

Change Management for Circular Economy via Circular (Business) Models



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List of abbreviations

EC – European Commission
LSGU – Local Self Government Unit
EU – European Union
BM – Business Models
SEA – Law on Environment
LWM – Law on Waste Management
PUC – Public utility company
MoEPP – Ministry of Environment and Physical Planning
NEAP – National Environmental Action Plan
RNM – Republic of North Macedonia
SEA – Strategic Environmental Assessment
FAO – Food and Agriculture Organisation of the United Nations
IUCN – the International Union for Conservation of Nature
IWRM – Integrated Water Resource Management
SPA – Special Protection Areas
WFD – Water Framework Directive
CE – circular economy
CCSCP: Collaboration Centre for Sustainable Consumption and Production
GPP – green public procurement
GRO – means grow in Nordic
KPI – key performance indicators
SDG – sustainable development goals
CEDP – circular economy design principles
CEAP – circular economy action plan
RENO – renovation wave (European government 2020)
WEEE – Waste Electrical and Electronic Equipment
IWMS – Integrated Waste Management Solution

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Disclaimer

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This book is not to be printed.

Executive Summary

This book is intended to assist students, researchers, trainers, coaches, mentors, practitioners, teachers, managers, entrepreneurs, business owners, citizens, government officials, i.e. any stakeholder in an economy willing to learn and adhere to an old-new paradigm of circularity. It encompasses the main theoretical foundations — the Circular Economy concepts, definitions, mechanisms, principles, regulations, approaches, frameworks; it describes the Business Models in their essence and it portrays their differences and how they can become (if new) or transition to (if existing) circular economy. That is one of the most important didactic aspects of the book. The second part enumerates important practices in Circular Economy, which are to be used as examples, trajectories, best practices to learn from, and ‘copy-paste special’ in its own context. The challenges we face are similar, the system design of solutions and their contextual adaptation are a necessity, so this is one step forward in the proper direction of conceptualizing and taking action.

This book contemplates and presents a plethora of works and contributions as learnings from the BeCircular project funded by the European Commission (with the partners Diadyma, CluBe Greece and ZMAI North Macedonia), original research of the authors and collaborates (Renata Petrevska Nechkoska, Geert Poels, Gjorgji Manceski) presented on conferences, master theses references and excerpts by Laura de Roeck, Manou Baert, Olivier de Gussemme, Sophie Sanders, Wouter van Cauwenberghe, Judith De Koninck, Tibo Hendrickx, Dieter Labeeuw, from the joint supervision at Ghent University Belgium (Renata Petrevska Nechkoska and Geert Poels), the MultiCreation projects carried out by the authors at the University St. Kliment Ohridski Bitola and a broad system of stakeholder partners, North Macedonia, and the mentoring and coaching sessions of the authors, Mimoza Bogdanoska Jovanovska and Renata Petrevska Nechkoska.

Methodology

Regarding the manner in which the book was compiled, it is visible that its theoretical background is derived from the established literature in CE and business models and conceptual frameworks, complemented with referenced original research in diverse domains of application of the circular economy, performed under the mentorship of the book's authors and other collaborating professors, and master students at the university of Ghent, Belgium. The methodology to bridge the business and problem-based models with the circular logic is creatively deployed to point out the differences and what needs to be incorporated to make them circular. On the other hand, the second part of the book draws on the learning from practice — on a global scale, from the BeCircular cross-border project between Greece and North Macedonia, from the Western Balkans context, and on the national level of the Republic of North Macedonia. In this part, both existing and novel approaches are discussed, derived from the authors' own experience and experimentation within their professional and voluntary engagements as well as within facilitated projects undertaken to initiate positive change, rather than adapting to negative changes.

Part A - Theoretical Foundations

1. Circular Economy - definitions

Circular economy can be perceived as a regenerative economic system, where all resources, waste, emissions and energy use are substantially reduced by slowing down and optimizing the production/consumption cycles and by extending both the energetic and material life cycles. It aims to change the paradigm of perception of waste, even its definition, and to portray it as a challenge attractive enough to be converted into money and goods.

According UNCTAD (Fig. 1), “a circular economy entails markets that give incentives to reusing products, rather than scrapping them and then extracting new resources. In such an economy, all forms of waste, such as clothes, scrap metal and obsolete electronics, are returned to the economy or used more efficiently. This presents us with ways not only to protect the environment, but also to use natural resources more wisely, develop new sectors, create jobs and develop new capabilities.” A notion pursued by UNCTAD is “the goods of today are the resources of tomorrow at yesterday's resource prices”.



Figure 1. Circular Economy, UNCTAD¹

According to the most established authority for Circular Economy, its definition is as follows:

“Circular Economy: A systems solution framework that tackles global challenges like climate change, biodiversity loss, waste, and pollution. It is based on three principles, driven by design: eliminate waste and pollution, circulate products and materials (at their highest value), and regenerate nature. It is underpinned by a transition to renewable energy and materials. Transitioning to a circular economy entails decoupling economic activity from the consumption of finite resources. This represents a systemic shift that builds long-term resilience, generates business and economic opportunities, and provides environmental and societal benefits“ (Ellen MacArthur Foundation, 2013).

When decomposing this definition, first and foremost, we see that CE is perceived as ‘a systems solution framework’ which means it promotes systemic design of any action or entity, and a comprehensive governance which doesn’t elude one-size-fits-all, but on the contrary, every action and actor needs to find

¹ <https://unctad.org/topic/trade-and-environment/circular-economy>

their own pathways aiming at these challenges, while following several main principles.

The entire direction of re-introducing CE is to address global challenges produced by the ‘business as usual’ or by the so-called ‘linear economy’ (Fig. 2), which follows the ‘take-make-dispose’ workflow. In any sense, that is problematic and cannot be sustained, both on a small scale and on a mass scale, across the globe and humanity. The ‘take’ consumes to some extent the resources which cannot be renewed (at all or at the needed pace), all the take-make-dispose activities consume ridiculous amounts of energy (so far predominantly from non-renewable sources) and the ‘dispose’ stage produces way too much waste which aggregates and piles up, endangering the soil, the water, and the air. Hence, CE is set in action to address the global challenges such as climate change, biodiversity loss, waste and pollution. Additionally, it underpins ‘renewable’ as the main trait of the resources, materials and energy, thus decoupling the economic activity from finite materials and resources, moving beyond the wrongfully perceived abundance towards the ‘humans being respectful hosts and guests on this planet’ premise.



Figure 2. Linear economy

We have reached another aspect of defining the CE — its principles. Different authors suggest a plethora of useful technological, managerial, ecological, societal and other principles. The three described here are:

- eliminate waste and pollution,
- circulate products and materials (at their highest value), and
- regenerate nature.

These should be incorporated in the design of business models, projects, endeavors which use resources of any kind. Only by interweaving them as design principles with a compulsory adherence will there be some chances of recuperating our Planet and improving the quality of life without further endangering it.

As defined here, the CE ought to produce a systemic shift that builds long-term resilience, generates business and economic opportunities, and provides environmental and societal benefits. We have to agree that humanity cannot simply shift the complex socio-economical-technological-ecological systems with substantial complexity and self-preserving motivation without encompassing a way of working and living which has to consider the business aspects, the profits, the economies and the societies.

Figure 3 depicts a relevant question — why should we care, as individuals? This question should be posed to every participant in any CE training. And the answers can vary from a better quality of life NOW, to a preserved planet for the FUTURE generations, since visible damage is ongoing and collective action is needed.



Figure 3. Why care? Every individual's life is relatively short on this planet, why should we care?

2. Principles of Circularity and Sustainability

Literature and practice combine and enhance a set of principles, which can be recognised in one way or another, in every approach, regulation, and framework. At the moment, there are 6Rs of sustainability (somewhere enhanced with a U-for upcycle) (Weetman, 2017), and currently, revolving around 10Rs. Hence we can distinguish the following 6Rs, as visualised on the poster below (Fig. 4):



Figure 4. The 6Rs of environmental sustainability, York University

However, here we are providing a brief description of the 10Rs, encompassing all currently in use:

Refuse: We consume more than we need: cars are often idle and offices are very often empty. We can change this by refusing to have such unnecessary and unsustainable products with solutions that maximize the use of fewer goods.

Rethink: Each product and system must be rethought to reduce its environmental impact.

Reduce: The central idea of a circular economy is dematerialization or "doing more with less." To achieve this, we must use and produce products in smarter ways.

Reuse: To achieve zero waste and reduce carbon emissions, we need to look beyond the extractive industry's current 'take-make-waste' model.

Repair: Planned obsolescence and a throwaway culture are a stark reality in today's society. An example: in October 2019, the EU adopted an eco-design law requiring manufacturers of phones, tablets, and laptops to make their products more easily repairable.

Reconstruct: Refurbishing is the process of restoring and updating an old or discarded product so that it can once again perform its original function. Damaged parts are replaced, resulting in an overall update while the product looks brand new. Refurbishing products can reduce the need for new materials, resulting in a reduction in waste and carbon emissions.

Remanufacture/Recondition: Remanufacturing, or reconditioning, involves refurbishing parts of a discarded product and reusing them in a new product with the same function.

Re-offer/Repurpose/Upcycle: transforming a discarded product into a new product with a different function.

Recycle: *Upcycle:* the quality of the recycled product increases after recycling.
Downcycle: the quality of the recycled product decreases after recycling.

Recover: What if waste was not? Through anaerobic digestion, microorganisms can break down biodegradable waste into materials that we can use to generate energy, as well as reduce pollution, water acidification, and carbon emissions. It is important to note that this R is the last resort after all other "10R" options of the circular economy have been exhausted.

3. Regulations and Strategic Direction

When discussing strategic focus for CE and in general, we need to look into some of the most present global principles for circularity. United Nations' Sustainable Development Goals are another popular concept (SDGs, 2015) and they have a broader scope and are based on the concept of long-term development. Incorporating some of the circular principles, on the other hand, can aid in the achievement of these SDGs (Fig. 5). According to the 73rd United Nations General Assembly and the UN Economic and Social Council, a circular economy can help accomplish SDGs 6, 8, 11, 12, 13, 14, 15, and 17.



Figure 5. United Nations' Sustainable Development Goals²

However, even though the leaders across the globe have somewhat dedicated their focus and efforts to the SDGs, on the tactical level and even more on the operational level, it is each country or union, on their own, meaning there is an aversion to the systemic approach, frameworks, design and hence, effects. On the dark side, there is a more realistic view on how the SDGs are achieved so far, transforming them into Sustainable Development Ghouls, which should make us question what has been done so far and how effective it is (Fig. 6)

² <https://www.un.org/en/sustainable-development-goals>



Figure 6. Sustainable Development Ghouls, University of Galway, Ireland³

In the case of the European Union is concerned, and for example, Belgium as a representative country of the EU, examined with regards to legislation, we can conclude that there is a plethora of regulations which, at least theoretically and conceptually, tackle the CE tactics and governing principles (Fig. 7).

The main principles deployed across EU are in the direction of **caution** — taking legal and regulatory action even if the risk cannot be fully pinpointed; **prevention** — of ecological damage to protected species, natural habitats, water and soil; **correction at source** — stopping solution at its source instead of repairing damages; **the polluter pays** — the financial damages from its actions.

³ <https://www.universityofgalway.ie/media/buildingsoffice/files/services/Sustainable-Development-Ghouls.pdf>

If we move from top to bottom, i.e. from Europe as high level union, to specific institutions deploying circularity principles, we need to consider at least the following regulations and legal aspects:

- The European Green Deal⁴
- The European Circular Economy Action Plan (CEAP)⁵
- The European Climate Pact⁶
- The Federal Action Plan for a Circular Economy (e.g. Belgium) (2021-2024)⁷
- The Third Climate Plan (e.g. the city of Ghent)(2020-2025)⁸
- The Climate Goals (e.g. Ghent University)⁹

Quantitative targets	Reduce landfilling of municipal waste to a maximum of 10% by 2030
	Prepare 65% of municipal waste for re-use and recycling by 2030
	Prepare 75% of packaging waste for re-use and recycling by 2030
Qualitative targets	Launch and continue waste prevention programmes
	Develop an EU methodology to measure food waste and define indicators
	Promote efficient use of bio-based resources
	Encourage recovery of critical raw materials



⁴ https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

⁵ https://environment.ec.europa.eu/strategy/circular-economy-action-plan_en

⁶ https://climate-pact.europa.eu/index_en

⁷ <https://khattabi.belgium.be/en/belgium-adopts-ambitious-federal-plan-sustainable-development>

⁸ <https://stad.gent/en/city-governance-organisation/city-policy/ghents-climate-actions>

⁹ <https://www.ugent.be/en/ghentuniv/mission/sustainability/climateplan>

Figure 7. Regulation perspective of the Circular Economy, De Roeck and Baert, 2022 and Labeeuw, 2020

4. Approaches for Circular Economy

The Butterfly Diagram

The Ellen McArthur Foundation developed a diagram called the “butterfly diagram” with the intent to graphically show the acceleration of the transition towards a circular economy. This diagram helped to spread awareness of the CE on both business and political levels (EU, 2015; UN Global Compact & Accenture, 2014), using the cradle-to-cradle approach. The **cradle-to-cradle** concept concerns eco-effectiveness instead of the other eco-efficiency approaches (Toxopeus, De Koeijer & Meij, 2015). The difference between eco-effectiveness and eco-efficiency is the fact that the former is focused on leaving a positive footprint and, thus, is about doing more good; whereas the latter is based on the negative footprint or “doing less bad” (Toxopeus et al., 2015). The cradle-to-cradle concept¹⁰ adopts 5 key principles: **material health** in terms of safety of people and the environment, **material reutilisation and product circularity**, **clean air, renewable energy and climate protection**, **water and soil stewardship**, and **social fairness**.

¹⁰ <https://www.c2ccertified.org/get-certified/product-certification>

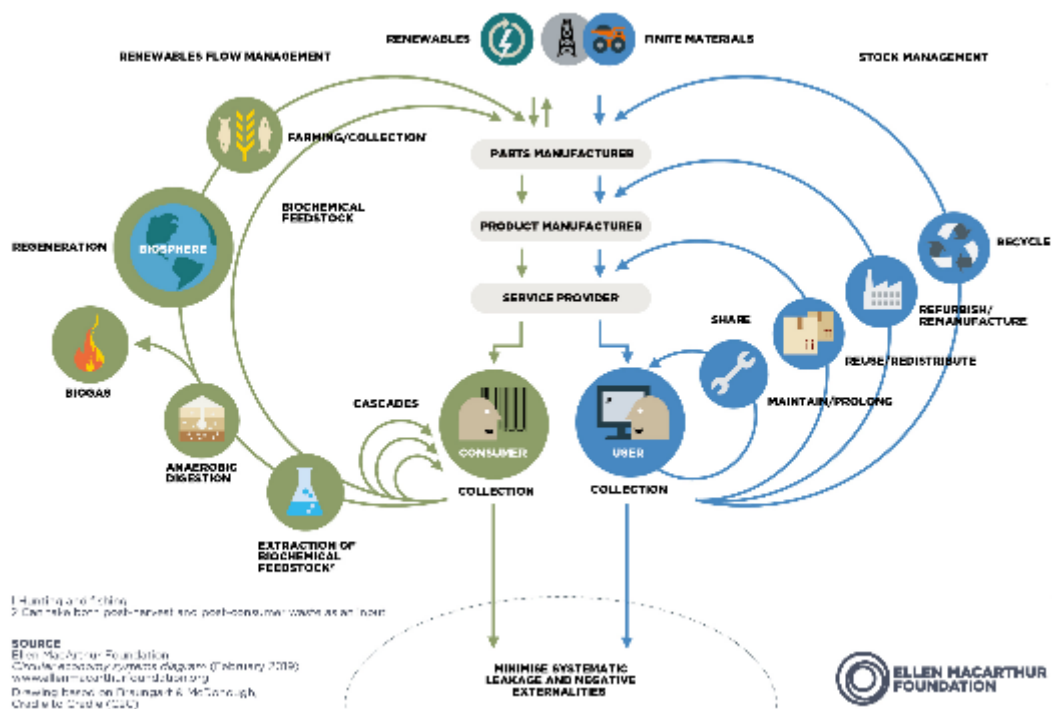


Figure 8. Butterfly diagram, Ellen MacArthur Foundation¹¹

Within the butterfly diagram (Fig. 8) as a concept of circular economy, a distinction can be made between a technical and biological cycle. Both cycles are visualized in the butterfly diagram, which depicts the ongoing flow of all materials present in an economy (Ellen MacArthur Foundation, 2013). This visual allows possibilities to adopt the best-suitable approach and technology to a circular flow mode. The tighter the circles are, the more complete the implementation of a circular strategy is (Bastein, Roelofs, Rietveld & Hoogendoorn, 2013).

The technical cycle intends to sustain the value of the utilised material while also using it continually, via strategies such as: recycling, refurbishing, reusing and redistributing, and lastly maintaining or prolonging the product life. In other words, within the technical cycle, inorganic materials (e.g., chemicals) are constantly circling in a closed-loop manner within society.

¹¹ <https://ellenmacarthurfoundation.org/circular-economy-diagram>

Conversely, materials from biological sources are sustainably operated and renewed in a biological cycle which can be achieved through the extraction of biochemical feedstock, anaerobic digestion, regeneration and farming or collection. This allows continuous circulation of organic materials (e.g., wood) in open loops in nature.

Out of the remarks and issues with the butterfly diagram, we can enlist the creation of imaginative natural environment, where no such thing as waste is mentioned in the biological cycle; separate perception of humankind, while people are actually part of the entire ecosystem; the notion of continuous cycles where no quality or energy is lost is not realistic; exclusion of the extractive industries and the primary processing of materials (Velenturf et al., 2016, 2017, 2019).

The ReSOLVE Framework

The ReSOLVE Framework has been introduced by McKinsey Center for Business and Environment, and consists of the following notions:

“Building a circular economy requires complex efforts at the local, national, regional, and global levels. To transition from the current trajectory to a circular one, European economies and companies must undertake six actions: regenerate, share, optimize, loop, virtualize, and exchange—the ReSOLVE framework.” (McKinsey, 2016)

Regenerate. Shift to renewable energy and materials; reclaim, retain, and regenerate the health of ecosystems; and return recovered biological resources to the biosphere. For example, the Savory Institute’s promotion of comprehensive land management has influenced the regeneration of more than 2.5 million hectares of commercial land around the world.

Share. Maximize utilization of products through peer-to-peer sharing of privately owned products or public sharing of pools of products; reuse them throughout their technical life spans; and prolong those life spans through maintenance, repair, and design for durability. Examples include car- and home-sharing business models.

Optimize. Improve the performance and efficiency of products; remove waste from their supply chains; and leverage big data, automation, and remote sensing. None of these actions requires changing products or technologies.

Loop. Keep components and materials in closed loops and prioritize the inner ones. For finite materials, this means remanufacturing products or components and (as a last resort) recycling materials, as Michelin, Rolls-Royce, and Renault are doing. For renewable materials, it involves anaerobic digestion and the extraction of biochemicals from organic waste. In the United Kingdom, 146 anaerobic-digestion plants treat 66 percent of sewage sludge, and an additional 175 plants produce bioenergy from solid waste—a number that is growing rapidly.

Virtualise. Deliver utility virtually—books or music, online shopping, fleets of autonomous vehicles, and virtual offices.

Exchange. Replace old materials with advanced renewable ones; apply new technologies, such as 3-D printing and electric engines. In different ways, these actions all increase the utilization of physical assets, prolong their life spans, and shift the use of resources from finite to renewable ones. Moreover, each action reinforces and accelerates the performance of the others. Separately and together, they could have a profound impact, increasing cost competitiveness substantially. Most industries already have profitable opportunities in each area. Not all of the technological advances will reduce costs; many might improve performance instead, and in some cases, the technology will need time to make a difference. But the analysis is persuasive: the circular economy carries a transformational potential that business—and society—would do well to take seriously. The main reasoning within this framework is presented in Fig. 9.

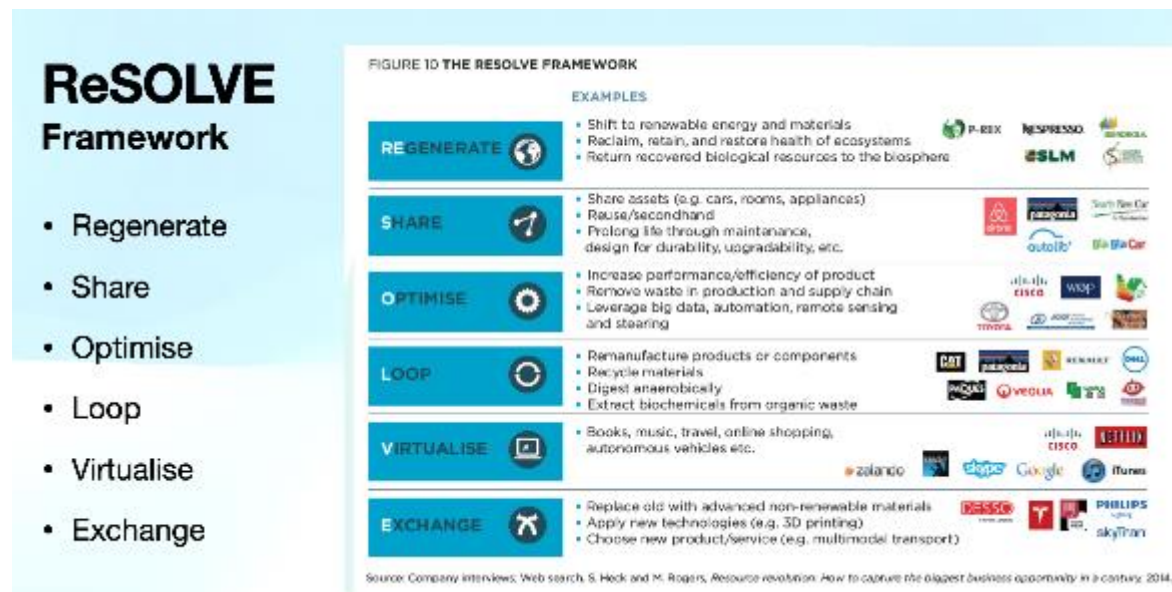


Figure 9. ReSOLVE Framework, McKinsey

Fig. 10 below depicts some useful aspects of the ReSOLVE Framework in reality.

top-down change [/'tɒp- daʊn, CHɪn/] noun Top-down change is institution-driven change, such as strategy and policy decisions including public-private partnership projects that are concerned with developing and facilitating market initiatives.¹¹		bot-tom-up change [/'bɒtəm- daʊn, CHɪn/] noun Bottom-up change can describe social movements and social innovation, such as initiatives and entrepreneurial activities initiated and run by civil society, NGOs, communities and businesses.¹²	
Principle	Definition	Top-Down Example	Bottom-Up Example
Regenerate	The shift to renewable energy and materials—to reclaim, retain, and restore the health of ecosystems and return recovered biological resources to the biosphere.	Utilizing rooftops as solar fields, developing green space for biodiversity and to improve air quality.	Personal acquisition of renewable energy, solar panels, urban farming, electric or biogas-fueled mobility.
Share	Sharing assets (e.g., cars, rooms, appliances), and prolong the life of materials through maintenance, design for durability, upgradability and encouraging reuse/ second-hand.	Policy/innovation to support the collaborative economy, regulate sharing, tax and fiscal measures incentivizing sharing.	Car sharing, appliance sharing (washing machines, tools), repair (repair cafes), reuse (clothing, furniture, vehicles, appliances)
Optimize	Increase performance/ efficiency of a product, remove waste in production and supply chain, and leverage big data.	By using gathered data on traffic flows, the efficiency of cities' major transportation can be optimized, decreasing congestion. Installing smart LED lighting throughout the city to save energy. Retrofitting old buildings to increase their energy efficiency.	Smart cities labs, Rob Labs, smart grids, smart communities.
Loop	Remanufacturing products or components; resources are processed, looped around and put back into the economy rather than lost in a landfill.	Waste separation and recycling, district heating, bio-based economy, reverse logistics.	Community recycling initiatives, upcycling initiatives, community bio-digesters.
Virtualize	Dematerializing directly and indirectly (for example e-readers replacing physical books, or a Netflix subscription replacing material DVDs).	Virtual city hall counters. Autonomous public transportation and semi-private transportation like taxis. Virtualization of public libraries, archives, legal information. A paperless municipality.	Community-led digital platforms, citizen-science climate monitoring.
Exchange	The process of replacing old technologies with advanced non-renewable materials, applying new technologies (such as 3D printing) and choosing new products/services.	Circular construction, demolition materials and processes, electric-powered public transportation, procurement of circular office furniture.	Electric mobility, organic and locally sourced (super) markets, eco-fashion, e-readers.

Figure 10. ReSOLVE Framework¹² examples

In diverse domains, specific strategic, tactical, operational approaches are needed to deploy circularity not just to new, but even harder to achieve, to existing businesses and business models. After analysing the construction industry, food industry and fashion industry, the authors Van Cauwenberghe et al., 2023, suggest a helicopter view of the circular production chain from an expanded perspective (Fig. 11).

The authors wish to make clear that a “CPC is the result of co-creation and collaboration of multiple parties in a business ecosystem. In the center is the business itself, with its production chain. Here the new material flow goes from the business’s own waste toward its own resources. This is the micro level as explained above, which also encompasses the implementation of the input, the design, and the output. The first layer outside of a business is the sector the business operates in. These are companies that in the end aim to fulfil the same needs. On this (meso) level, there are two input flows: products from other companies (#1) and waste from other companies within the same sector, which functions as a resource to the production chain (#2). The latter is a flow which is introduced by the CE paradigm. It can come from both up (pork by-products) and down (demolition waste) the supply chain. There are also two output flows visible: one where the product of the internal production chain flows toward the next business (#12). The other circular flow converts the waste from the production chain into resources for a different business in the same sector (#10) and is an addition by CE.

The next layer is the economy as a whole. It encompasses the economic world outside the sector that our company is part of. This is thus the macro level, yet the connections between the company and other economic agents manifest themselves on the meso level. Here we see a circular approach introducing waste flows from both businesses (#2) and consumers (#3) to the

¹² <https://guides.co/g/circular-economy-65746/176021>

resources of the production chain. Some companies produce the end products of a sector; these flow directly toward the consumer without any more alterations to the product (#13). The consumers of these products are located outside the sector because they are the ones that the sector aims to please. In this layer, there are two waste flows originating from the production chain. One is toward the resource of a business (#10); once again this is a new addition to the CE paradigm. The other is toward a landfill that we consider part of the economy as a whole (#11). This last flow is one that the CE aims to cancel out or at least minimize.

Outside this last layer sits the Earth. This is also the macro level, but because it encompasses more than just the economy, we make a division here. Since the CE (and especially the model of Pearce and Turner) aims to close the loop on our whole planet and not just within a company, a sector, or the economy itself. In the CE, we consider natural resources to be more than just economic assets. They are the positive and negative externalities we hope to internalize through the introduction of CE. Thus they reach further than the economy as a whole. The waste produced in the production chain can either flow directly toward the natural resources or through the landfill (#11). Either way, these are flows that the CE considers to be the least desirable. Indeed, whether or not this waste has a negative effect on the natural resources depends on the proportion of waste compared to the assimilative capacity. Ultimately, the aim of the CE is to only keep the waste flow smaller than the assimilative capacity. This would then lead to zero waste in the big picture, even if individual production chains still produce waste. Because the assimilative capacity can only be measured on the macro level, measuring whether or not the waste is under or above the assimilative capacity can also only be done on the macro level. Finally, the last flow in the model is the one that represents the use of virgin resources in the production chain (#4). These resources can be exhaustible or renewable. When they are exhausted, they will always have a negative effect on the natural resources, because the harvest is always bigger than the yield. The effect of renewable resources can be negative or positive depending on the harvest to yield ratio (Pearce & Turner, 1990). The CE promotes the use of renewable resources whose harvest is smaller than the yield. Nonetheless, the CE still aims to limit the use of virgin resources. Much like the assimilative

capacity, the yield and the harvest of a resource can only be measured on the macro level. Note that we placed the three forces mentioned earlier in this outer sphere. All three of them influence the production chain through the different layers and are influenced by them. ” (Van Cauwenberghe et al., 2023)

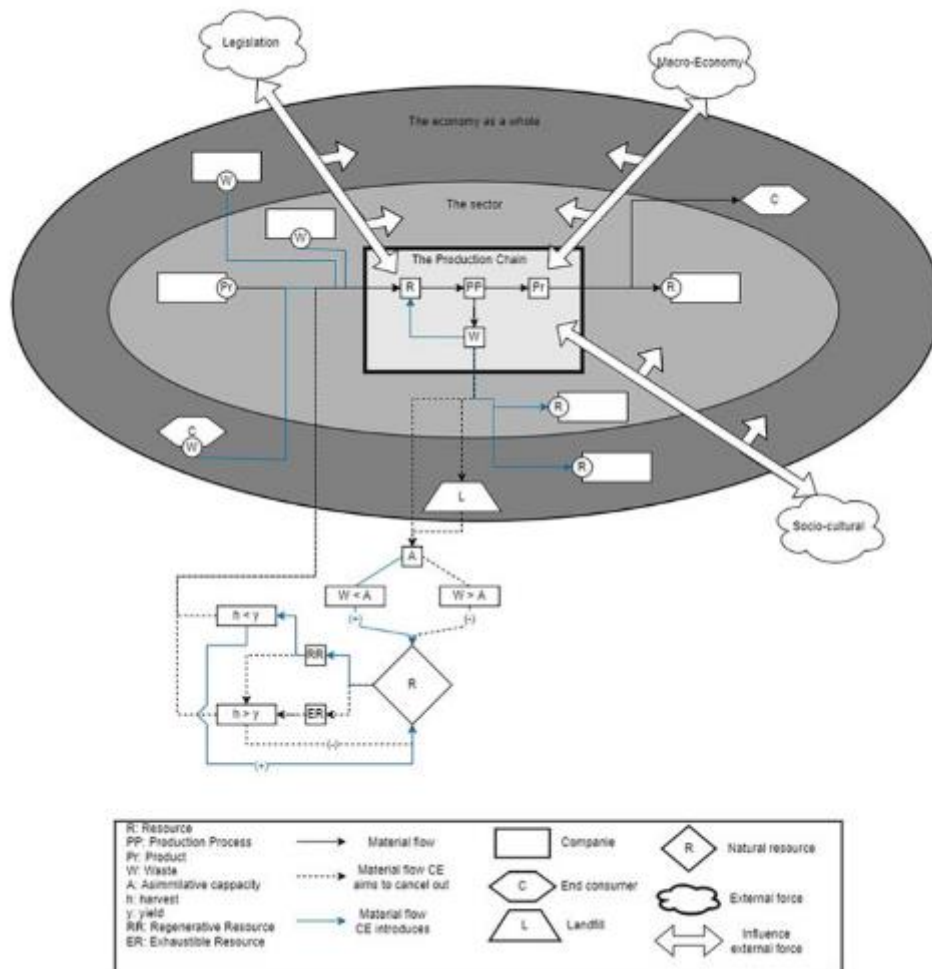


Figure 11. Circular production chain (CPC) from extended perspective (Van Cauwenberghe et al., 2023)

Furthermore, using the Denica managerial method¹³, Hendrickx visualised the circularity mechanism across an entire business ecosystem, in order to portray the necessary system perspective needed for any governance to be able to deploy circularity. While Fig. 12 features the generic business ecosystem, Fig. 13 considers the big picture view as well as the internal decomposition of roles and accountabilities, to be able to portray the circular process.

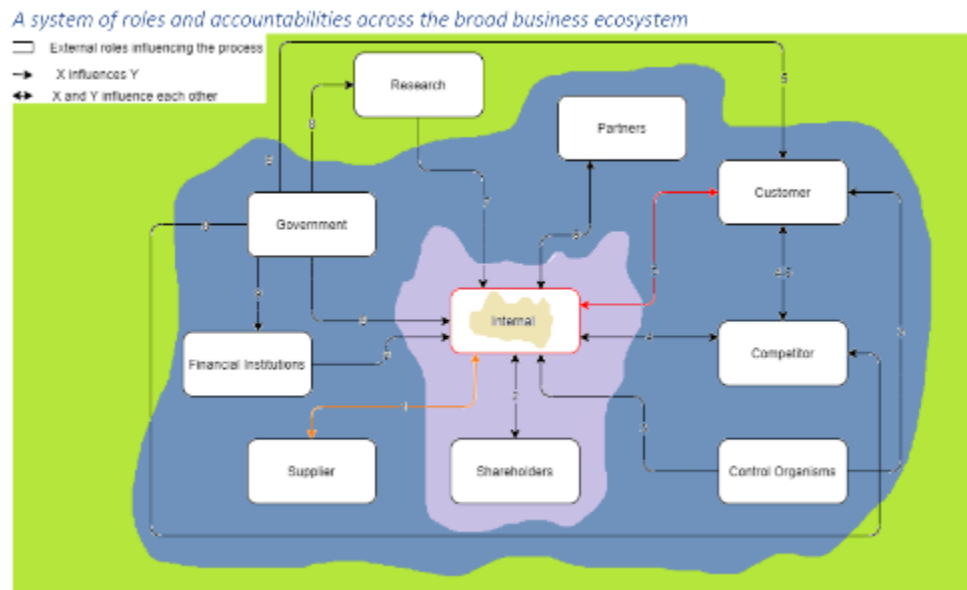


Figure 12. System of roles and accountabilities across the broad business ecosystem, using the Denica managerial method, Hendrickx (2020)

¹³ <https://link.springer.com/book/10.1007/978-3-030-22804-0>



Figure 13. System of roles and accountabilities across the broad business ecosystem, decomposed with internal roles and components to portray the circular process (red line), using the Denica managerial method, Hendrickx 2020

5. Business Models and Entrepreneurship

A **business model** is the conceptual representation of an enterprise (Teece, 2010). It embodies the *raison d'être* of the organization and outlines how the enterprise will create, capture, and deliver value to its customers (Osterwalder & Pigneur, 2010; Rosa et al., 2019; Teece, 2010). Nowadays, there is an abundance of business models, both traditional and more contemporary.

Among the traditional, contemporary and hybrid business models, we can list the following:

- Direct sales (retail, producer — seller, distributor network, services)
- Subscription (marketplaces and discounts)

- Franchising (business multiplication on various locations with usage of the brand name)
- Marketing (fixed price or percentage of sales)
- Strapping (cheap basic product and expensive replaceable parts, conditional purchase, gifts)
- Pay per use (fixed amount plus payment for used goods/services)
- Brokerage (charging after the goods are sold)
- Anything as a service (enabling use of anything and charge per its use — not ownership or purchase)
- Freemium (free version plus paid services in premium)
- Shared assets (investment in ownership of goods which can be used by multiple customers)
- Leasing (of equipment, vehicles)
- Reselling (collection and aggregation of goods, waste, ...)
- Agents (connecting different businesses across the circular net)
- Hybrid combination of different models

The most practical one-sheet model for the business logic, helpful both for entrepreneurs and theorists, is the Business Model Canvas (Osterwalder & Pigneur, 2010), which encompasses the following components (De Gusseme, 2021):

Value proposition

Every working business model has a specific offer towards the customer to satisfy their needs and solve their problems. This offer can be seen as a collection of products and services that fulfil the needs of a particular customer segment. The value proposition of business models varies from very innovative offers to existing market offers with slightly different features. The value proposition can be qualitative (e.g. brand, customisation, design, performance) or quantitative (e.g. cost reduction, price, risk mitigation) (Lewandowski, 2016; Osterwalder & Pigneur, 2010).

Customer segments

Most businesses are not able to serve all customers in the market. Defining and targeting a particular customer segment is essential for a successful business model. Customers can be divided into small or large groups based on everyday needs, behaviour or other characteristics. Once the segments are defined, based on their specific characteristics, certain distribution channels must reach them, particular relationships must be held, profitability will vary, and their willingness to pay can differ. Examples of different types of customer segments are mass market, niche market, segmented market (slightly different needs), and diversified market (very different needs) (Osterwalder & Pigneur, 2010).

Channels

How to communicate the organisation's value proposition to the customer? Business models' channels are an essential tool to enhance customer experience. Channels have 5 phases through which customers can be influenced (to raise their awareness, to help them with the evaluation, to convince them to purchase, to deliver the value, and to offer after-sales support). Communication can be done by owned or partner channels, directly or indirectly (Lewandowski, 2016; Osterwalder & Pigneur, 2010).

Customer relationships

What kind of relationship to hold with customers? The different relationships can range from personal to automated and driven by customer acquisition, retention, or cross/upselling. Examples are personal assistance, self-service, automated services, or co-creation (Osterwalder & Pigneur, 2010).

Revenue streams

Without generating revenue, a business cannot survive. Revenue streams occur when the value proposition of the company is successfully delivered to the customer. There are two types of revenue streams: transaction revenues from one-time payments or recurring revenues from ongoing payments (Lewandowski, 2016; Osterwalder & Pigneur, 2010). Examples are asset sale, usage fee, subscription fees, licensing, and advertising. Each revenue stream can have a particular pricing mechanism. The main pricing mechanisms are fixed menu pricing (e.g. volume dependent) and dynamic pricing (e.g. bargaining) (Osterwalder & Pigneur, 2010).

Key resources

To create and offer a value proposition, every enterprise needs assets. Key resources are essential assets that, besides those mentioned above, help reach markets, generate revenue, and hold relationships with customers. They can be divided into four categories: physical, financial, intellectual, or human (Osterwalder & Pigneur, 2010).

Key activities

Several key activities need to be performed to operate a company successfully. Like key resources, key activities are necessary to offer a value proposition, help reach markets, generate revenue, and hold relationships with customers. They

can be divided into the following categories: production, problem-solving (e.g. consultancy, hospitals), and platform (Osterwalder & Pigneur, 2010).

Key partnerships

Key partners can be defined as a network of suppliers and partners necessary to operate a business model successfully. There are several reasons to create partnerships: economy of scale, to reduce risk and uncertainty, and to acquire resources and activities. Partnerships can be divided into four categories, i.e., strategic alliances (between non-competitors), coopetition (between competitors), joint ventures, and buyer-supplier relationships (Lewandowski, 2016; Osterwalder & Pigneur, 2010).

Cost structure

Incurring costs when running a business is unavoidable. It is necessary to create and deliver a value proposition, reach markets, generate revenue, and hold relationships with customers. Every company wants to minimise costs as much as possible, but some are more sensitive to costs than others. With that being said, we can identify two main classes of cost structures: cost-driven and value-driven. Examples of features of cost structures are fixed costs, variable costs, economies of scale, economies of scope (Osterwalder & Pigneur, 2010).

Figure 14 offers visualisation of the BMC.

6. Circular Business Models

If we would like to move on from the linear economy and generic business models toward circular economy and circular business models, which incorporate in their design the circularity principles, we need to enhance the BMC with several components and accents.

Hence, a **circular business model** is a business model that operates in closed loops where it creates, captures, and delivers value (Antikainen & Valkokari, 2016; Lewandowski, 2016). The business model is based on retaining the value of materials, products, and components after usage and enhancing the regeneration of finite resources within a relevant system boundary (Smith-Gillespie, 2017; Rosa et al., 2019).

Lewandowski, in 2016, having analysed an abundance of business models and circularity principles, suggests an addition of at least two components to the business models (Fig. 12):

- **Take-Back system**—the design of the take-back management system including channels and customer relations related to this system, and
- **Adoption factors**—transition towards circular business model must be supported by various organizational capabilities and external factors.

Partners • Cooperative networks • Types of collaboration	Activities • Optimising performance • Product Design • Lobbying • Remanufacturing, recycling • Technology exchange Key Resources • Better-performing materials • Regeneration and restoring of natural capital • Virtualization of materials • Retrieved Resources (products, components, materials)	Value Proposition • PSS • Circular Product • Virtual service • Incentives for customers in Take-Back System	Customer Relations • Produce on order • Customer vote (design) • Social-marketing strategies and relationships with community partners in Recycling 2.0 Channels • Virtualization Take-Back System • Take-back management • Channels • Customer relations	Customer Segments • Customer types
Cost Structure • Evaluation criteria • Value of incentives for customers • Guidelines to account the costs of material flow		Revenue Streams • Input-based • Availability-based • Usage-based • Performance-based • Value of retrieved resources		
Adoption Factors • Organizational capabilities • PEST factors				

Figure 15. A framework of the circular business model canvas. Source: adapted from Osterwalder and Pigneur, by Lewandowski, 2016

Within the Live Circular Canvas project¹⁵, there have been very applicable additions made to the BMC in the direction of the CE, which are used also along with this handbook/manual. Namely, within the Market value proposition, there are two additional aspects:

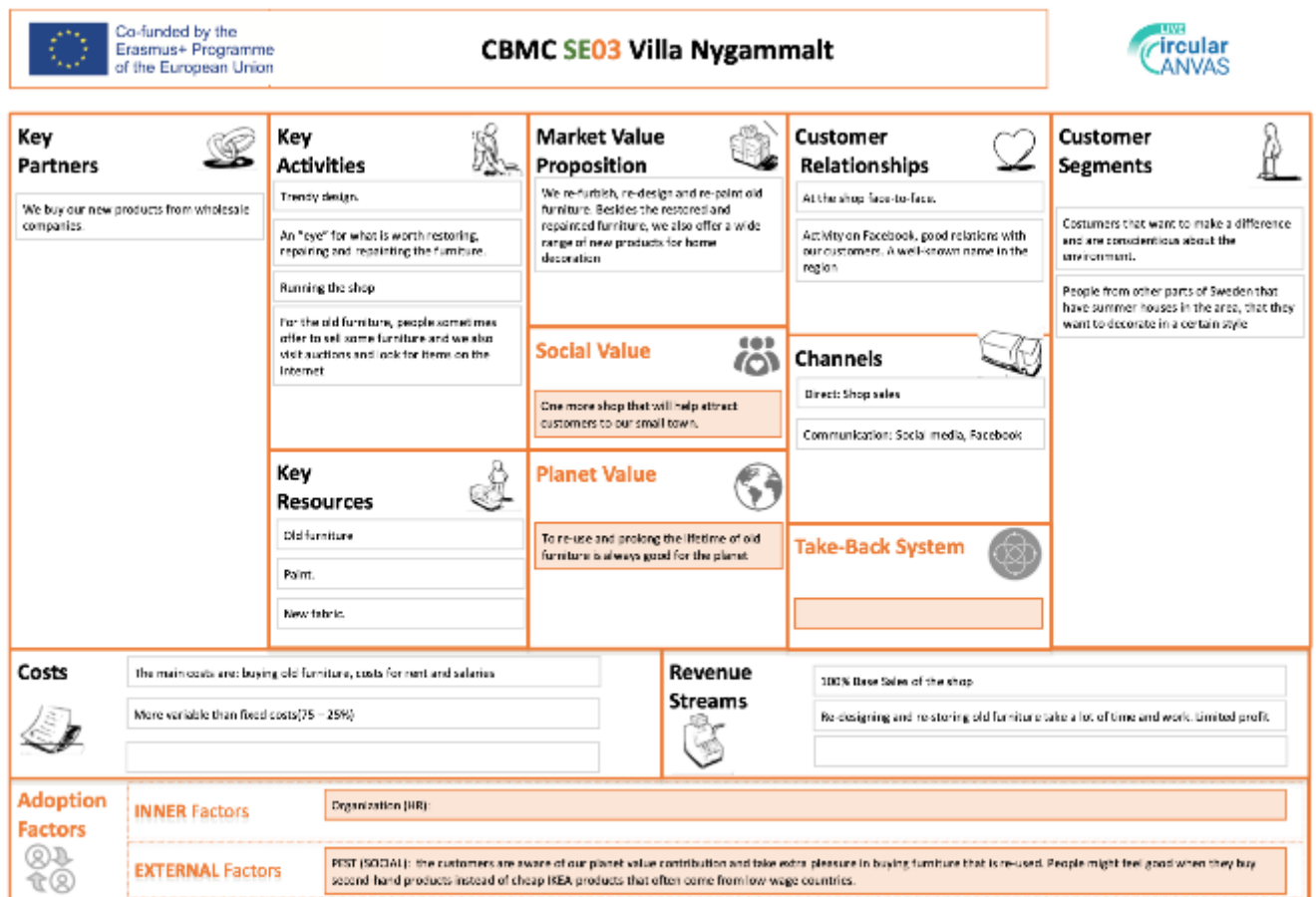
- **Social value** — the value to be provided for the society, and
- **Planet value** — the value to be provided for the planet.

While, the existence of the:

¹⁵ <https://livecircularcanvas.eu/en>

- **Take-Back system** — in the direction of ‘whose output is my input’ and ‘where does my input go’, and
- **Adoption factors** — inner and external factors

The comprehensive circular business model canvas incorporating these new elements is visible in Figure 16.



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Figure 16. Circular Business Model Canvas, Live Circular Canvas project

Regarding the issue of **managerial guidelines for the CE and entrepreneurship**, we are suggesting the following (Sanders, 2022) (Fig. 17):

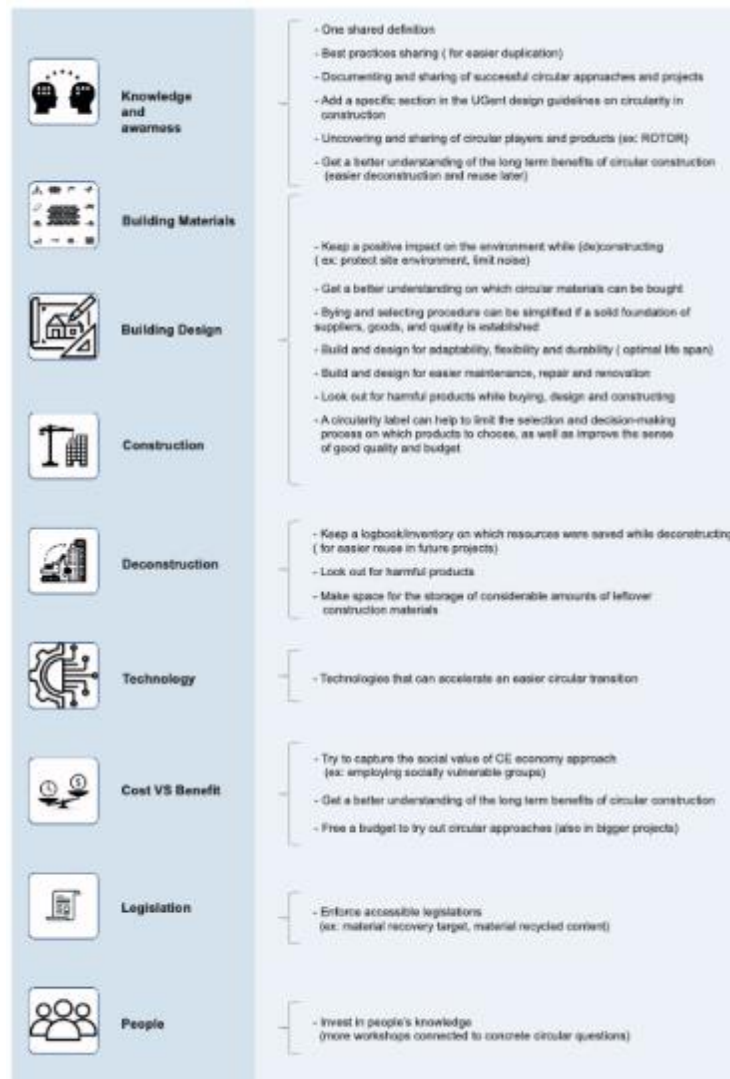


Figure 30: IVAGO's adaptive loop for GFT container collection

Figure 17. Managerial perspective on Circular Economy guidelines (Sanders, 2022), and IVAGO's adaptive loop for GFT container collection (Lebeeuw, 2020)

Part B - Circular Practices in Diverse Contexts

7. Global Practices

Out of the numerous global practices and best practices in the spirit of the CE, we are placing here several, as presented in the research work of De Koninck, 2020.

The Omni processor¹⁶

The Omni processor is a machine built and engineered by Janicki Bioenergy in Seattle; the project is funded by the famous Bill & Melinda Gates Foundation. The original function of the omni processor consisted of physical, biological and chemical processing of fecal sludge. Liquid waste dumping is a big problem in developing countries, the waste contaminates the drinking water intended for many people, and this in turn can lead to diseases and to physically and mentally underdevelopment (Gatesnotes, 2019).

The processors' principal activity is to exclude the pathogens and to make sure to halt the spreading of fecal sludge diseases but at the same time to generate outputs that contain a commercial value (Kuchenrither et al., 2012). The rest of the products of the sludge processing consist of energy, clean drinking water and soil nutrients, and these products have the potential to create revenues (Gatesnotes, 2019). Despite all these benefits, the most interesting and innovative aspect of this processor is the fact that it is not only capable of processing human sludge but also waste water. This is very useful in the journey of providing clean drinking water from treated and polluted water.

¹⁶ <https://www.gatesnotes.com/Development/Omni-Processor-Update>

The Automated Vacuum Waste Collection System¹⁷

The automatic vacuum waste collection system was invented and produced by the Swedish company, Envac AB. The system relies on an underground system of pipes, where garbage is automatically sorted and recycled or burned for energy. It is a sustainable garbage-removal system which excludes street-corner trash or garbage pick-up trucks. Regardless of the location, the vacuum system can be used everywhere. The goal is to make cities cleaner, greener and more attractive, but the most important aspect is the reduced amount of waste associated with traffic, which leads to significantly lower carbon emissions. After collecting the waste through the pipes, it is further automatically separated with a smart recycle system (Arrabal et al., 2015; Hidalgo et al., 2018; Envac, 2019).

The waste bins can be located strategically, wherever it is most suitable, considering the premises (e.g. hospital vs. a smart city). One big change with respect to the prevailing waste collection system is the operating hours. The automated vacuum system is working 24/7 which means that this system gets rid of bulging bins due to its automatic working and independency of human workforce (Hidalgo et al., 2018). The system can be installed outside or inside, considering the preferences and location of placement (Envac, 2019).

Winnow¹⁸

Winnow is a company founded by Marc Zornes and Kevin Duffy. Marc is a former McKinsey worker who set up Winnow. Winnow is a software-as-a-service company. The system is based on groundbreaking artificial intelligence and aims to run kitchens where food waste is cut in half. In their latest product, Winnow Vision, kitchens only need to throw away food. The bin will capture the waste on camera, recognize it and thereafter calculate by weight. The smart bin “learns” to recognize all types of foods, so the smart system knows exactly what and how much you are putting in your kitchen bins and thus how

¹⁷ <https://www.actenviro.com/glossary/automated-vacuum-waste-collection-system/>

¹⁸ <https://www.winnowsolutions.com/>

much actually has been wasted. Up to a third of all food that is produced in the world is lost or wasted, with an estimated value of 1 trillion USD discarded each year. Furthermore, greenhouse gas emanating from decomposition of post-consumer organic waste is responsible for 5% of global emissions (FAO, 2018). As David Jackson, head of marketing in Winnow stated: “if food waste was a country, it would be world’s 3rd largest greenhouse emitter” (Mekhsian et al., 2017; Altariba et al., 2017).

The focus of Winnow is kitchens within the hospitality industry, who have had a difficult time in recent years due to the competition of new businesses, such as UberEats and Deliveroo, which is leading to lower profits. This is where Winnow comes in, offering a simple and novel technology package that helps commercial kitchens manage their food resources in a smarter way. Within the first year of operation, food profits will increase by 30-60% and food waste will decrease by 40-75%. Winnow’s slogan “Unlock the value of food waste in your kitchen” aims to a more profitable and sustainable commercial kitchen in the hospitality industry. On 26th November (2019) Winnow reached a total saving of \$33.000.000; 23.202.500 meals, and 42.000 tonnes of CO₂ were saved (Winnow, 2019).

The Interceptor¹⁹

The Ocean Cleanup, founded by Boyan Slat, develops technologies to rid the world’s oceans of plastic. Except for cleaning up the current trash in the sea, the inflow of new river plastic needs to be addressed too. Research by the Ocean Cleanup concluded that only 1000 rivers are responsible for 80% of ocean plastic entering the oceans, which makes rivers the main source of ocean plastic pollution.

As a solution to this problem, the Interceptor was invented, a system to clean up river flows to the sea. The interceptor works as follows; first, the interceptor is placed at a strategic position in the river and debris flows into the system because the barrier is directing waste to the mouth of the interceptor.

¹⁹ <https://theoceancleanup.com/rivers/>

The barriers covers only half of the river so it will not interfere with other vessels or impede the movement of wildlife. Next a conveyor belt extracts the debris from the water onto a giant shuttle, this system functions autonomously, using smart software, the shuttle knows when to equally distribute waste into one of the six dumpsters until they reach a similar amount of trash. At any time, local and global operators can remotely access the interceptor's dashboards from anywhere in the world. Once full, the interceptor automatically sends a text message to the local operators to come and collect the waste. Operators then remove the barge, and it is brought back to the shore, where the dumpsters are emptied, send off the debris to local waste management facilities, and return the barge back into the interceptor. The interceptor can store up a maximum of 50m³ of trash before needing to be emptied, so at top performance, the interceptor can extract more than 100.000 kilograms of trash per day. This means it is capable of operating even in the most polluted rivers all over the world (The Ocean Cleanup, 2019).

DyeOx²⁰

The textile industry is a big business, in India only it is worth \$2.64 billion. But despite the many economic benefits to the textile industry cities, the benefits come together with enormous environmental and social drawbacks. The “dyeing part” in a textile industry is a major producer of hazardous waste and at the same time large amounts of fresh water are used during this process (Agrawal, 2015). And to make it even worse, most of that untreated wastewater is discharged as toxic effluents which eventually leads to contamination. Soils, water surfaces and mainly rivers are polluted; subsequently, rivers will bring the toxics to the sea, where they can further spread to every ocean in the world. DyeCoo has found a solution for the giant pollution caused by the major textile industry (DyeCoo, 2019).

The DyeOx4 machine is the latest technology invented and manufactured by DyeCoo. The machine's process consists of dyeing cloth while using not one

²⁰ <https://dyecoo.com/the-dyeox/>

drop of water or chemicals, besides the dyes themselves. The technology is using heated and highly pressurized carbon dioxide as a dyeing medium, at that phase the CO₂ can act as a solute and solvent at the same time. This results in a very quick penetration of the color pigments into the textile fibers without any extra needs. In this process, the cloth does not need to be dried, which cuts the processing time in half, uses less energy and eliminates costs. At the end, the carbon dioxide is recycled and used again, and thus a fully closed loop is created. This new efficient technique makes the textile industry both cleaner and more profitable at the same time (Agrawal, 2015; Van Der Kraan, 2017; DyeCoo, 2019).

MycoComposite²¹

MycoComposite is a platform that uses mycelium to bind together organic agricultural byproducts, such as wood chips, to produce durable, bio-based and 100% compostable material. The company Ecovative is responsible for developing this alternative styrofoam. In our natural system we find mycelium as the natural adhesive that holds the forest floor together. Mycelium can be used as a main substitute for polystyrene, the main component in plastic which is made from petroleum and is a non-sustainable, non-renewable, hyper polluting and fast disappearing commodity. It is not biodegradable and ends up into landfills, while the mushroom based packaging will decompose in a garden in a couple of weeks. The production of the mushroom packaging is very easy and relies on a natural system. First clean agricultural waste is inoculated with mycelium, thereafter mycelium does the work. Over a few days the fungus binds the waste together forming a solid shape. The great thing about mycelium is that you can grow it into every mold as you like and it will fit exactly. At last the mycelium package needs to be dried to prevent the fungi from growing. In fact, mycelium is used as a natural glue. Using mycelium as packaging is promising and compatible with our planet as it decreases waste, increases recycling and

²¹ <https://www.ecovative.com/pages/mycocomposite>

prevents plastic pollution (Dahmen, 2017; Kim & Ruedy, 2019; Ecovative, 2019).

Micronized Rubber Powder (MRP) by Lehigh Technologies²²

About one billion tires are discarded worldwide, annually. Using post-industrial raw rubber materials and post-industrial rubber materials end-of-life tires to generate renewable raw materials for industrial applications (fa. high-performance tyres, coatings, asphalt and construction material) can end this enormous rubber waste and satisfy the rising global demand from governments, manufacturers and consumers for more sustainable products (Habibah et al., 2018; LeHigh Technologies, 2019).

Lehigh Technologies has succeeded in this and is creating a more sustainable rubber industry. They manufacture high-performance, lower cost, sustainable Micronized Rubber Powders (hereafter MRP) from rubber materials. Lehigh has commercialized a proprietary cryogenic turbo mill technology that transforms end-of-life tire and post-industrial rubber materials into MRPs. The company is dedicated to developing high value uses for end-of-life tire materials that would otherwise be burned or deposited in landfills. Lehigh provides a sustainable solution to the important environmental problem of end-of-life tires and other post industrial rubber material by transforming waste materials into high-value products. They succeeded to close the loop by using these rubber particles over and over again (Habibah et al., 2018; LeHigh Technologies, 2019; Michelin, 2018).

Renewable Food for Animals and Plants²³

More than 30% of the organic waste, such as food containing loads of nutrients, is wasted daily, mostly sent to landfills creating toxic greenhouse gases that are harming our environment. At the same time there is a growing demand for high quality protein in the animal feed and aquaculture sectors. Currently, this

²² https://lehightechnologies.com/what_we_do/what_is_micronized_rubber_powder/

²³ https://www.rcbc.ca/files/u7/RCBC2015_EnterraLeung.pdf

aquaculture feed is produced in a way that depends on finite resources, and leads to environmental degradation. Black soldier fly (hereafter BSF) larvae provide a valuable solution to this global problem, as they naturally upcycle nutrients from organic matter. For over a hundred million years, fly species have been breaking down organic material, whilst providing food for fish, birds and animals in our nature. This is the essence of how we use black soldier flies to transform discarded organic matter to high quality protein feed for the fish, poultry and other industries. At Enterra, traceable, recycled food including fruits, vegetables and grains are used to feed our insects. The Canadian company is diverting food waste from landfills and the flies are converting it to high quality nutrients for animal feed, pet food, oils and organic fertilizer. After eating the waste, the bugs are cooked and dried (which kills the insects and any pathogens inside BSF), they are pressed for oil and the remaining solids converted into a powdery meal. This environmentally friendly approach makes sure that nothing is wasted and everything is gained. Likewise, the operation requires no water as all the water the insects need comes from the recycled fruits and vegetables in their diet. Black soldier fly larvae are a highly efficient, low-impact source of nutrients compared to resource-intensive alternatives like beef, pork, chicken, fishmeal, soymeal, coconut oil and palm kernel oil and non-organic fertilizers (Enterra, 2019).

The author's analysis and placement of the Business Model components within the Butterfly Diagram and the ReSOLVE Framework, has resulted in grading them as in Fig. 18.

P = ReSOLVE element present in the CBMC of the particular waste management solution.

	Regene rate	Share	Optimise	Loop	Virtualize	Exchang e	Total
The Omni processor	p	p	p	p		p	5/6
Automated Vacuum waste collection system	p		p	p		p	4/6
Winnow	p	p	p		p	p	5/6
The Interceptor	p	p	p	p		p	3/6
DyeOx	p	p	p	p		p	5/6
Mycocomposite	p	p	p	p	p	p	5/6
Micronized Rubber Powder	p	p	p	p	p	p	5/6
Renewable Food for Animals and Plants	p		p	p		p	4/6

Table 4: Summary of the fit of the investigated approaches to Circular Economy principles of the ReSOLVE framework.

Figure 18. Analyzed global best practices and their placement within the CE frameworks, De Koninck, 2020

8. BECircular project best practices

Within the BeCircular project, a best practice has been used to improve and co-evolve the region's situation with waste management and with circular business models in general. The main carriers for this knowledge have been DIADYMA S.A.²⁴ — Responsible Body for Waste Management in Western Macedonia, Greece, and CluBE²⁵ — Bioeconomy and Environmental Cluster in Western Macedonia, Greece.

²⁴ <https://diadyma.gr/en/>

²⁵ <https://clube.gr/en/>

Integrated Waste Management Solution - Diadyma

Diadyma's main objective is the “design, implementation and operation of the Integrated Waste Management Plan in Western Macedonia Region” (IWMS) and has been unfolding in stages since its founding in 1998 to date, based on remarkable ambitions and plans for the upcoming decades. Its application of sustainable waste management methods objectives of National and European legislation (at lowest cost for the citizen) follows the Directive 2008/98/EC on waste (Waste Framework Directive)²⁶ and the relevant European regulations.

The evolution of IWMS of Western Macedonia, has gone through the following phases:

- 1st Phase: Ensure Landfill and Restoration of Uncontrolled Dumpsites (2003-2007)

Restoration of 207 Uncontrolled dumpsites (38 with funding of €6 million from the operational program ‘Environment and sustainable development’ (EPPERAA), 169 with funding of €3 million from the program THISEAS “Development Program for Local Government”) (Fig. 19).

²⁶ <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32008L0098>

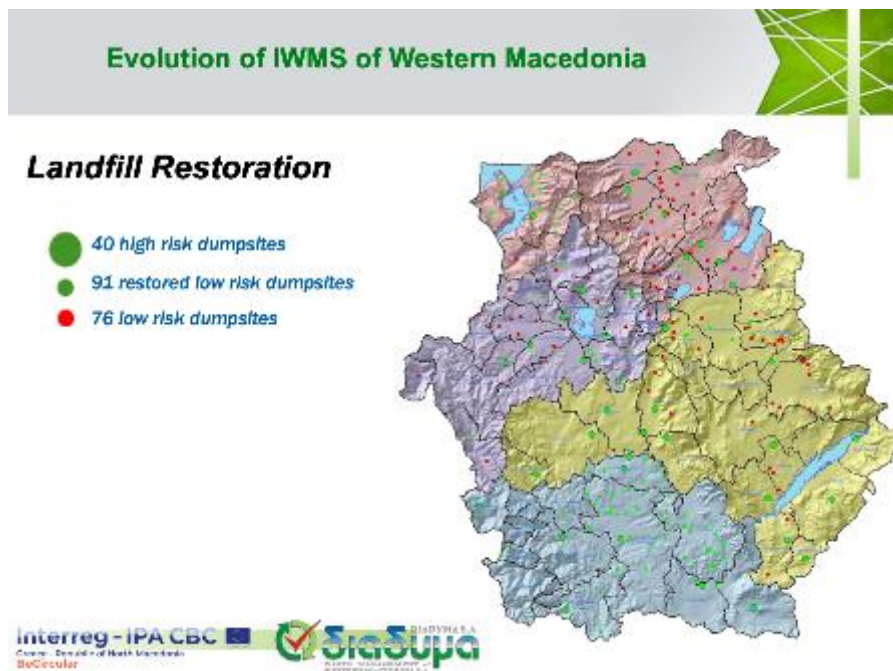


Figure 19. Landfill Restoration, DIADYMA S.A., Greece

Figure 20. Regional Sanitary Landfill and 9 LWMUs, DIADYMA S.A., Greece

The comprehensive facility for waste management incorporates managerial, technological, logistical, organisational and environmental aspects and represents a next level solution for waste management (Fig. 21).



Figure 21. Facility for the IWMS, DIADYMA S.A., Greece

- The **2nd Phase** consisted of: **Development of Recycling with Collection at Source Programs & Exploitation of Waste with the MBT Plant (2009-2015)**

Development of Collection at Source programmes with the use of four different bins (each for different recyclable material) (ESPA €4 million, Hellenic recovery recycling corporation €1.5 million).
 Construction of C' cell of sanitary landfill and supplementary mobile equipment (ESPA €10 million).
 Signing of contract for the construction of MBT plant — through PPP project (total investment €48 million) — Beginning of construction (01.07. 2015).

- The **3rd Phase: Prevention and Reuse** (2016 - 2020)

Green Points Network for reuse and exploitation

- a) Urban type “Green Points” in specific settlements (<3.000 inhabitants)
- b) Collection of items for reuse in Materials Reuse Centers (logistics centers) (Fig. 22)
- c) Networking of facilities – Online access for citizens (e-platforms)



Figure 22. Reuse Centers, DIADYMA S.A., Greece

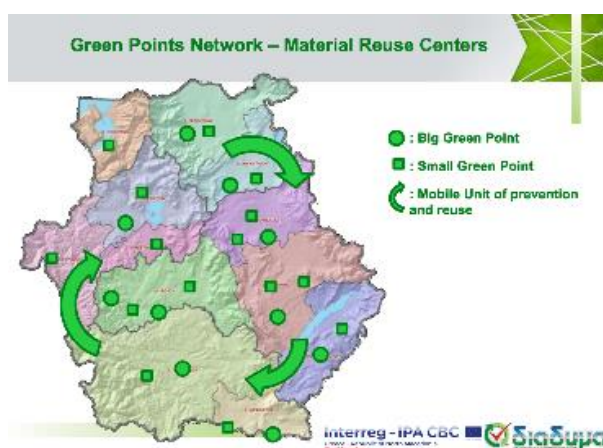


Figure 23. Green Points, DIADYMA S.A., Greece

- The **4th Phase: Towards a Circular Economy** (2020 -) encompasses plans and actions to achieve:

Circular Economy Park

Complex of Treatment and Utilization Units of Special Categories of Non-hazardous Waste of Municipal Solid Waste (MSW)

Complex of Hazardous Waste Classification, Storage and Treatment Units Contained in Municipal Solid Waste (MSW)

Circular and Innovation Center

The circularity achieved in the IWMS of Diadyma is portrayed in the visual presentations they provided us for this handbook (Fig. 24, Fig 25), which fits perfectly within the Butterfly diagram and the ReSOLVE framework of the CE:

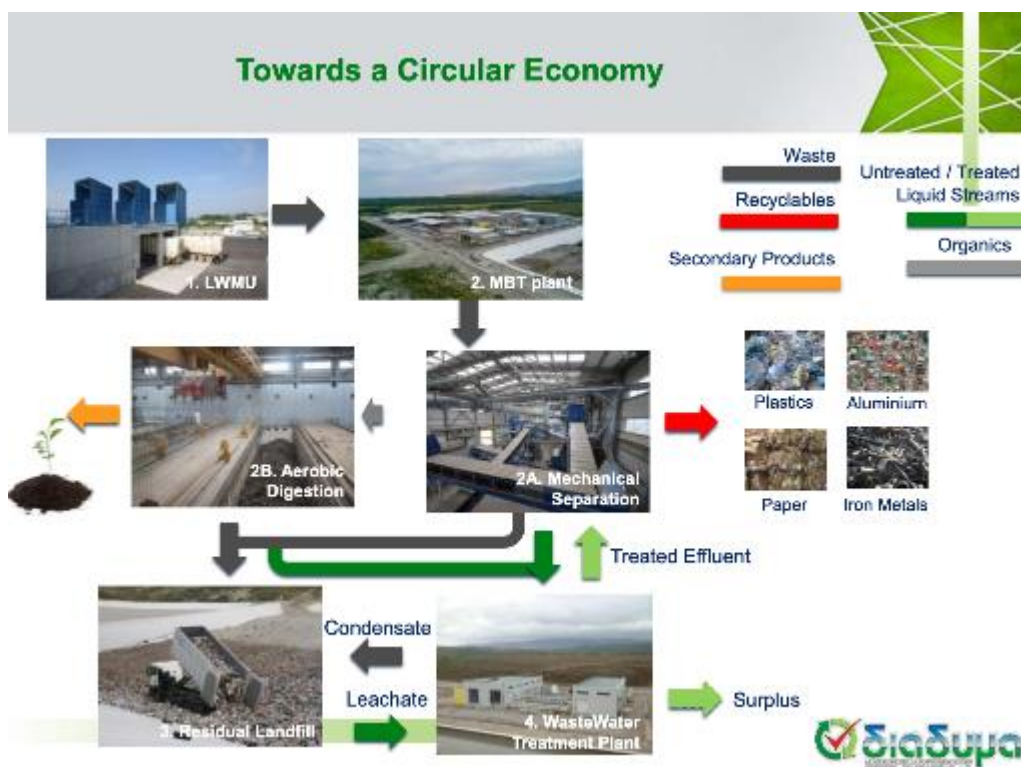


Figure 24. Circular workflow, DIADYMA S.A., Greece



Figure 25. Recyclable materials circular workflow, DIADYMA S.A., Greece

Bioeconomy and Environment Cluster – CluBE

Another best practice to learn from is the specific cluster approach for undertaking projects, especially in the CE, where the stakeholder ecosystem is broad, the motivations are diverse, the socio-environmental-technological aspects are all intertwined with some (but not exclusive) business and project logic.

“The Cluster of Bioeconomy and Environment of Western Macedonia (CLuBE) is a platform for cooperation of the three pillars of the regional economy: the public sector, research and entrepreneurship. The Cluster seeks to develop synergies between local and regional players and businesses in bioenergy and the environment, aiming at introducing and developing innovation in the sector and increasing its added value.”²⁷ Such a cluster operates since 2014 as not-for-profit company, in a variety of sectors, such as: BIOENERGY, ENVIRONMENT, ENERGY SAVING, BIOMASS, SUPPLY CHAINS, BIOGAS, BIOECONOMY, SMART CITIES, BIOHYDROGEN, which necessitate multi/trans/cross/interdisciplinarity, n-tuple helix co-creation, bottom-up approaches and strategic/tactical/operational altitude of collaboration and remarkable vision and adaptation, to achieve the change management by engagement and facilitation of all necessary agents.

Some of the challenges being addressed in CLuBE's specific manner are towards the energy sector and agriculture (Fig. 26 and Fig. 27) which are directly relevant for cross-border learning and knowledge transfer, since the North Macedonia side also faces the same difficulties and challenges.

²⁷ <https://clube.gr/en/>



Figure 26. Energy sector in Western Macedonia, CLuBE, Greece

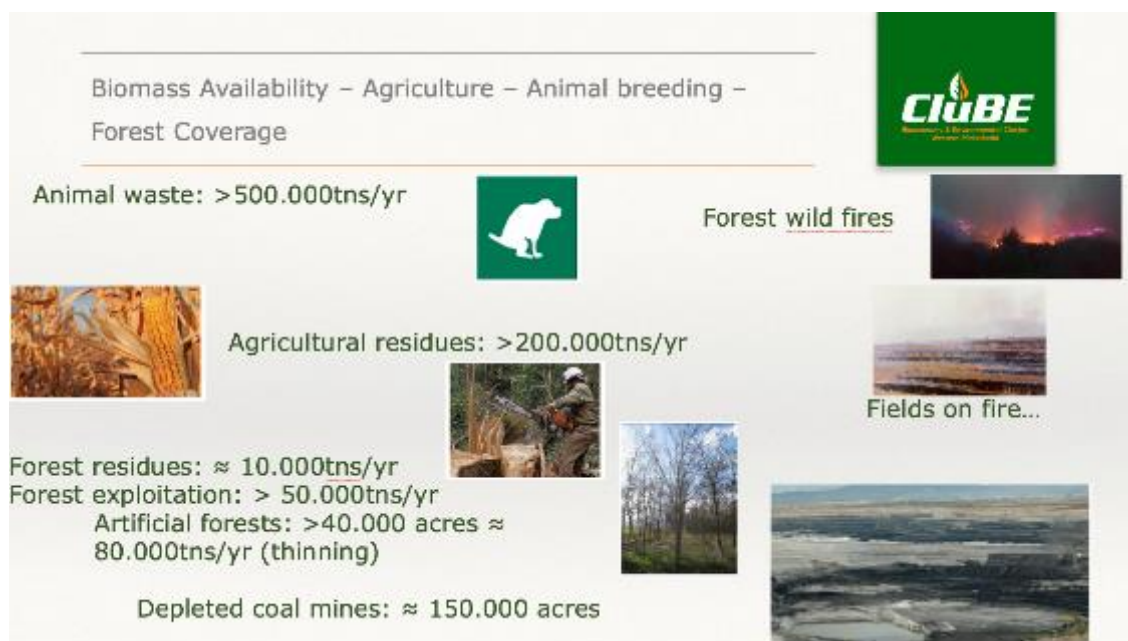


Figure 27. Agriculture, Animal Breeding, Forestry Potentials in Western Macedonia, CLuBE, Greece

To portray the managerial aspect of how and why a cluster such as CLuBE is effective and sustained through the years, we are using their member portfolio — which is a rich ecosystem with more than 40 Quintuple Helix members from public sector, R&D, SME, environmental and social enterprises (Fig. 28); and their partnership and project outreach (Fig. 29).



Figure 28. Cluster membership structure, CLuBE, Greece

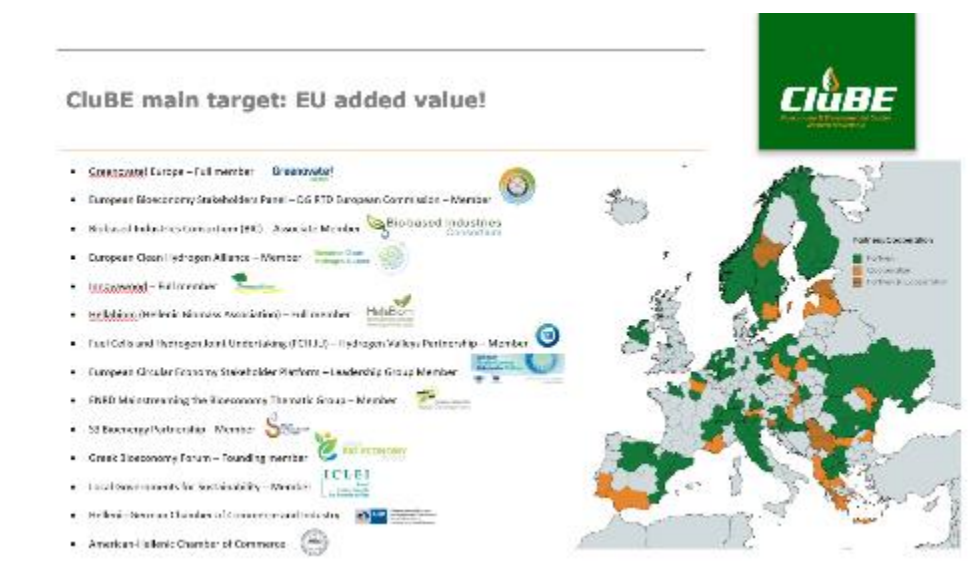


Figure 29. Cluster project and partnership network, CLuBE, Greece

9. Local Context of North Macedonia

PESTEL Analysis - North Macedonia

Our PESTEL analysis carried out for the Republic of North Macedonia on environmental principles, sustainability and circular economy, sheds multiple aspects that need to be tackled on the level of regulations, enforcement, engineering and education.



Political environment

The Republic of North Macedonia has been in an unstable political situation for the past few years. This situation has a great influence on the focus of the Government. In other words, political parties are increasingly competing and focusing on winning power, rather than solving the problems of the citizens or of the environment. However, with the organization of protest marches, various civil associations began to raise awareness about the pollution in the environment and the excessive concentration of waste. The government, together with the Ministry of Environment, has set goals for the fight against climate change at the global level as an integral part of all sector policies in

different modalities, such as: *preventive action* (before damage occurs, i.e. pollution), *the polluter pays* (the costs of environmental protection must bear the responsibility of the legal or physical person who endangers the environment), fight against environmental damage *at the very source of pollution* (where it is simpler and more economical to remove the consequences of pollution) and *integration of environmental protection into other policies* (agriculture, transport, energy, industrial policy, etc.). To achieve these goals, various laws have been passed and various activities have been carried out. One of the primary objectives of the Government is to regulate waste management. Part of the Government's objectives, incorporated in the Plan for Waste Management for the Republic of North Macedonia (2021-2031) are:

“Our goal is that by the end of 2025, at least 60% of the weight of packaging waste generated on the territory of the Republic of North Macedonia will be processed by processing operations or used to obtain energy, and by the end of 2025, at least 55% , and a maximum of 80% of the weight of packaging waste generated and collected in the territory of the Republic of North Macedonia to be recycled.

- In 2020, we will introduce the National Waste Prevention Plan as a national goal and policy for waste generation, reduction, reuse and recycling (2020-2026). We will continuously carry out activities to set up systems in accordance with the new 6 laws on special waste streams, in order to improve the primary selection of special waste streams (waste plastic and paper, waste household equipment, waste tires and oils, used vehicles and textile waste). We will work on an integrated regional infrastructure for the collection and treatment of waste, with an emphasis on separate collection, at the point of generation of waste, of materials that can be recycled, as well as on the treatment of biodegradable waste. The total reduction for the period 2020-2026 of biodegradable waste disposed of in landfills will be 25%.

- We are introducing enhanced control of import and export of waste, collection, storage and treatment of all types of waste, as well as extraordinary control of all issued permits for waste management. We will invite non-governmental organizations to join us for transparency and increased trust among citizens.

- We will implement strengthened inspection control of the legal entities that hold permits for the collection, transport and treatment of waste (especially medical and other types of hazardous waste), as well as of its creators.”²⁸

Economic environment

The global spread of the Covid-19 pandemic and the introduction of measures to prevent it caused major negative effects on global economic activity. The economic situation of the country was also affected by the pandemic. The consequences of the recession in our country, as presented in the Annual Reports of the Central Bank for 2020²⁹ and 2021³⁰ are:

- Weak growth of the economy in the first quarter of 2020, and the signals from high-frequency data on economic activity are in line with the expectations for a decline in activity in the second quarter;
- Improvement of the economy starting from the second quartile of 2021 and moderate improvement throughout the year, with GDP growth of 4% for 2021. However, the net-exports have been slower, compared to the imports, especially due to the energy crisis;
- Stable and low inflation, but slightly higher than the expected rate;
- Growth of foreign exchange reserves above expectations; maintaining the adequacy indicators of the foreign exchange reserves in the safe zone;
- The solid growth of the deposit base and the credit activity of the banks continued, supported by the measures of the state and the National Bank;
- The National Bank in the second quarter of 2020 reduced the main interest rate to the level of 1.5% and halved the supply of treasury bills, for a total of 15 billion denars, in order to provide support to the Macedonian economy by maintaining credit flows and the credit cycle;
- And there are more pronounced risks, especially from the external environment;

²⁸ <https://www.moepp.gov.mk/wp-content/uploads/2021/10/План-за-Управување-со-отпад-на-PCM-2021-до-2031-година.pdf>

²⁹ https://www.nbrm.mk/content/Годишен_извештај_за_2020_НБ.pdf

³⁰ https://www.nbrm.mk/content/Годишен_извештај_2021_НБ.pdf

- The National Bank will continue to monitor these developments and take additional measures if necessary.

Socio-cultural environment

The socio-cultural environment consists of the population together with its characteristics, i.e. the attitude of people towards themselves, towards others, towards institutions as well as towards the environment. In order to keep our environment clean and healthy, people's habits have the greatest influence. Many expressions show that the awareness of the excessive amount of waste in our country is at a very low level. A large proportion of the waste generated by households is thrown into landfills. That's why these landfills are everywhere. According to the environmentalist, Antonio Jovanovski, this behavior of people is a result of the lack of awareness of the damage caused by waste and the education system in the country. The traditional view of education that it is necessary to "produce" personnel needed in the labor market is not at all efficient for the environment, as the focus is on the need for all kinds of personnel, not on the sustainability of the environment. He also points out that humanity generally does not care to what extent and in what ways resources are used, so in the coming years we will face a lack of a large number of resources.

However, as time passes, more and more awareness is raised about the waste problem and civil associations are formed such as, for example, the ecological society Planetum, which aims to manage waste, develop alternative forms of tourism and urban development. In order to achieve these goals, it undertakes a large number of activities and initiatives such as doing research and educating the population. The most up-to-date initiative is the "Stop illegal landfills" initiative, for which money is instantly collected, and will be allocated to cleaning illegal landfills.

The Eco-awareness association also contributes to the sustainability of the environment, by aiming to contribute to sustainable transport, renewable energy sources and energy efficiency, sustainable waste management, protection from chemicals and heavy metals, protection from genetically modified organisms, etc.

The fact that the awareness of the population regarding a healthy environment is starting to be raised more and more is evidenced by the growing number of

protests organized by citizens who are asking the Government and the Ministry of Environment to pass more laws to protect the environment as well as to introduce appropriate sanctions for those who break the laws.

Technology environment

The collection of municipal waste is mainly carried out by public enterprises. According to the National strategy for waste management, only a small proportion of waste collectors are private enterprises, usually those working with waste in rural areas. About 70% of the total population uses waste collection services, but only 10% of them are from the rural areas³¹. The collecting, sorting and transporting of waste is insufficient in several areas to achieve compliance with existing regulations. Much of the waste is leaking when transported as the waste collection vehicles are very old, with limited capacity and break down quite frequently. Mixed industrial and municipal waste, including hazardous waste fractions, is collected from service users. Daily activities are usually characterized by low productivity practices and inadequate utilization of fixed resources, which does not encourage the provision of a service that will be efficient compared to the costs incurred. On the territory of Macedonia, there are 43 active municipal non-standard landfills (Đubrishta) without any permit. The "Drisla" landfill, which serves the Skopje region, is the only landfill in the Republic of Macedonia that is relatively well managed. At municipal landfills (or landfills) in rural areas, waste is simply disposed of by utilities at no operating cost, with the exception of some overhead costs (guard pay, if any) and the occasional cost of water consumption to extinguish spontaneous fires. None of the 54 municipal landfills meets the requirements for sanitary operation and environmental protection. Most of the municipal solid waste, along with the rest of the collected waste, is deposited without any pre-treatment in the communal non-standard landfills. Most packaging waste is disposed of in landfills as part of municipal solid waste and similar commercial/industrial solid waste. Landfills operate without the technology normally applied to landfills and without any environmental impact monitoring activities. There is no comprehensive record of the delivered waste, and no visual inspection is carried out of the

³¹ <http://www.ezo.mk/zakoni/003.pdf>

characteristics of the waste to be deposited . Municipal waste that is not collected by the official collection companies is disposed of at inappropriate places — landfills. Construction waste and rubble are also, for the most part, disposed of at inappropriate places — garbage dumps; there is no capacity for separation nor landfills for disposal of this type of waste. It is estimated that the number of landfills, especially, in the rural municipalities is around 1,000.

In terms of application of innovations and implementation of new technologies, Pacomak³² is a leader in society. Pacomak is a non-profit company, founded on December 3, 2010, whose activity is management of packaging waste. According to the new Law on the management of packaging and packaging waste, since January 10, 2011, Pacomak is the first company in Macedonia that has a permit for the selection and processing of packaging waste. With the help of the Innovation Fund, Pacomak is the first Macedonian company to introduce the secular trend in recycling — returnable vending machines for plastic bottles and cans.

The enormous volume of waste that is created by the increased consumption in modern society, the selective disposal of waste, its collection and recycling is an extremely important process for maintaining a clean and unpolluted environment. But, for many, this process is stressful and takes too much energy, that is why Pacomak is trying to motivate the citizens of Macedonia to join in, in a very simple way, through the introduction of reversible vending machines, the so-called SmartBin, which will work in conjunction with ecoMac — an incentive system that rewards people who selectively dispose of waste through prizes, discounts or other benefits. We have never had such a project on the territory of Macedonia and it represents a real innovation in the field of municipal waste collection and recycling.

Legal environment

In the Republic of North Macedonia there are several laws that tackle and attempt to solve certain problems and issues related to waste. Part of those

³² <https://www.pakomak.com.mk/PakomakSite/mk-zanas.html>

laws are under the jurisdiction of the Ministry of Environment and Spatial Planning³³. Laws governing waste include the following:

Environmental Protection Act

The objectives of this law are: 1) preservation, protection, restoration and improvement of the quality of the environment; 2) protection of human life and health; 3) protection of biological diversity; 4) rational and sustainable use of natural resources and 5) implementation and promotion of measures to solve regional and global environmental problems.

Packaging and Packaging Waste Management Act

In accordance with the principle of sustainable development, the objectives of this law are: to prevent the creation of packaging waste; to reduce the amount of packaging waste; to reduce and limit the use of harmful metals and materials in packaging and to reduce the toxicity of packaging waste; to prevent or reduce the negative impact on the environment of packaging waste and to ensure a high degree of environmental protection; to achieve a high level of packaging reuse; to achieve a high level of recycling and other types of processing of packaging waste and to reduce the final disposal of packaging waste; to provide conditions for the establishment of systems for return, selection, collection, reuse, processing and recycling of packaging waste; to provide conditions for the establishment and development of a market for the processing and recycling of packaging waste, and to ensure equal protection cooperation between domestic and foreign legal and natural persons and to avoid and remove trade barriers that can disrupt the market.

Introduction of new regulation for plastic bags

According to the latest amendments to the laws on packaging and packaging waste management in Macedonia from December 1, 2021, the use of plastic bags is prohibited. Biodegradable bags, produced according to prescribed standards for biodegradability, are sold on the market for 15 denars each p. Understandably, doubts remain about how thorough the implementation of the law will be. With this law from December 1, traders are obliged to keep records, on a neighborhood basis, of the number of bags sold, which they must

³³ <http://www.igu.gov.mk/?q=node/29>

deliver to an expert body at the Ministry of Environment. The total amount obtained from the compensation from the sold bags, the merchants must transfer to a special account opened for the purposes of the environmental authority. It is assumed that the price of 15 denars will demotivate consumers to unnecessarily buy disposable bags, reorienting themselves towards using reusable alternatives. Markets will be required to provide paper bags or other alternatives. In addition to this, the amendments also stipulate a ban on the use of single-use plastic packaging in catering establishments on the territory of protected areas in the country. Environmentalists ask why this ban is limited only to the territory of the protected areas, and does not apply to the entire territory of the country.

Environmental analysis

The numerous identified environmental problems in the Republic of North Macedonia can be grouped according to the medium and the area in the environment where they appear:

- Problems with waste management (municipal, industrial hazardous and non-hazardous waste and other types of waste), due to the absence of an integrated waste management system (organized collection, transport, treatment and final disposal), which would consist of an appropriate network of processing facilities for the use of materials/energy and landfills built in accordance with modern standards;
- Air pollution with different intensity in different parts of the country;
- Soil contamination, resulting in inadequate quality of agricultural products caused by such contamination. A special problem related to the state of all environmental media is the insufficiently developed monitoring of the environment with an emphasis on the absence of historical data. Such data on the state of the individual environmental media are a basic prerequisite to determine the new desired status of the media, as well as to plan correct and reliable actions for mitigating or eliminating the environmental problem. In the past and today, improper waste management leads to the degradation of ecosystems and the loss of valuable natural resources. Certain environmental impacts even lead to potential and documented risks to human health.

Improper waste management has serious impacts, especially on soil and water, i.e., surface and underground waters. Groundwater is contaminated by landfill runoff, which is generally highly contaminated with toxic organic and inorganic compounds, and in some cases with pesticides and heavy metals. The quality of surface waters (rivers and lakes) is evidently impacted by the higher concentrations of biodegradable organic substances, ammonia and nitrates and toxic metals. Improper disposal of waste, general disposal of hazardous and non-hazardous waste and wild landfills pose a risk and cause soil and water pollution; in some cases, impacts on the health of the population living near such areas have been identified. Industrial contaminated sites represent a special source of water, soil and air contamination. They mostly belong to mining and thermal processes (thermo-energy and metallurgical capacities) and contribute to higher concentrations of toxic metals and suspended particles; abandoned landfill areas containing flotation slag and dry-weather fly ash represent an unconventional source of dust particles. The impacts on the natural environment and agricultural crops are evident. Improper management of medical waste and potentially infectious animal by-products represents a serious risk to the health of the population, as well as an economic risk to the food industry. Uncontrolled burning of waste in open areas of landfills and plastic films in fields and the use of waste oils and other combustible fractions of waste result in the synthesis of highly toxic and bioaccumulative organic compounds. Such uncontrolled air emissions result in ambient air pollution, long-term pollution of agricultural soils and plant tissue, all of the posing a serious risk to human health.

We are referencing in this category the notions from the Report for strategic evaluation of the environment as strategy for development of energy sector in Republic of North Macedonia up to 2040³⁴. An additional problem is the traditional burning of communal waste, waste from plant tissues, as well as plastic from plantation or silage production in open space; such a way of burning waste can cause the synthesis of highly toxic and bio-accumulative organic compounds, and uncontrolled emissions in the air cause pollution of the ambient air and long-term pollution of agricultural soils and plants. The existing waste

³⁴https://www.economy.gov.mk/Upload/Documents/SEA_FINAL_MK_Dek_2019.pdf

disposal practice does not comply with the technical standards and/or the environmental protection standards.

The annual reports on the quality of the environment from the state monitoring network for years have recorded an alarmingly impaired quality of the ambient air in larger settlements, especially in terms of solid particles up to 10 micrometers in size (PM10 and PM2.5). First of all, the large urban areas of Skopje, Bitola, Tetovo should be highlighted, where the situation is much worse in the winter period and with significantly more exceedances than allowed during the year. According to the inventory of suspended particles (PM2.5, PM10, TSP) for 2018, the most significant share in the emissions of these particles is the heating of homes and administrative facilities, using biomass as fuel. The share of emissions from the category of households and administrative buildings, (especially from burning wood) in 2017 is substantial. In total emissions of total solid particles (TSP) is 33%, emissions of solid particles up to 10 micrometers in size (PM10) accounted for 37% and 62% in emissions of solid particles up to 2.5 micrometers in size (PM2.5). It was determined that other key sectors in the emissions of suspended particles are 2-Industry (32% TSP, 13% PM10, 5% PM2.5) and I.A.I— Electricity and heat production (25% TSP, 26 % PM10, 18% PM2.5). The greater share of 2-Industry in TSP emissions in relation to smaller particles results from high dust emissions (TSP) from the Road Asphalt category which falls under the Industry sector³⁵.

MultiCreation project: Sustainable Non-garbage

A MultiCreation project for Sustainable Non-garbage (the conceptual antonym of continuous waste)³⁶ has been taking place in the Pelagonija region (Bitola, Prilep) across a broad ecosystem of stakeholders: Faculty of Economics Prilep (Prof. dr. Renata Petrevska Nechkoska), Technical Faculty Bitola (Prof. dr. Daniela Koltova Nechoska), Primary school in Bitola, Voluntary initiative #MetiSiSoKlasneto and business actors Oriflame and Wellness.

³⁵ <https://www.pravdiko.mk/wp-content/uploads/2013/11/Zakon-za-kvalitetot-na-ambientniot-vozduh-31-07-2012.pdf>

³⁶ <http://tactical-management-in-complexity.com/course/view.php?id=28>

The project focused on educational research activities for the involved students from the participating academic institutions, secondary and primary schools, as well as specific tangible solutions for: (i) organizing self-sustaining student space within the faculty's premises, where the students will circulate books, test entrepreneurial ideas, collaborate, meet with professors, employers, guests, present ideas, showcase their own art or models, which will be equipped by reusing existing wasted furniture with a creative twist; (ii) mapping the household garbage trajectory in one part of the city of Bitola and offering traffic-like solution, and (iii) conceptualizing an app that will be used as a solution to the car-sharing and transportation of passengers who commute from Bitola to Prilep, for different reasons (business, studying, personal), occasionally or on a regular basis.

The Denica managerial method was used to make the Role and Accountability System diagram so that whoever is onboarded, could immediately understand what the student space is about and how to fit in (Fig. 30). The main roles are between the Student (who is at the same time host/guest) and everyone else in the student space, with a primary purpose of having a functional space for friendships and cooperations, which is self-sustained, by all means.

5. Систем со улоги и одговорности за нашиот проект

(Информациони сензори, информативни емитери и ризици)

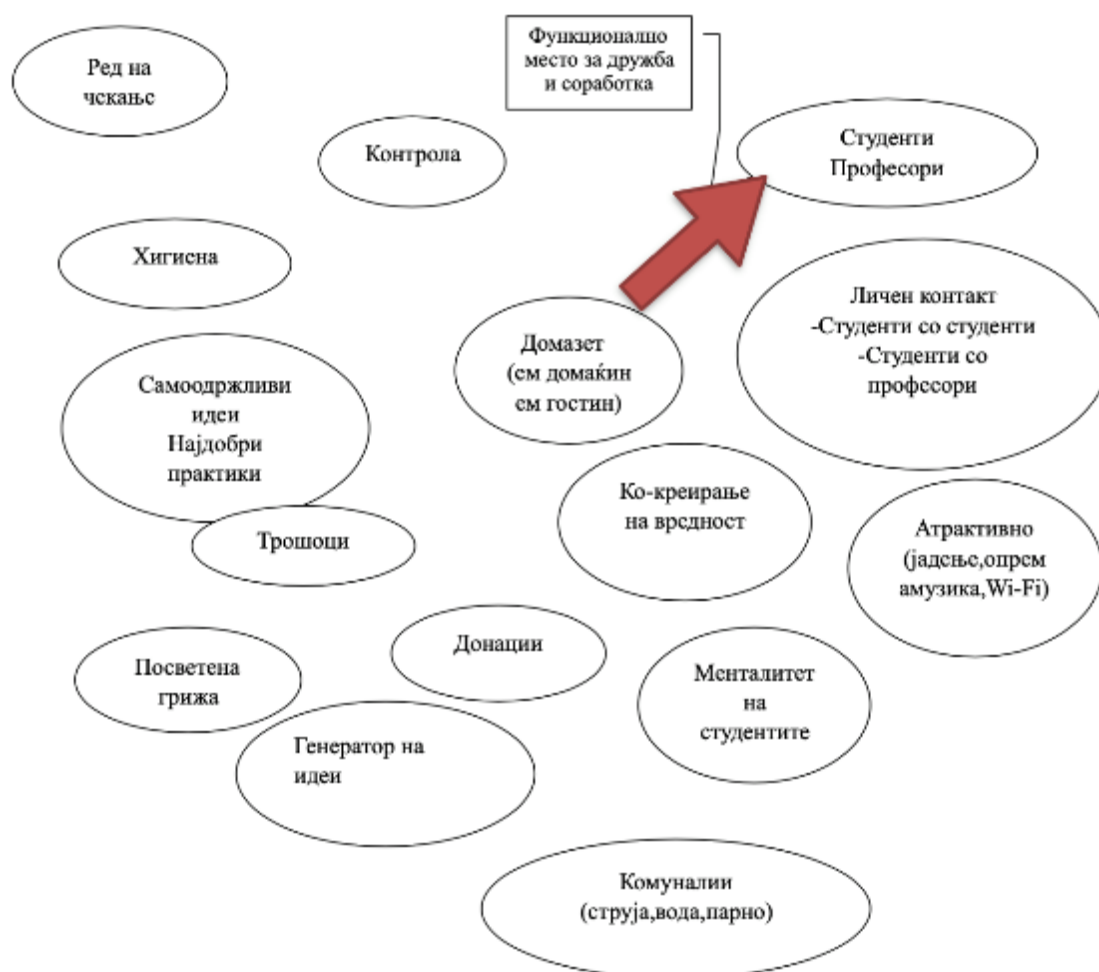


Figure 30. Role and Accountability System diagram for the student space, MultiCreation project

The first challenge got kicked off by circulating books and scripts among the students, placed on special shelves where they have been disposed to be taken from another student. The students created a promotional post and re-shared it on social media, so it became a yearly habit, which saves a substantial amount of the student budget, and has other benefits too (Fig. 31).

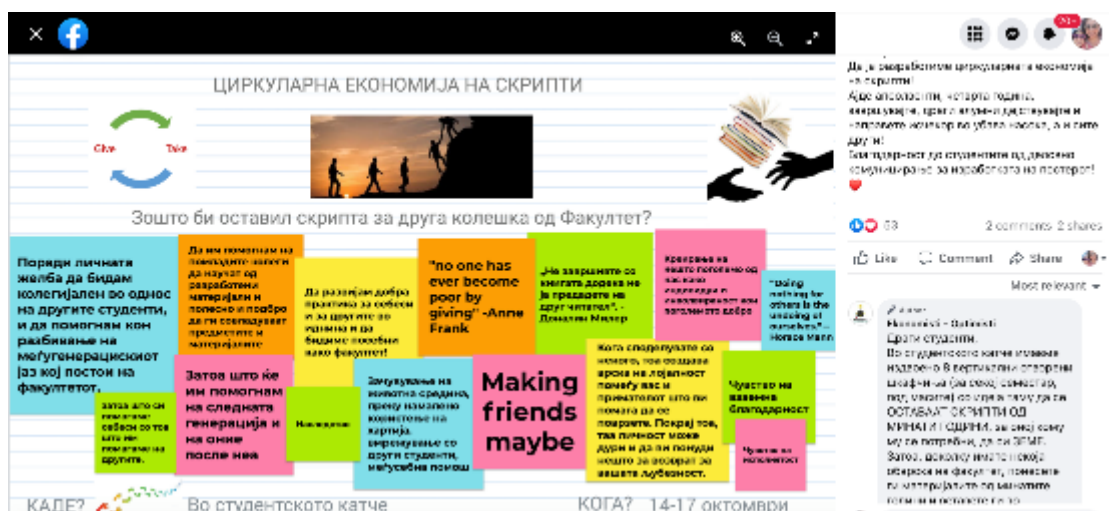


Figure 31. Circular Economy of student scripts and books, MultiCreation project³⁷

The process of refurbishment and reuse of existing leftover materials and furniture across the faculty building has been creative, and since the initial principle was to achieve it all with ZERO money, all was in the direction of incurring no expenditures and by observing the CE principles.



Figure 32. Interior items made from household materials

Students also made fun videos about some of their main necessities (such as second hand printer-copier, water heater, etc.) and shared them on social media to attract companies to donate these items³⁸.

³⁷ <https://www.facebook.com/EkonomistiOptimisti/photos/pb.100057406391342.-2207520000/381724706568064/?type=3>

³⁸ <https://www.facebook.com/watch/EkonomistiOptimisti/1154236008472980/>

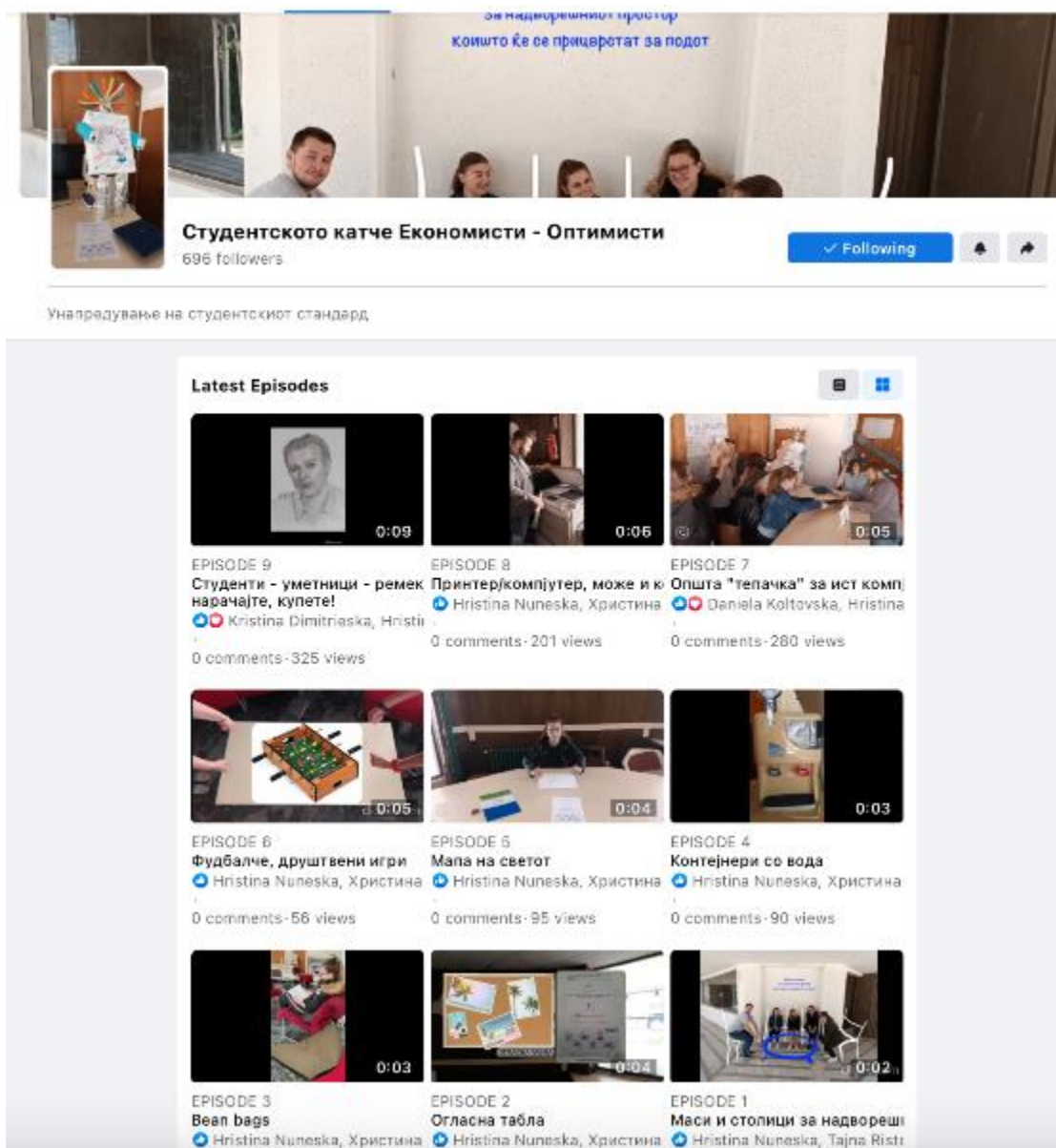


Figure 33. Creative videos for attracting supporters for second-hand furniture

The second challenge was undertaken by the students from the traffic engineering stream who analyzed, mapped and modeled the garbage trajectory and the congestion points, using an Integrated Waste Management approach. Eventually, the students offered solutions as to how this problem could be addressed which ranged from achieving cross-fertilization from traffic engineering solutions for green waves, to congestion resolution, and to regular flow of garbage disposal and management.



Figure 34. Integrated waste management system - TFB



Figure 35. Garbage route, analysed as traffic congestion



Figure 36. Using AI for route traffic and intelligent containers to address the garbage congestion in the analyzed region

As to the third challenge which included designing an app solution that will serve as an information system for the car-sharing and transportation of passengers who commute from Bitola to Prilep for different reasons (business, studying, personal), occasionally or on a regular basis, the involved parties made the preliminary analysis of passengers' needs, the number of passengers, the frequency of their traveling, the budget, the interested parties, their preferences, and tried to onboard with the existing transportation companies, private taxis, individual drivers. This is work in progress.



Figure 37. Route for car-sharing application needs

From young age

In the context of North Macedonia, within the continuous activities of raising awareness and engagement, on the side of education, we can list several modalities towards CE, performed by primary school children:

- **Sensory eco-fidget book!** by Noela³⁹, a complete sensory book with all the sensory teasers, devised by household waste such as wrappings, cardboard paper containers, plastic bags, textile leftovers etc. to replace the plastic pop-its, fidgets, squishies, ... which have been overproduced, overpriced and piled up. The child has complete instructions on how to make one from any random household waste, and can serve children of all ages — typical and atypical. Both the process and the book are worth engaging in and reading.

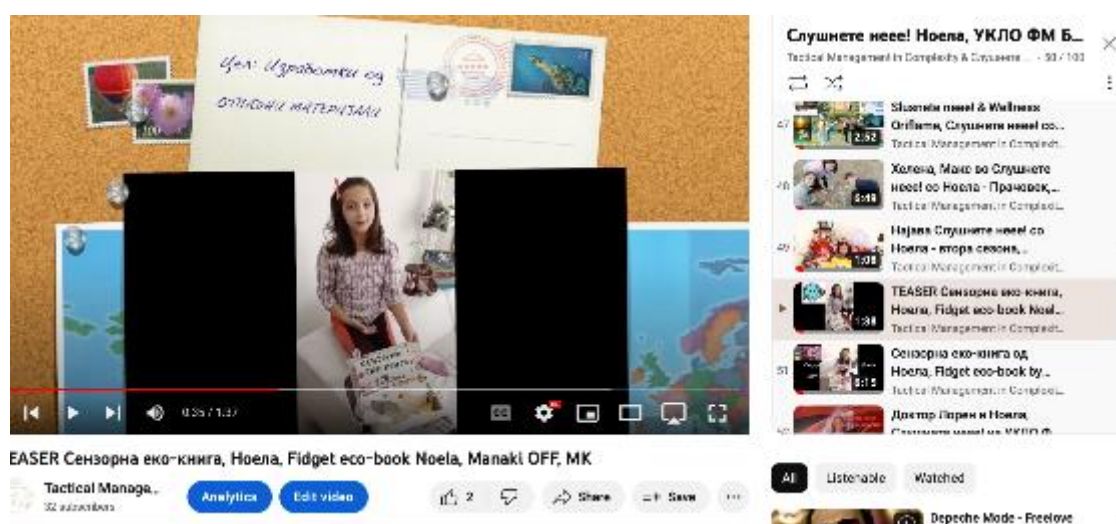


Figure 38. Sensory eco-fidget book, made from household items

- **Moto: “I can — we can do this together”** created within the radio show “Listen to ussss!”⁴⁰ with Noela, at the university radio station, UKLO FM Bitola. The moto has been reworked multiple times by the school-children who engaged in the projects about the CE⁴¹;

³⁹

https://www.youtube.com/watch?v=VpJqsNFmP3I&list=PLuGD39XFPX9F5koAkd8g7wbKp_yV_JO54&index=50 and

https://www.youtube.com/watch?v=j5rCSvE9Hkg&list=PLuGD39XFPX9F5koAkd8g7wbKp_yV_JO54&index=51

⁴⁰ https://www.youtube.com/watch?v=Q7TD7-GjNmo&list=PLuGD39XFPX9F5koAkd8g7wbKp_yV_JO54&index=26

⁴¹

https://www.youtube.com/watch?v=riZHGnzQfgM&list=PLuGD39XFPX9F5koAkd8g7wbKp_yV_JO54&index=30



Figure 39. Audiovisual content, moto for environmental action

- **Pupil engagement** in exploring the concepts, the approaches and the best practices within the CE — in video clips and audios⁴² with professor Janet Taskovska.

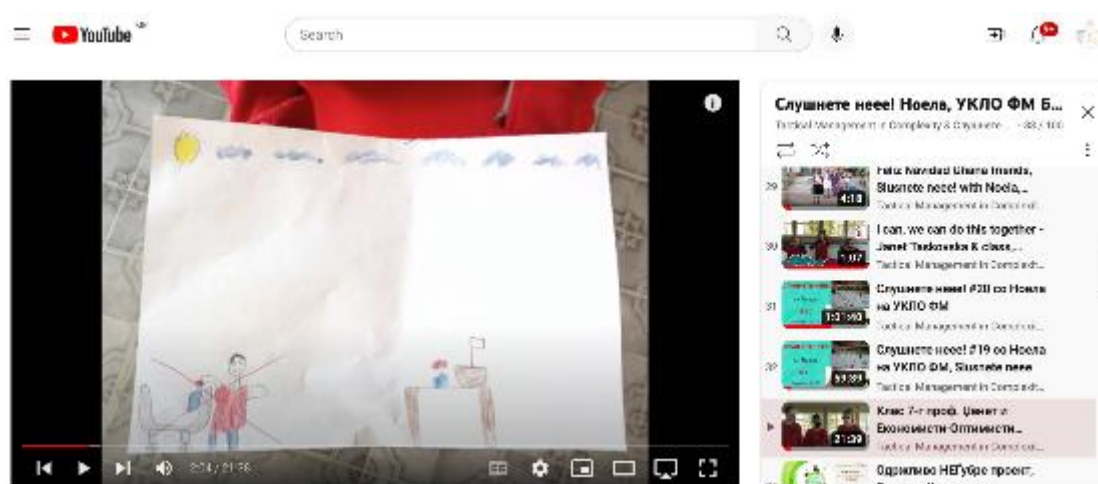


Figure 40. Student works on the principles of CE

The youngest pupils create their greeting cards from leftovers, saving their family budget and acting circular⁴³ with professor Gordana Ugrinovska

⁴²

https://www.youtube.com/watch?v=6l0KZjfd7Fw&list=PLuGD39XFPX9F5koAkd8g7wbKp_yV_JO54&index=33

⁴³ https://www.youtube.com/watch?v=y2snrQ18mM&list=PLuGD39XFPX9F5koAkd8g7wbKp_yV_JO54&index=34

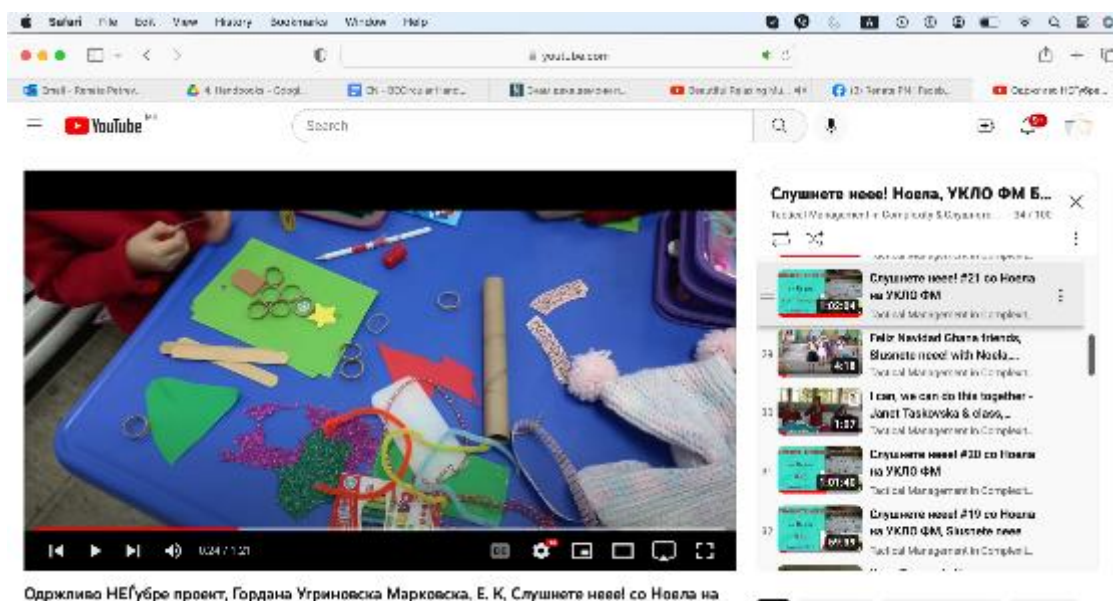


Figure 41. Youngest pupils' contribution — greeting cards from household items

PDIA project: Worsening of the air quality in North Macedonia during the heating season

Another bottom up project aiming to address the problem of environmental pollution in North Macedonia and assist one of the main stakeholders — the citizen — directly, both with managerial and technical solution has been the investigation of the problem of worsening of the air quality in North Macedonia during the heating season, in a project carried out by participants from Ghent University, Belgium, and St. Kliment Ohridski University, Macedonia, within a Harvard University CSI module for Problem Driven Iterative Adaptation (PDIA), in the course of 12 weeks during the heating season of Autumn/Winter 2017⁴⁴. The PDIA approach prescribes the strategy for addressing complex problems by decomposition into sub-causes, their formulation, investigation of authority, acceptance and ability and providing iterative search for solutions (best practices, positive deviations, ...) that may work in a specific context, in our case North Macedonia, as an initiation point for expansion across the region. The investigation resulted in proper identification of several main sub-causes of the problem. The tactical approach was to focus on the citizen as one of the main

⁴⁴ <https://conference.unt.edu.mk/wp-content/uploads/2019/03/TSD-ABSTRACT-2018-TZP-05.03-FINAL.pdf>

stakeholders, in a holistic manner, but also on the contributors to the pollution and/or to the solution, using the Denica method, based on the Sense-and-Respond framework. The contribution aims to act as a bridge between the scientific solutions and the reality, to guide and help various stakeholders to obtain a helicopter view and a draft strategy for this complex problem, along with a system of roles and accountabilities that will support the citizen's adaptable behavior towards reducing his/her own participation in the air pollution, on a tactical level. The methodology that involves scientists and practitioners and combines strategies and tactics for complexity can be replicated in the Western Balkans, enabling proper context capture and effective addressing of the problem, for the benefit of all.

We will showcase the logic of reasoning within the PDIA guidelines, in order to reach a proper problem resolution.

Why does it matter? (and how would you measure this or tell stories about it?)

- Health of citizens – oncology patients, respiratory diseases, ...
- Environmental degradation and pollution – PM10 particles, quality of soil, presence of pollutants in milk, wine, wheat
- Reproduction of the population – fertility, in vitro increase, having first child at the age of 35+
- Deforestation happens (legal and illegal) – as main resource for heating is wood, ...

To whom does it matter? (who else cares?)

- Citizens in this geographic location
- Animals, plants, future generations, ... the ones to whom we owe a change and the ones who cannot do anything in return, except adapt
- Healthcare professionals

Incorporated sub-question: Who doesn't give a damn?

Who needs to care more and how will you get them to give it more attention?

- Individual citizens who live in this geographic region, within their possibilities (heating alternatives, transportation, Reuse, Recycle, Reduce)
- Government (infrastructure, subsidizing, facilitation, regulations and evaluations of discrepancies, addressing the biggest pollutant businesses, emphasis on proper solving, waste management, ...)
- Business (the business model shouldn't be just profit; big picture gives/takes, ...)
- International community (this pattern of doing inadequate things because of lack of money, knowledge, consciousness, capability and proactivity on an individual and a collective level exists in at least half of the global developing countries, if not all)
- EU and International community

The attention and dedication needs to be captured on various levels (mostly mentioned in brackets in the bulleted answers to this question): individuals need to start thinking that there are some things they can do to improve the situation by themselves and within their capabilities and stop using the 'it is not worth it, it is just one drop in the ocean' excuse . The government should produce systems design of projects towards setting purpose(s) and identifying proper roles and accountabilities, as well as populating those roles with various agents. The international community should exemplify economies that lead the way and facilitate functional exchange of information and resources towards co-evolving together; EU should step towards systemic design of project(s) with the purpose to reduce the pollution and make sure the ones who populate the roles are accountable and fulfill their accountability in the system, ...)

WHAT WE DID — COMBINE STRATEGY AND TACTICS FOR COMPLEXITY

The project team consisted of participants from Ghent University Belgium, and St. Kliment Ohridski University, Macedonia (bachelor and master students:

Mihaela Atanasovska, Damjan Chkatroski, Martin Trajkovski — supervised and coordinated by Asst. Prof. dr. Renata Petrevska Nechkoska) within a Harvard University CSI module for Problem Driven Iterative Adaptation (PDIA) in the course of 12 weeks during the heating season of Autumn/Winter 2017⁴⁵.

Strategy for complexity: Problem Driven Iterative Adaptation (PDIA) (Building State Capability, Evidence, Analysis, Action; Andrews, Pritchett, Woolcock, 2017)

Tactics for complexity: the Denica method (Petrevska Nechkoska, 2017), based on the Sense-and-Respond framework (Haeckel, 1999)

PROBLEM DRIVEN ITERATIVE ADAPTATION - COMPONENTS

1. Needed authority – Key stakeholders

Name	Role	Why are they important?	Rank (where in the matrix?)	Current attitude	What we would like them to do?	Key messages	How (Tactics?)	When	Who
Intellectuals	Support the cause without political background (gather personal network of intellectuals from all ranges, profiles, political or no political background, MKD and diaspora, to recognize and support the cause)	To exemplify that smart, wise, engaged and proactive people do care and want to make a difference to a common purpose of quality of life for all	A	Segmented and individualism – no collective purpose nor facilitator to guide them. Only sporadic scattered efforts which are usually colored in one or the other political party	(1) Support the project (and get involved in dissemination) as individual intellectuals (otherwise groups, institutions, NGOs, leaders, ... are all going to be considered politicized) and (2) act in line with the project through personal example	If not now – when? If not us – who?	Activate the personal network and initiate a meeting, check for support climate and see if it can spread more and how – social media, personal discussions, workshops, interviews, ...	January 2018	Renata & (Martin, Damjan, Mihaela)
Model PR citizens	Support the project with own	To act as referrals to the common	B	Each fighting their own battles, but with	(1) leave some of their recognizable	If not now – when? If not us –	Persuade one by one by getting contact,	February 2018	Renata & team (Martin, Damjan,

Intellectuals.
Model PR citizens,
Media,
Ministries -
Of transportation,
Of environment,
Of finance,
Of economy,
Of internal affairs,
Of law;
Commercial businesses and banks,
Neutral citizens and households,
Municipal government,
Transport companies,
External investors,
EU

Figure 42. Problem Driven Iterative Adaptation, Influencers and Enablers

⁴⁵ <https://bsc.cid.harvard.edu>

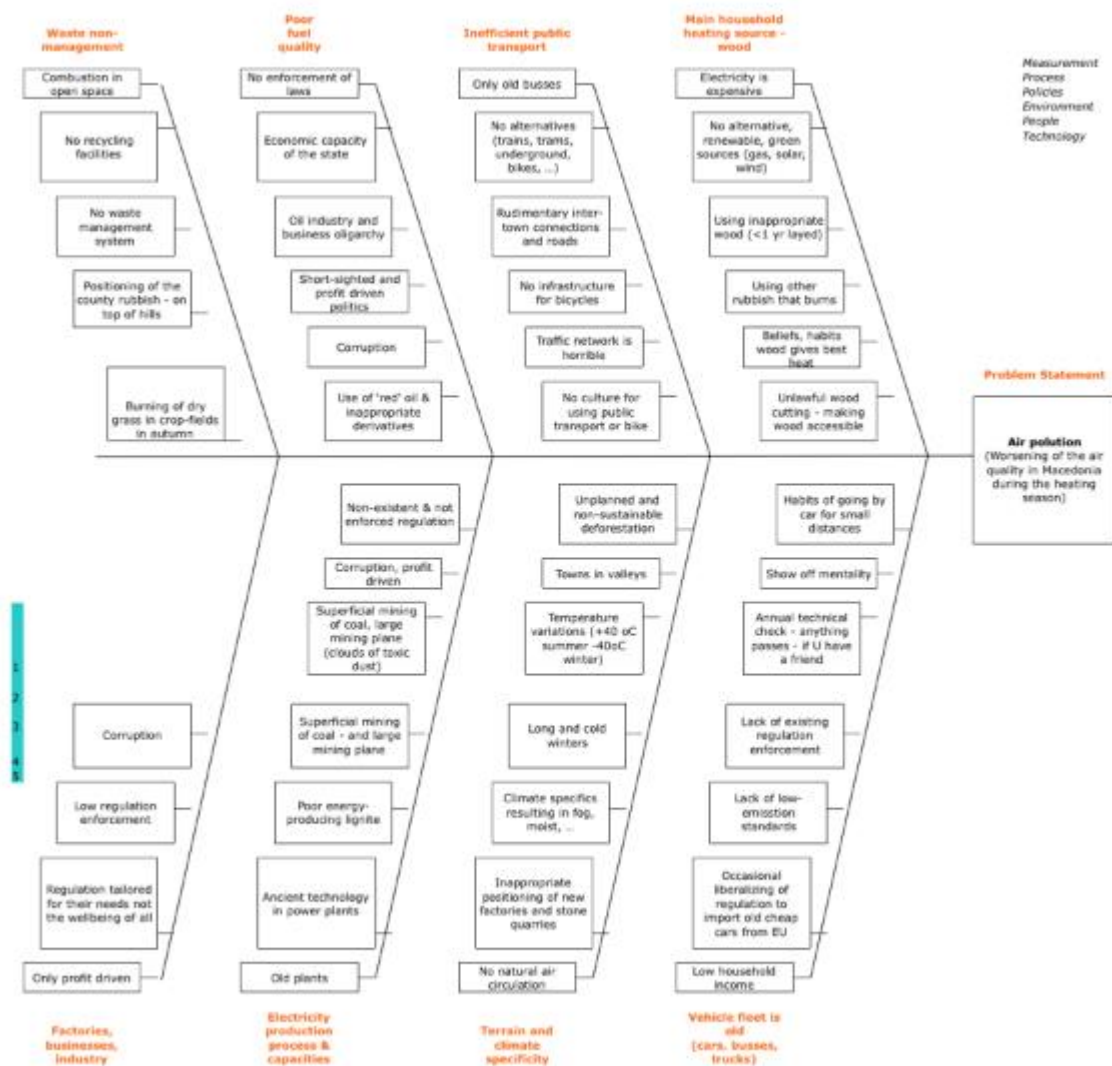


Figure 43. Fishbone diagram — the problem of Air pollution — Worsening of the air quality in North Macedonia during the heating season

	Use the questions provided to help you reflect	AAA estimation (low, mid, large)	Assumptions																				
Cause # 1	Main household heating source - wood																						
	Overall, how much Authority do you think you have to engage?	Large	Supportive: Government: Ministry of transport, Ministry of economy – electricity price); Ministry of environment (alternative green solutions), Ministry of law, Ministry of internal affairs (unlawful wood cutting) Non-supportive: Citizens (change of behavior and mentality) Neutral: Commercial businesses (they will seek for profit anyway)																				
	Overall, how much Acceptance do you think you have to engage?	Mid	<table border="1"> <thead> <tr> <th>Agents</th><th>Engagement</th><th>Influence</th><th>Acceptance</th></tr> </thead> <tbody> <tr> <td>Ministries</td><td>5</td><td>9</td><td>Mid</td></tr> <tr> <td>Citizens</td><td>2</td><td>6</td><td>Low</td></tr> <tr> <td>Commercial businesses</td><td>6</td><td>6</td><td>Mid</td></tr> <tr> <td>Total estimate:</td><td></td><td></td><td>Mid</td></tr> </tbody> </table>	Agents	Engagement	Influence	Acceptance	Ministries	5	9	Mid	Citizens	2	6	Low	Commercial businesses	6	6	Mid	Total estimate:			Mid
Agents	Engagement	Influence	Acceptance																				
Ministries	5	9	Mid																				
Citizens	2	6	Low																				
Commercial businesses	6	6	Mid																				
Total estimate:			Mid																				
	Overall, how much Ability do you think you have to engage?	Mid	Time: Short time because the adverse effects are already putting heavy risk on quality of life Agents (HR): Collaborators in all spheres – in governmental institutions, especially higher managers; in NGOs to have broad support regardless of the political party (main danger to become politicized project on two-player political arena); reputable academic staff (teachers, professors, students, researchers, ...) to support the cause; Media attention and support; Own example – practice what you preach. Money: 1) Our financial needs as project team are to establish contacts, persuade, coordinate action, disseminate and promote via different means (social media, forums, presentations, debates, leaflets, ...). In this sense, the necessary funds are EUR 5.000+ 2) If the projects of infrastructure, renewable energy and electricity price are undertaken, then the funding is expressed in Millions EUR.																				
	What is the change space for cause # 1 (large change space, some change space or no change space) – AAA Venn diagram	Some small change space																					

Figure 44. PDIA — Identifying possibility for initiating change — Authority, Acceptance, Ability (AAA)

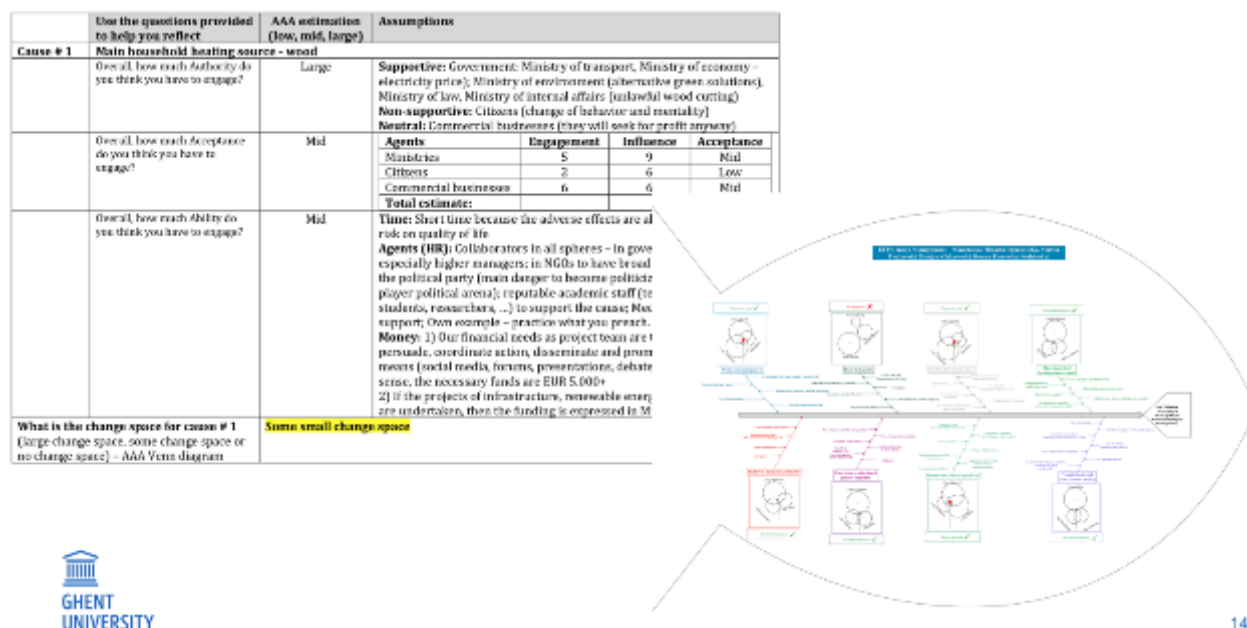


Figure 45. PDIA — Identifying possibility for initiating change —Authority, Acceptance, Ability (AAA) for all causes in the fishbone diagram

1. Needed authority – Key stakeholders

Name	Role	Why are they important?	Rank (where in the matrix?)	Current attitude	What we would like them to do?	Key messages	How (Tactics?)	When	Who
Intellectuals	Support the cause without political background (gather personal network of intellectuals from all ranges,	To exemplify that smart, wise, engaged and proactive people do care and want to make a difference to a common purpose of quality of life	A	Segmented and individualized – no collective purpose nor facilitator to guide them. Only sporadic scattered efforts which are usually colored in one or the	(1) Support the project (and get involved in dissemination) as individual intellectuals (otherwise groups, institutions, NGOs, leaders,	If not now – when? If not us – who?	Activate the personal network and initiate a meeting, check for support climate and see if it can spread more and how – social media, personal	January 2018	Renata & (Martin, Damjan, Mihaela)

Figure 46. PDIA - Identifying and profiling the Key stakeholders

Structuring your first iteration		
case note: You will need to actually take these action steps this week		
Sub cause from our fishbone diagram	Our idea of what to do	Action steps * this should be something that can be completed in the next five days.
Terrain and climate specificity (sub-causes of the sub-cause: unplanned and unsustainable deforestation; fog; inappropriate positioning of factories and stone quarries; natural air circulation; temperature variations; long and cold winters)	Investigate the project plans (from 1980) (if can be found) of the electricity power plant that incorporate use of the warm water for mass heating of the town Bitola; and make stakeholder analysis in order to see whether and how it can be implemented today. Also see how the same plants are organized in neighboring Greece that are located along the same plane of Pelagonia.	-Find the plant plans and projections for the hot water supply to the town of Bitola - Consult with some professors, engineers, specialists on what that means in technical and economic terms - Investigate how electricity plants throughout Pelagonia plane are organized in Greece
Waste non-management (sub-causes that create this macro sub-cause are: Combustion in open space, no recycling facilities, positioning of the country rubbish – on top of the hills, burning dry grass in crop-fields, no waste management system)	Create a detailed plan on how and where to start. Analyse the main waste disposal facilities and explain how they should be renovated. There are several solutions for this idea.	- Find all disposal plants on the map - Consult with some employees there and see the key reasons why waste management is nonexistent. - Present the idea in short to the employees. How they will react and is this idea possible to fulfill its plan.
Main household heating source - wood (sub-causes that create this macro sub-cause are: expensive	Meet and interview households that use wood as the primary source	-Find households that use wood as their main heating source -Interview them on why they use wood and go through all the details behind their

Figure 47. PDIA Iterating to initiate change and manage it

PROBLEM DRIVEN ITERATIVE ADAPTATION - TACTICS FOR THE CITIZEN, THE DENICA METHOD

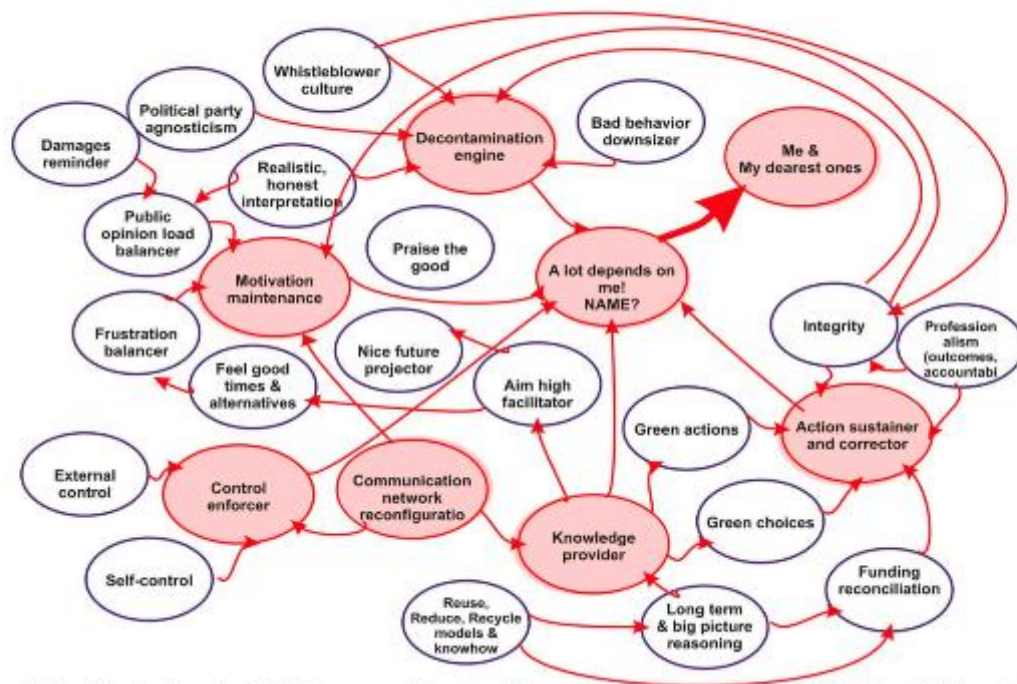


Figure 48. PDIA tactics using the Denica managerial method, System of roles and accountabilities for the Citizen within the Circular Economy with regards to the air pollution

BeCircular Business Ideas

Within the BeCircular project, all the insights gained from the project meetings, coaching, mentoring and training have been designed to be extended to a broad audience from all ecosystem helices within an economy — academia, civil sector, business sector etc. They all had to integrate in their design the CE frameworks, principles, approaches, mechanisms and components, and have been shaped within the CBMC, emphasizing the value to society, the value to the planet and the take-back system as well as the internal and external adoption factors.

Here, we provide a list of a few of the pool of business ideas which have been outlined to be shaped and carried out further, to make a tangible impact on the region:

- Remanufacturing plastic utensils from household plastic waste
- Production of household items (furniture, jewelry, decorations) or interior solutions (walls, mosaics) from glass waste
- School paper recycling (with all stages for children to learn from) to be used for making greeting cards, gift wrapping, paper bags, etc.
- Reuse and repurpose of old clothes, by adding additional details, upcycling to be functional
- Adaptation and repurposing of old clothes
- Production of clothes from organic materials in spray tube (which can be reused, refilled)
- Freon reuse
- Reuse for refill of metal/plastic paint buckets
- Reuse of plastic buckets for UV-connection to be refilled
- Medical waste management within hospital departments, on an institutional level, on a regional scale
- Repair and reuse of household electrical items
- Repurpose of styrofoam from student model crafts in faculties of architecture, to be used for bean bag filling

- Repurpose and reuse of PVC waste materials from student model crafts in faculties of architecture
- Repurpose and reuse of paper and cardboard waste materials from student model crafts in faculties of architecture
- Remodeling of old furniture to be upcycled in order to extend its lifetime by introducing personalized design items (e.g. personal memories from clothes, personal belongings etc.)
- Repairing old furniture, from vintage to functional, emphasizing the emotional value
- Establishing connection between students of architecture and design and direct resource providers
- Use of textile leftovers for depilation stripes
- Biomass energy production
- Crafting new interior products from old scraps
- Repurposing and remanufacturing used clothes, accessories
- Consultancy to make point-to-point connections between the companies which produce waste and the companies which can use it as an input
- Application for waste management collection
- Application for car-sharing
- Application for use of food weeks before expiry date
- Connection of pharmacies with end users for almost expired products (which are usually discarded)
- Creation and production of eco-fidget sensory book for children from materials at hand
- Reuse of old items for jewelry, using creativity and experimentation
- Creation of jewelry from pine mat (material from pineapple leaf)
- Connecting collectors of plastic bottle caps and the ones who can manufacture something from them
- Collection of construction waste, separation and use for filling gaps and holes

- Use of textile scraps for teaching sewing to students
- Organization of the process of collection of bio-waste and distribution to Diadyma, Greece
- Renewal and repurposing of old facilities and objects for the purposes of tourism, restaurants, co-working spaces etc.
- Producing isolation materials from medical marihuana production waste
- Production of goods from plastic as input for 3D modeling and 3D printing
- From seed to food — tourist attraction of the ‘from plantation to the table’ experience
- Education for hiking and nature preservation
- Use of casks from apples in ownership of the schools to sell products at a fair and at fundraising events
- Collection of meat bones and such waste from restaurants, barbecues, households for someone who will use them (ZOO, pet rescue shelters, ...)
- Stray dogs lifetime management
- Thrift shop
- Collection of all plastics used in rural regions and their distribution to factories who can recycle it, to be resold to agro-producers again, at a lower lower price
- ...

Let this handbook serve as an inspiration for the plethora of ideas and solutions which can be conceptualized and realized if we set the ‘right’ principles and motivation for saving and regenerating our Planet as a home to such biodiversity, and ourselves as Humanity.

[illegible]





BeCircular Logo Noela

Complete

explanation:

https://www.youtube.com/watch?v=5CuaNmtJkz8&list=PLuGD39XFPX9F5koAkd8g7wbKp_yV_JO54



Be careful – the most advanced species ...



are advancing!



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