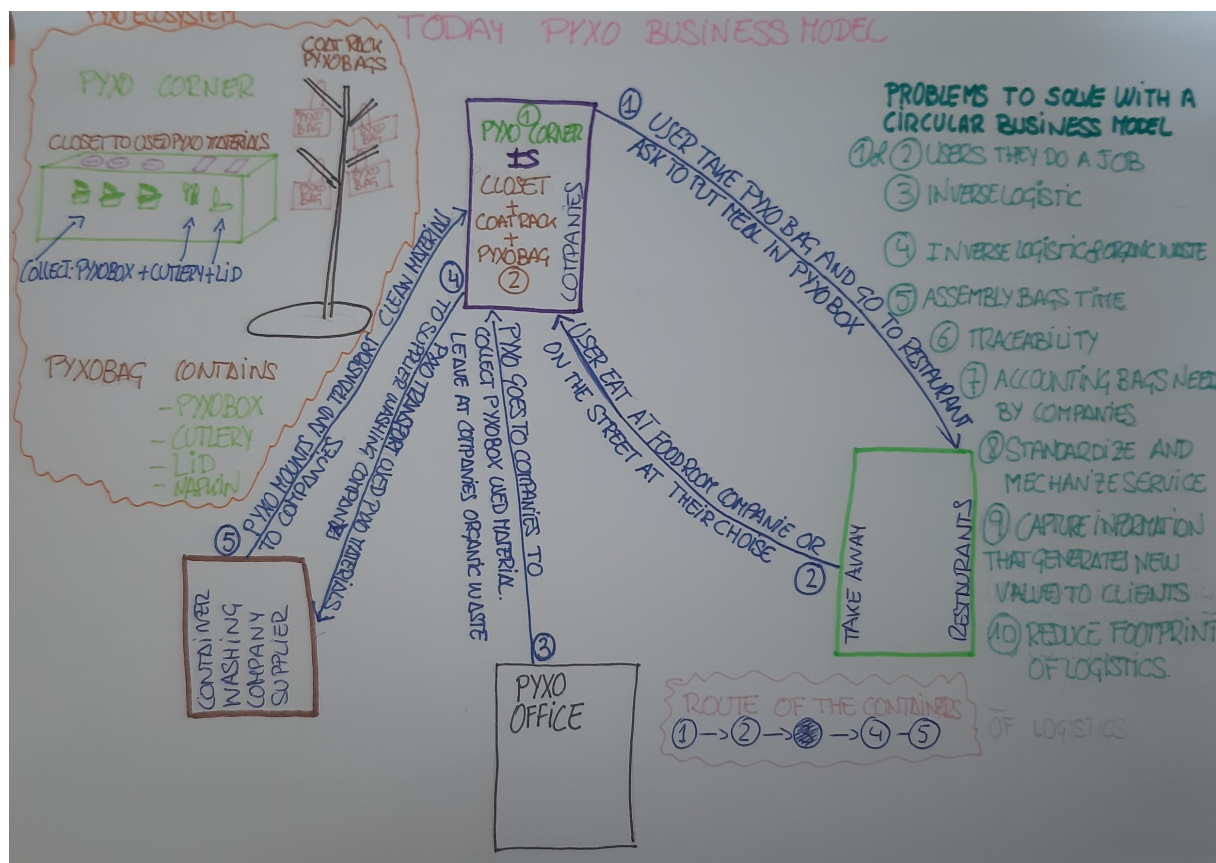


Figure 1: PYXO today's circulars problems analysis.

Contrary to the usual management of single-use containers, PYXO has designed a new management model for reusable packaging in the take-away sector where the capture of information, the computer control of packaging at each key point of the process that will be carried out using RFID technology are key in a new takeaway service experience.

As well PYXO can provide services to clients (enterprises and restaurants) with the capture of information. Pyxo makes workers more efficient, reducing wait times in restaurants with the order and delivery service at office, reporting free time for the company and for the worker who could plan his lunch from the first hour of the morning. On the other side, PYXO offers restaurants customer loyalty and work orders in advance so that restaurants cook exclusively what they are going to eat.

In the logistical aspects, PYXO redesigned its system of collection, cleaning and delivery of reusable containers for food so that the kilometers traveled by the containers during the process are reduced. Above all that, reduce water use and chemical products to clean containers can be change with autoclaving disinfection more circular.

The benefits of PYXO service are:

- It reduces pressure and environmental impacts associated with the takeaway
- It improves the experience of the moment of relaxation of food for thousands of people contributing with ecology and respect for Nature
- It reduces the generation of waste at the municipal level
- It reduces the emissions derived from logistics and the treatment of wastewater and waste.
- It is flexible and replicable in in different sectors and territories.

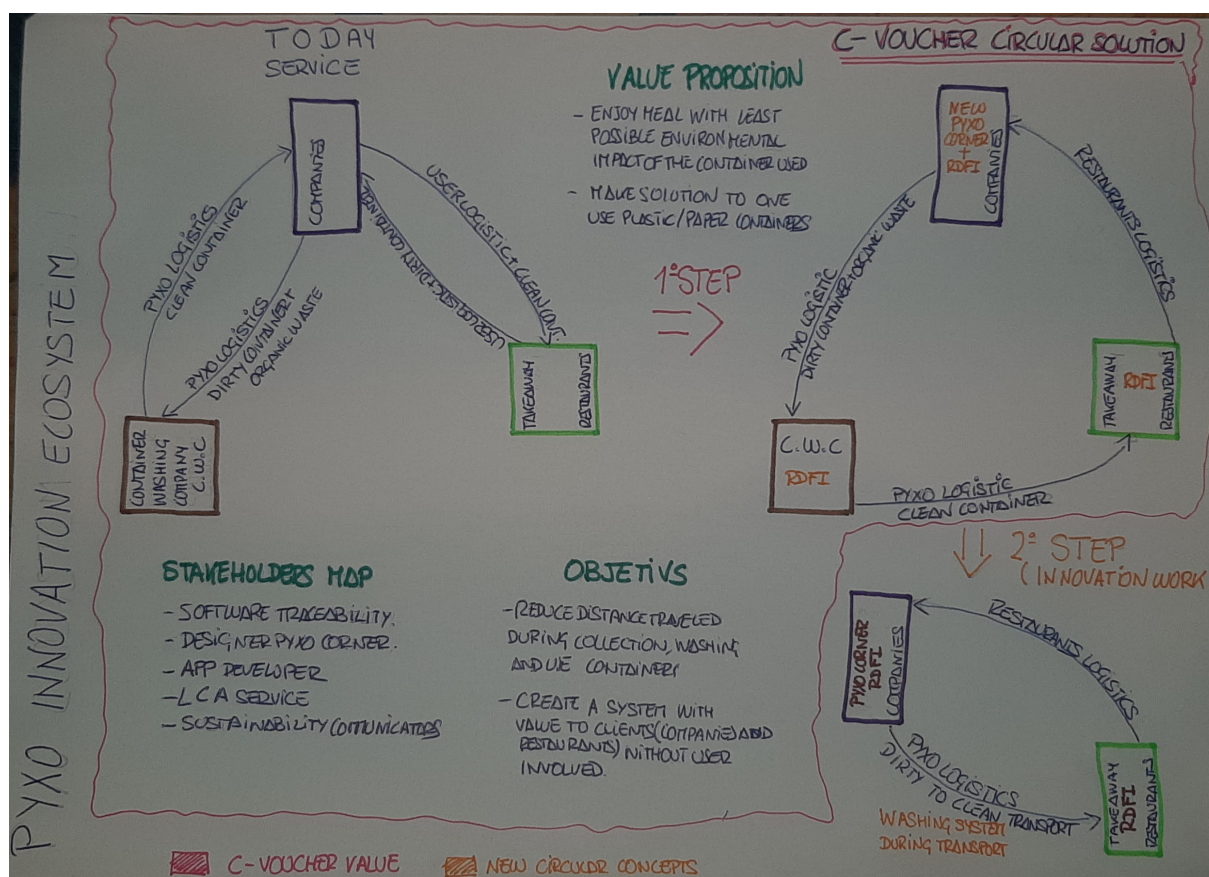


Figure 2: comparison of the PYXO service today versus the circular proposal.

### Solution Development

Pyxo intends to implement the solution of the first step that can be seen in the design of figure 2:

The solution needs three parallel phases: (1) a prototype of the shelf (pyxo corner) to leave the food ordered by the employees and where to deposit the used containers as well as cutlery and food remains that today are left behind generating a problem for the companies, (2) engineering project for the development of containers traceability solution with indication of the amount of clean containers in deposit delivered to restaurants and the amount of packaging required daily for each company-client (3) design evaluation through life cycle analysis to detect future innovations and the continuous redesign of the service.

The second step will be a future innovation project to reduce the storage and the travelled kilometres by the containers to the minimum possible.

#### C-Voucher:

Through C-Voucher PYXO is able to carry out the solution development. The PYXO corner solution will be implemented as a personal-scale test in one enterprise-client and restaurant-client to validate the proposal design and detect possible deficiencies.

The software and hardware needed to make real the PYXO solution for traceability will be made as well as a personal-scale to reduce cost.

Finally, the LCA will be carried out completely to be able to implement the most urgent eco-measures on the design of the service.

As mentioned above, the second step (figure 2) will be executed after the C-Voucher program because it requires more time and resources than we currently have.

## 2.6. Katty Fashion – optimization of material use powered by digital production

Industry Domain: Textile

Circular building block: Material resource efficiency

Technology focus: Digital/ Software

Region: Rumania

### Background/ Idea:

Katty Fashion (KF) is a textile manufacturer and -service company who works for a number of European fashion brands. With services ranging from design, pattern making, prototyping, sourcing of materials, sewing the clothes and shipping of final product Katty Fashion has gained great insight into the whole fashion value chain. From this experience and outlook the ideas of more circular approaches have formed.

KF's circular solution is a sustainable approach in garment development and manufacturing combining advanced pattern-making tools and 3D virtual prototyping with Zero Waste and systemic design principles to develop the elements of a digital collaborative product development service (co-design) to provide efficient, pragmatic and easily applicable solutions.

It is addressed to fashion designers and producers facing the major challenge of making their processes more ethical and sustainable, whilst staying in the game in a globalized fashion market, marked by fierce competition and high versatility.

### Solution Development

KF aims to modernize its garment development service with 3D CAD software expert technology to allow it to optimize its activities in the 2D pattern creation area with extensive operating capabilities on virtual samples and prototypes.

The software application has to ensure at least the following functions:

- Advanced pattern construction, adjustment and grading
- Automatic autonomous framing with hi-optimizing degree
- Quick estimation of the materials consumption
- Wide fabrics library with the possibility of adding/creating new ones
- Body library with the possibility to import new scanned bodies sent by the KF customers to be used for the fitting sessions.
- Import of files from other software applications (eg DXF, RUL, AAMA) and export to other software applications of the same type
- Import and export possibilities from Gemini CAD System (used currently by KF technicians)
- Material placement on the screen
- Bidirectional transfer 2D and 3D of the adjustments
- Realistic 3D viewing, including positioning of fabrics and product details like: pockets, folds, collars, belts, laces
- Managing folds, pockets, collars, symmetrical pieces, lace, V&T taps
- Dynamic measurement tables
- Gradation one-step curves for all sizes
- Automatic operation in batch list of framings
- Easy to use, user-friendly interface

The implementation of the software solution includes both training of the users but also adjustment of the business processes with the end customers.

This project is part of a step-by-step transition to a larger circular model in fashion production, implying digital and practical solutions from conception throughout fashion value chain, for easier and viable upcycling /reuse at the end of product's life and reintroducing them in consumption till recycling (e.g. cross-industry use such as construction and automotive).

#### C-Voucher

With C-Voucher KF will be able to develop the said solution and define it as an important first step in the transition to circular principles in the its business relationships. During C-Voucher Katty fashion will work to identify the viable circular solution elements: identifying the best available and affordable technologies in the field of CAD 3D and advanced garment manufacturing, defining initial target group of clients and obtaining their commitment for testing circular solution. They will also be able to match up with technology providers, install software applications and integrating with the KF product development requirements. At the end of the project they will have a report comprising a description of new software solution + collected feedback from technicians and customers and have demonstrated ZW PD Toolkit functionality and efficiency, including basic technical ZW solutions and 3D prototyping, in an iterative and collaborative testing with target group of clients.

Beyond C-Voucher KF aims to continue developing, together with an expert in systemic design and a software developer, a more complex digital service in garment design and manufacturing, by incorporating a Zero Waste and systemic design toolkit, addressed to fashion designers and traditional production systems, and a co-working interface that would enable recovering from the market of garments at the end of their life cycle, also generating practical solutions to reintroduce them in consumption by up-cycling or recycling in other cross border industries (e.g. as insulations for buildings or geo-composites).

### 3. From concepts to reality

The C-Voucher project provides the beneficiary companies with 9 months intense support structured as a “Circularity Programme” to define, develop and leverage their circular solution. The companies and solutions described above have been participating for 3-4 months with particular focus on scoping and refining the solution - both from a business perspective and to define and specify the technological components. In the coming months the solutions described above will be realized as actual collaborations with technology providers and other partner and client collaboration case dependent.

These solution descriptions are meant to inspire what a “circular solution” can be and how technology can be a key enabler. A report on the implemented solutions will be made at the end of the programme period (October 2019) with more details on the actual implementations and learnings.

A solution description will shortly be made available at the C-Voucher Marketplace, along with videos with testimonials from the participating companies/ beneficiaries. This content will be available and activated in connection with the C-Voucher open call for adaptor companies wanting to implement technology solutions inspired by the solutions from this round.



## Annex 1: Circular building blocks

The following examples of circular building blocks have been inspired by the report “Understanding the Circular Economy in Europe, from Resource Efficiency to Sharing Platforms: The CEPS Framework. July 2016”.

1. Industrial symbiosis. There are two concepts of industrial symbiosis: (1). a classic concept of material resource flows and (2). a digital-age concept based on knowledge flows across networks.
2. Material resource efficiency. It's the process of reducing a number of material resources needed to produce one unit of a product or service, or simply put as “doing more with less”.
3. Renewable energy and energy efficiency. It's reduction of fossil fuels consumption and curbing GHG emissions (almost 41% of final energy in 2013 was consumed by EU construction sector only<sup>24</sup>). Energy- efficiency measures (i.e. retrofitting) could save up to 75% of energy consumption.
4. Biological products. Modern agriculture, mostly dependent on pesticides and fertilizers, came at a price to the environment and to the quality of agricultural products. Annual consumer food waste in the EU reached 47 million tonnes in 2016, most of which could be avoided.
5. Product life cycle extension - The idea is to design products in a way for them to serve longer, repair them, reuse and recycle. Some of the products, from umbrellas to power tools, have been available on the market for several decades. Other newly developed products are progressively following even stricter design constraints.
6. Performance economy - It's “selling goods as services through rent, lease and share business models”, or providing products as services (Stahel, 2016). According to the concept of the performance economy, the number of manufactured units of products will decrease, but the revenue for each unit produced will increase.
7. Sharing economy - It entails the “peer-to-peer-based activity of obtaining, giving, or sharing the access to goods and services”. Obviously, people have shared/exchanged products for thousands of years but today's exchange can take place via the internet on a far larger scale, extending the geographical constraints.
8. Platform economy - It's facilitating information exchange and direct interactions between buyers and sellers on a global scale. It's not impacting the CE per se, but enables CE building blocks (e.g. performance and sharing economies) and offers a bottom-up market approach of B2B, B2C and C2C trade/exchange.