SUSTRAINY
Sustainable action Training for Youth

Co-funded by the Erasmus+ Programme of the European Union

SUSTRAINY PROJECT

ENVIRONMENTAL

TOPIC N°3 CIRCULAR ECONOMY

Project funded by: Erasmus+ / Key Action 2 - Cooperation for innovation and the exchange of good practices, Strategic Partnerships for VET education
SUSTRAINY – Sustainable action Training for Youth. Project number:2019-3-FR02-KA205-016556

SUSTRAINY
Sustainable action Training for Youth

Co-funded by the Erasmus+ Programme of the European Union

Table of content

SUSTRAINY
Sustainable action Training for Youth

Co-funded by the Erasmus+ Programme of the European Union

SUSTRAINY
Sustainable action Training for Youth

Co-funded by the
Erasmus+ Programme
of the European Union

Introduction to the topic

The circular economy proposes an economic and productive model based on sustainability and the saving of resources and energy sources. Goods are produced, consumed, recycled, produced and re-consumed, entering a circular life cycle. It is a recent and increasingly widespread concept based on economic principles and other aspects such as the environment. In this way, the life cycle of products is extended.

In that sense, the concept of circular economy covers all stages of the product life cycle, from product design and production process, through transformation and consumption to waste management, recycling and reuse. For example, an initial focus on designing products that are more resource-efficient throughout their lifecycles can make products more durable.

The circular economy also demands greater efficiency in production processes and here the focus is on seeking to reduce the environmental and social impact of production, such as through promoting innovative industrial processes or more sustainable supply.

- References to EU policies in line with this topic

The European Commission presented in December 2015 its Action Plan (European Commision, 2.12.2015 COM(2015) 614 final) for a circular economy in Europe. The objective of this plan was to point out the different measures (up to a total of 54) that it considered necessary to carry out in the following 5 years to advance in the circular economy. The measures affected:

- To the different stages of the product life cycle (design and production, consumption, waste management and use of the resources contained in the waste through its reintroduction into the economy) and
- Five areas that the Commission considers priority (plastics, food waste, critical raw materials, construction and demolition, and biomass and bio-based products).

Likewise, the plan also included a horizontal section on innovation and investment and a timetable for the 54 measures.

SUSTRAINY
Sustainable action Training for Youth

Co-funded by the
Erasmus+ Programme
of the European Union

In march 2020, the European Commission adopted a new Circular Economy Action Plan (European Commission, COM/2020/98 final) - one of the main blocks of the European Green Deal, Europe's new agenda for sustainable growth.

This new Action Plan announces initiatives along the entire life cycle of products, targeting for example their design, promoting circular economy processes, fostering sustainable consumption, and aiming to ensure that the resources used are kept in the EU economy for as long as possible. It introduces legislative and non-legislative measures targeting areas where action at the EU level brings real added value. The new Circular Economy Action presents measures to:

- Make sustainable products the norm in the EU;
- Empower consumers and public buyers;
- Focus on the sectors that use most resources and where the potential for circularity is high such as: electronics and ICT; batteries and vehicles; packaging; plastics; textiles; construction and buildings; food; water and nutrients;
- Ensure less waste;
- Make circularity work for people, regions and cities,
- Lead global efforts on circular economy.

This text is still at a stage of communication, it was thus written as a founding text for future legislation, but has no coercion value at this stage. However, it clearly shows the willingness of the European Union to become a prominent force in this field.

SUSTRAINY
Sustainable action Training for Youth

Co-funded by the Erasmus+ Programme of the European Union

Chapter 1 – The 7 R's of the circular economy

1.1 The circular economy concept and the R-Imperatives

Circular economy aims to optimise the use of materials at their highest value and optimal use for an increased efficiency of products and a reduced environmental impact. The use of R's as operational imperatives of the circular economy answers to a need of conceptualisation and modelisation of the circular economy principles. They are commonly used nowdays in order to give orientation about possibles actions that participate to the circular economy process. Historically, this modelisation has been developed in different steps, as explained in the research paper The circular economy: New or Refurbished as CE 3.0? (Reike 2017) (ScienceDirect, s.f.)

Back in the 70's the first environmental movements arise both in Europe and in the United states, with the first emergence of what we call the "3R" concept of reduce, reuse and recycling. During the first decades of circular economy concerns, the majority of policies developed in this field focus on the outputs, the pollution, with principles such as "polluter pays" but few is done to prevent such pollution and generation of waste. This period is nowadays called CE1.0 (As circular economy 1.0)

From the 90´s to 2010 (CE2.0), a connection is made between the inputs and the outputs, and measures start addressing the prevention of pullution. Also, environmental problems start to be framed as an economic opportunity and new concepts as design for the environment appear.

Finally, since 2010 and still nowdays (CE3.0), appears the notion of "maximizing the value retention in the age of resource depletion". In addition to the sustainability design approaches, the reduction of input materials and resources, as well as the concept of reuse, become central.

All along this period, numerous of theories and research documents were published with number of references to the R-Imperatives (Rs). In "The circular economy: New or Refurbished as CE 3.0", researchers have analysed a total of 69 texts of references and found a large range of Rs, from 3Rs to 10Rs, making reference to a variety of concepts. Also, it seems the the 3Rs principle are the most commonly used and consensuated in the CE2010+ literature, despite a frequent use of 4Rs, 5Rs and &Rs. The next title will present first the 3Rs of the circular economy, and will add four of the most commonly addressed R-Imperatives, as complementary references.

SUSTRAINY
Sustainable action Training for Youth

Co-funded by the
Erasmus+ Programme
of the European Union

1.2 The 7 R´s of the circular economy

After having contextualised the 7R's in the circular economy, we propose to review now these 7R's one by one, with some example of application:

Reuse:

Many products can be used for more than one application over the time. Even if the first customer won't need a product anymore, because his circumstance change or because he simply does not want it anymore, this same product has good probability of being in a good enough state to enable a new use by someone else. This can be the case for most products, clothes, furnitures, cars… There is an important market for second hand products, that can be proposed by particulars (for instance on websites such as ebay), but also by some retail professionals themselves. This is largely developed for cars, but you can also think at shops like GAME (for videogames) that propose a section for second hand video games and consoles, where customers can resale the products that they are not using anymore. For more information, you might also refer to the topic "Sustainable Global Economy" and our section about the shared economy.

Recycle:

Recycling consist in reintroducing waste that were already consumed in a production process, so that they can be used again as a raw material for the manufacturing of new products. Recycling offer an entire world of possibilities and a great optimisation of resources. When you throw glass in a recycling bin, this one is sorted by color and washed in a glass treatment plant. Then it is crushed and melt, and moulded again in new products such as new bottles, ready to be used again. Recycle is also a core in the cascading use of raw materials, detailed in chapter 3.

Reduce:

Reduce can be applied at 2 levels:
- For the consumers: we buy a lot, consum huge quantities, and very fast. Also, a good way of taking care of the environment is to reduce the number of products that we buy and waste that we generate. For instance, making an inventory of what we have in the fridge from time to time would probably help reducing the quantity of food we purchase, and optimize what we already have in order not to waste it.
- At industrial level, reduce is about decreasing the use of raw material needed to develop a product. This can be achieved thinking about non essential features of a product, such as the packaging, avoiding plastic bags, etc.

Rethink

Rethink, or redesign is about not taking anything for granted. Ecology and environmental concerns should be part of the design process to manufacture products that are more sustainable. It is not only about functionnalities, but also about the raw material, the packaging, etc. Also, when thinking about solution, you should avoid to stick to traditional models and take risk, reinvent new models that are more adapted to our current environment, using all the available knowledge.

Repair

While recycling means a different use, repair is simply about taking what is broken and putting it again into service thanks to putting it back into good conditions. It is simple, and efficient. We might think about it for larger home appliance. Washing Machine is broken? Before buying a new one, you probably call the technical service. This can also be applied to most smaller items: you might sew your holey trousers, or simply paste an old frame.

Refurbish

Everything doesn't need to be brand new, and vintage is actually fashion. So why not joining the move? Refurbish is mostly applied to building, taking some old premises to renovate them. But it can also be applied to other things, such as old pieces of furnitures, and any old good that will be transformed to become a modern item.

Recover

Recovery offer a similar approach, while focusing mostly on resources. In recovery, people use wastes as an input material to create valuable products as new outputs. The aim is to reduce the amount of waste generated, therefore reducing the need for landfill space and also extracting maximum value from waste. This can for instance be easily applied inside the kitchen, main chefs todays develop everyday new receipies to maximise the use of the products, making dips with fried skin of fishes or potatoes peel chips.

1.3 Apply Circular Economy in your Life

You can apply circular economy in your life, and in your work and enterprise. Here you have some tips to apply circular economy in your normal day:

• Buy only if it´s absolutely necessary. Make regular inventory of your belongings (especially, of your fridge and wardrobe), prepare a shopping list with what you really need and limit your purchases to this shopping list.

• Think twice before throwing something away. Especially in case of furniture, appliances etc. Can it be repaired? Could it be re-used in any part? Could you give it to someone who might need it? Think in your close environment, but also about charities that might collect clothes or other objects.

• And if throwing is the only solution, don't forget to take it to its corresponding container for recycling!

• Return used items to the store where you purchased them. It is common for expired medications, but you can also return empty batteries or glass bottles in some supermarkets, and even clothes in some stores.

• Buy in local stores, prefer the purchase of fresh and local products that come from your neiborhood, as well as craft products, and support the local commerce and fair trade.

• Minimize litter and waste: avoid products with unnecessary packaging, such as plastics, and prefer products in bulk. Use your own bags and containers.

• Adjust energy expenditure, remember that every little step is important to achieve the entire loop of circular economy. Moderate your use of energy, use sustainable transports.

Foto de Magda Ehlers

1.4 Application of the R-imperatives in the fashion sector

The fashion sector offers many possibilities of application of the 7Rs and is encouraged to handle the role of a pioneer in this field. At EU level for instance, the CIRCFASH call, launched by the European funding programme COSME, encourage the transnational partnerships between SMEs from the fashion sector to develop circular projects.

Best practice 1: MUD Jeans

The European Circular Economy Stakeholder platform provides number of examples of application of the circular economy principles in different economic sectors, that you can search by key area, sector or country.

This platform present over 15 best practices dedicated to the textile sector (among many other initiatives). For example, the MUD jeans practice: circular denims (almost) never die (circulareconomy.europa.eu, s.f.). Here is there best practice, as presented in the platform:

MUD Jeans is a circular jeans brand from the Netherlands which has been applying a circular model to the production of jeans for a number of years. Customers can lease or buy MUD jeans, and return these to have them recycled into new denim products, thus saving water and resources. As it is important for MUD customers to wear their jeans as long as possible, MUD also offers a free repair service.

When customers no longer wear their jeans, they can send their old jeans back to MUD, which can reuse them. Consumers receive a discount on a new pair when they hand in an old pair. Non-MUD jeans are also accepted for recycling, the only condition being that the jeans must be at least 96% cotton.

When old (MUD) jeans are sent back to the firm, a small quality check is carried out: if they are still in good condition, they are given a second life through MUD's vintage program (re-use). If they are irreparably worn out or from another brand, jeans are mechanically recycled at MUD's recycle factory in Spain (recover@), where the worn jeans are shredded into small pieces and processed back into recycled fibers.

Fibers then go to MUD's fabric manufacturer, Tejidos Royo, also in Spain. Here the fibers are mixed with organic GOTS certified cotton and yarn is spun from it. The yarns are dyed and woven into fabrics.
The resulting fabrics contain between 23-40% post-consumer recycled cotton fibers made from old worn jeans.

The fabrics go to MUD's jeans manufacturer, Yousstex International, in Tunisia, where they are cut, sewn into jeans and washed.

As soon as the jeans are ready, they come to MUD's warehouse in the Netherlands. From there the jeans are sent to MUD's B2B and B2C customers.

Best practice 2: CUITU

Another European initiative, impulsed by The European institute of Innovation and Technology (EIT) RawMaterial is the circular economy award to the European most promishing project.

In 2019, this award was given to Cuitu, a start-up created by students aged from 19 to 30 who have participated in the JA Start Up Programme, a year-long programme during which students gain real experience of the world of business: coming up with a concept for a business, creating and researching a business plan, taking responsibility and being accountable to their shareholders for the running of the company. (eitrawmaterials.eu, s.f.)

Cuitu is a Finnish fashion brand that creates modern items for urban people. They have a strong passion to develop the most sustainable practices to produce ready-to-wear-fashion. They explore opportunities across industries on local and international scale, playing with oversized details, tech-vibes, signature patterns and high quality materials.

There entire business model has been built around it sustainability, as s norm and a baseline. It is transparency, quality and functionality. They do research, calculate and compare. Therefore Cuitu is always a promise of responsibly created items.

For further information about sustainable fashion, we also invite you to visit the blog of the Italian NGO **Vesti la Natura**, (*Dress the nature* - https://www.vestilanatura.it/) which provide information about sustainable and cruelty free fashion and has created online guides for those who need to choose eco-friendly fabrics, or to understand textile certifications.

SUSTRAINY
Sustainable action Training for Youth

Co-funded by the
Erasmus+ Programme
of the European Union

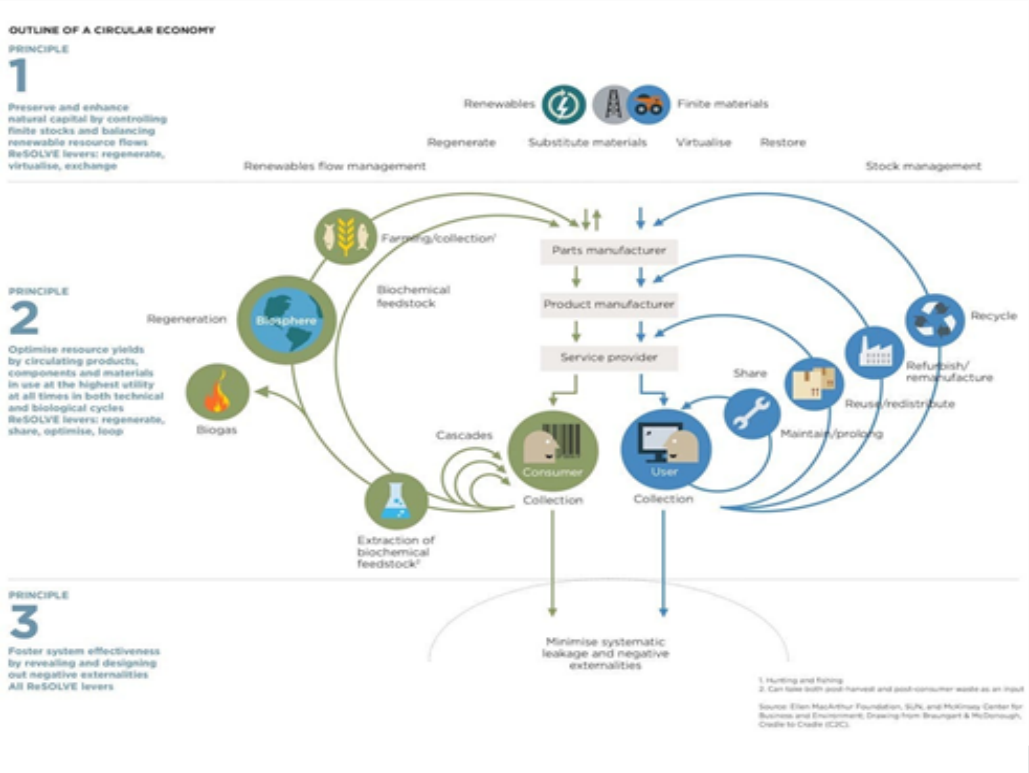
Chapter 2 – Circular economy and CANVAS

2.1 The modellisation of Circular business

In the recent past the most common economy was the linear economy, which prevailed sinde the Industrial Revolution in the late 18th century. This traditional model was based on 'take-make-consume-waste' approach to using resources. The raw material is transformed into a product and after it ends its life cycle is thrown to waste. Experts and non-experts know that this model is one of the main causes of the actual natural resource depletion and if this model is not replaced, the world will approach a tipping point where it will lose the capacity to sustain itself.

As the Circular Economy (CE) progressively moved from theory to practice, new ways of conducting business took shape leading to solid economic models. (Marcello Tonelli and Nicoló Cristoni , 2019). We must be clear that the circular economy is not a passing fashion concept, but it is here to stay. In fact it is a reality, and with which companies that are not aligned with the circular economy with any future future, especially once the policies (legislation and strategy) by the EU (such as the Green Economy Action Plan) are focused to this economic model.

Here is an infography of the circular economy process designed by the EllenMacArthur foundation, which modellise the structure of the business relationships that should take place in such an economy.



SUSTRAINY
Sustainable action Training for Youth

Co-funded by the Erasmus+ Programme of the European Union

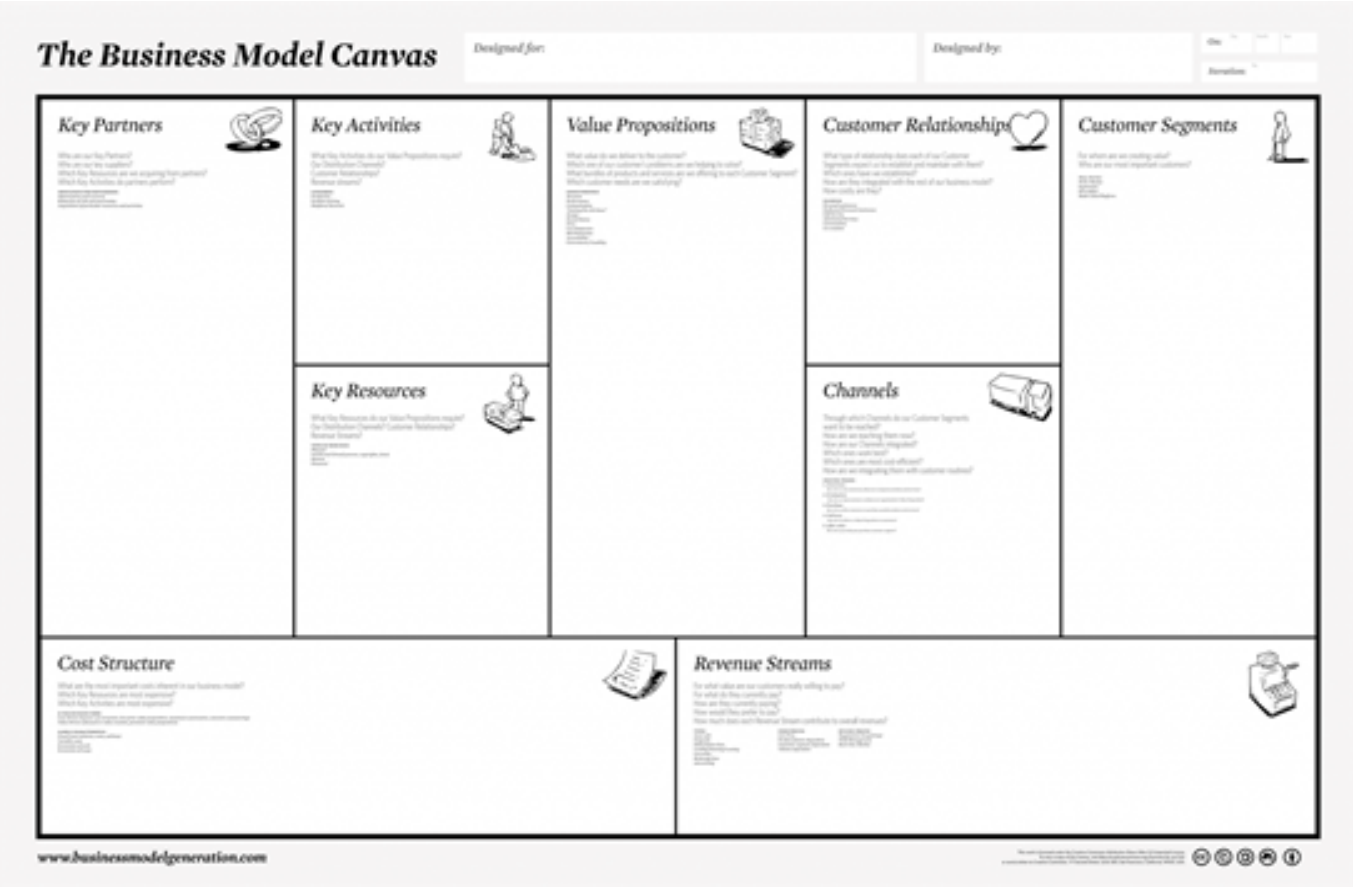
There are a lot of types of business models that could be reached in a circular business models, but here we are introduce you, the most important tips and tools you can use to develop your own Business Models based on the Circular Economy.

The so-called Canvas Model or canvas method was developed in 2011 by Alexander Osterwalder and Yves Pigneur in the book *Generation of Business Models*, where the different types of models are analyzed and a business model generation tool is presented, which is called CANVAS.

The Canvas Model is a tool to define and create innovative business models that simplify 4 major areas: customers, supply, infrastructure and economic viability in a box with 9 divisions.

- Value propositions that seek to solve customers' problems and satisfy their needs
- Key activities which are performed to offered and deliver the aforementioned elements
- Key resources as the assets required to offer and deliver the aforementioned elements
- Key partnerships being a network of suppliers and partners that support the business model
- Customer segments that an organization serves
- Channels which an organization uses to deliver, communicate and sell value propositions
- Customer relationships which an organization builds and maintains with each customer segment
- Revenue streams resulting from value propositions successfully offered to customers execution by providing some resources and performing some activities
- Cost structure comprising all the costs incurred when operating a business model

The Canvas Model is designed so that the members of the company can debate on what business model they want and how they will achieve it.



As this method relies on fluid communication, the table is designed for entrepreneurs to fill it with posits, so they can discuss, note, try new iputs, etc.

2.2 Using Canvas to develop a circular business model

The Spanish Sustain Enterprise has proposed a methodology to use the Canvas Business Model Generation tool to create Circular business models. We will review here how they propose to fill in the different cells of the Canvas model and the different step that one should follow to develop a circular model. (We are Sustainn, s.f.)

Step 1: Proposed Definition of Value Propositions

You should start with defining the Value Proposition (PV) for the main client oriented to "Product as a Service" models (based on use or result), following predefined keys based on the principles of Circular Economy.

Step 2: Market Segments & Income Sources

Once the PV is defined, you should delimit the specific market segment and estimate the main customer's revenue sources in the complete circular business model, considering revenue models based on pay-per--use or pay-per-result.

Customer Relations and Channels are designed to ensure the quality of the service, with special attention to user experience, usage patterns and reverse logistics.

Step 3: Key Activities and Associations & Cost Structure

Next, you should focus on identifying the Key Activities, paying special attention to the areas that most affect the Quality, Cost and Term of the service.

Regarding the Key Associations, the following concepts are considered, taking into account the complete framework of the Circular Business Model:

- Nutrient Management Strategy, where product, component, material and waste flows are analyzed.
- Hierarchy of Circularity Criterion (Repair-Reuse-Renewal-Remanufacturing-Recycling). All potential for material recirculation and waste recovery are analyzed, either internally (repair or internal waste recovery) or with the collaboration of external stakeholders (renovation, downcycling, recycling, etc.).

Then, the Key Resources are specified, setting out the cost structure with the most relevant items of the LCC (Life Cycle Cost).

Then, the Key Resources are specified, setting out the cost structure with the most relevant items of the LCC (Life Cycle Cost).

Step 4: Identification of Additional Value Proposals

In this step, additional value propositions are identified among the different interest groups within the complete framework of the Circular Business Model, which derive from any potential recirculation
It is important to highlight that this step must be carried out collaboratively, integrating the knowledge and experience of different stakeholders (multi-stakeholder approach).

Step 5: Specific Canvas for Additional Value Proposals

Then, a specific Circularity Canvas is developed to detail additional value propositions, with the same approach used for the entire Circular Business Model framework (fractal approach).
The profitability of the Circular Business Model depends on the correct integration and synchronization of these additional value propositions, which affects the cost of the service and the income flows.

Step 6: Integration of the Global Canvas

Finally, the initial Business Model Canvas integrates the modifications and adjustments derived from the additional value proposals in the different blocks, especially in the Key Activities and Associations, with attention to:
- Cost Structure: the Life Cycle Cost approach is followed, considering all potentials.
- Income Flows: their diversification and additional income flows derived from waste recovery, downcycling, upcycling, industrial symbiosis, etc. are analyzed.

2.3 From a linear to a circular business model

If the above section focuses on the development of new business models, some proposals have also been develop to transform existing linear business models into circular ones. In collaboration with the co-author of the Business Model Canvas, Alexander Osterwalder, Finch & Beak has created a process tool that is specifically designed to integrate sustainability into a company's core business. In seven concise steps the existing business model and stakeholder concerns are translated into opportunities for change. (Finchandbeak, s.f.)

Step 1: Description of the business model according to the 'Business Model Canvas'	•How is your current business constructed? •Who are the paying customers? •Who are the users of our products and services?
Step 2: Definition of the issues related to sustainability in the sector	•Who are our key stakeholders? •What concerns and issues are important to them? •Where in the Life Cycle Assessment are the hotspots?
Step 3: Selecting and ranking material issues according to the relevance of stakeholders and impact on the company	•What is the relevance of the identified issues for our key stakeholders? •What is the business impact of the material issues?
Step 4: Mapping the competitive environment in a value curve	•What does the competitive environment in our category look like? •Who is driving sustainability in the value chain •What are the existing systemic initiatives?
Step 5: Setting ambitions and targets for future progress	•Which specific targets and ambitions do we need to set in order to demonstrate our product/service superiority?
Step 6: Identifying opportunities in the strategic areas	•Which opportunities are available in the field of eco-efficiency, innovation and customer intimacy? • Which partners and resources do we need for systemic change towards more circular solutions?
Step 7: Feedback to the business model for a potential business model re-design	•Disruptiveness: How can we redesign the existing business model? • How to develop a full circular economy business model in a startup situation?

2.4 Aplication of Circular Business Models

<u>Best practice 1: SUSTAINN</u>

Sustainn is a Spanish company which designs and developes sustainable business models, products and services (economical, social and environmental), applying Circular Economy principles. Sustainn helps you to outline a Circular Business Model from scratch through the Circularity Canvas Methodology.

It helps to take the first step to circularity and to conceive economical, social and environmentally sustainable business models. It aims to reduce the waste generation integrating Circular Economy and Cradle to Cradle ®principles from the early business model conception stages.

Know more about all circular economy methodologies under the following link

Best practice 2: IDEMA SPORT

This Belgian company offers sports equipment to municipalities, schools, sports clubs and businesses. The company has been EMAS registered since 2012; part of its product range is made from recycled materials. In 2017, IDEMA Sport joined Club EFC — a programme on functional economy funded by the Wallonia region. In this programme, eight companies will receive coaching to identify how they can transform part of their turnover into a model based on functional economy. Instead of selling equipment for sports facilities, IDEMA could give its clients access to these facilities, ensuring its equipment is well-maintained and lasts longer. The service to the client could be improved, as they could offer new equipment to test from time to time and establish a lasting relationship with the client. At the same time, this new model could help them distinguish themselves from competitors and allow them to develop reverse logistics for reuse.

SUSTRAINY
Sustainable action Training for Youth

Co-funded by the
Erasmus+ Programme
of the European Union

Chapter 3 – Cascading use of biomass

3.1 Definition of cascading

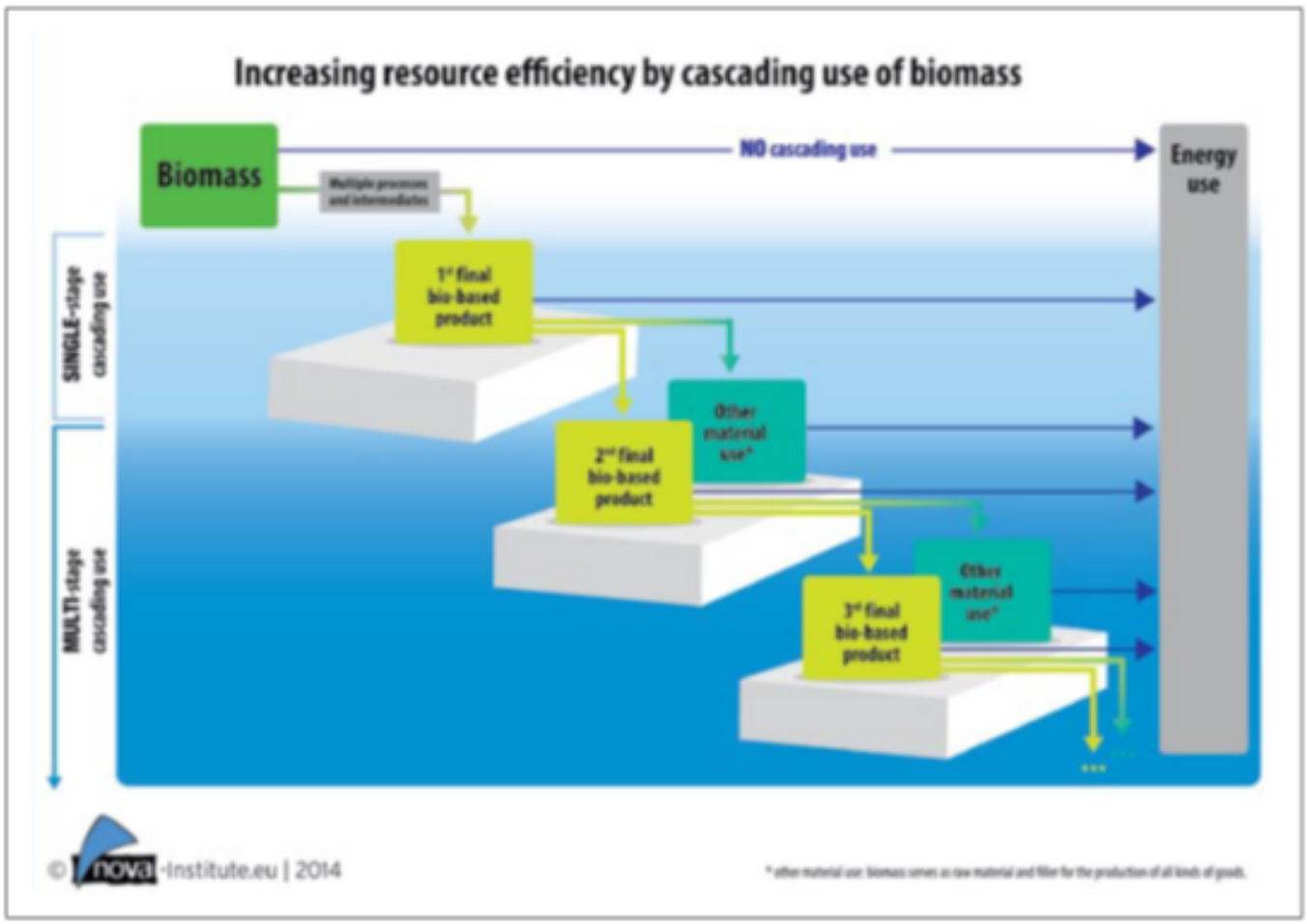
The concept of cascading has been described under a wide varity of appoaches and perspectives, leading a quantity of definitions. Although, in a report prepared by WWF and Mondi in 2016, an analyse of these different definition is done, intending to highlight the common elements and propose a series of criteria on which to base a comprehensive concept of cascading use (awsassets.panda.org, s.f.):

"1. The concept should be applicable to all biomass sources, whether they are from forestry, agriculture, marine environments, or different waste streams or byproducts.
2. The concept should focus on the multiple sequential material use of biomass.
3. Cascading should aim at maximising the value of products in order to achieve the highest resource efficiency.
4. The concept should be in line with existing European waste legislation, and the (future) European strategy on the Circular Economy.
5. The concept should not consider direct energy use of virgin biomass as a cascading use, because energy use implies the automatic end of any life cycle and the leakage of the resource from the system. If the first use of biomass is energy, a cascade cannot start.
6. The concept should be applicable at the product level (e.g. the life cycle of a product) as well as at the sector level (including the allocation of a specific resource to different products).
7. Cascading should be quantifiable in order to measure its contribution to resource efficiency of the cascaded resource and to compare the results of different policy actions."

Also, from those criteria, they propose to use the difinition published by Carus et al. 2014 and Essel & Carus 2014, as it is the only one that cover all the above mentioned elements. According to this definition, "Cascading use of biomass takes place when biomass is processed into a biobased final product and this final product is utilised at least once more either for material use or energy."

For a better understanding, it might be interesting to add the definition of 2 key concepts linked to cascading:
- Biomass is used to define an organic material, made from plants and animals. It is also a fuel developed from organic material (for example wood, crops or garbage), thus a sustainable and renewable source of energy.
- Bio based product refers to products wholly or partly derived from biomass

The figure below, developed by Nova in 2014, illustrate this definition:



Then, the term cascading refers to sequential recycling of a material into another type of product at its end of life. Cascading contribute to resource efficiency. However, this concept should be differenciated from resource efficiency, as resource efficiency is achieved by increasing the utility of the biomass, but not necesarily only from its multiple use.

While looking for further information on this topic, you might find a lot of recent texts and policies focusing on cascading and ciruclar economy. However, this practice is not entirely new. Some practices pre-date the industrialisation of wood, in the middle of XIXth century, as industries were seeking for a maximum utility of the product, and already thinking about multiple sequential uses. Also, is has been reported that larger sawmills have often been integrated cascading with veneer and plywood production. It was also typical for the pulp, textile or paper industries (Carus 2017). Then, the term and theorisation of cascading dates from the 70´s in parrallel to the growth of environmental concerns. From 2010, the interest for cascading was decupled. It has been subject to many studies and policies intending to encourage the implementation of cascading practices, as it offers evident benefits for both the industries and environment. The European Commission, as well as international organisations have published important reference documents in the fields, highliting the huge potential that it represent for the future. You can find references to some of these text in chapter.

SUSTRAINY
Sustainable action Training for Youth

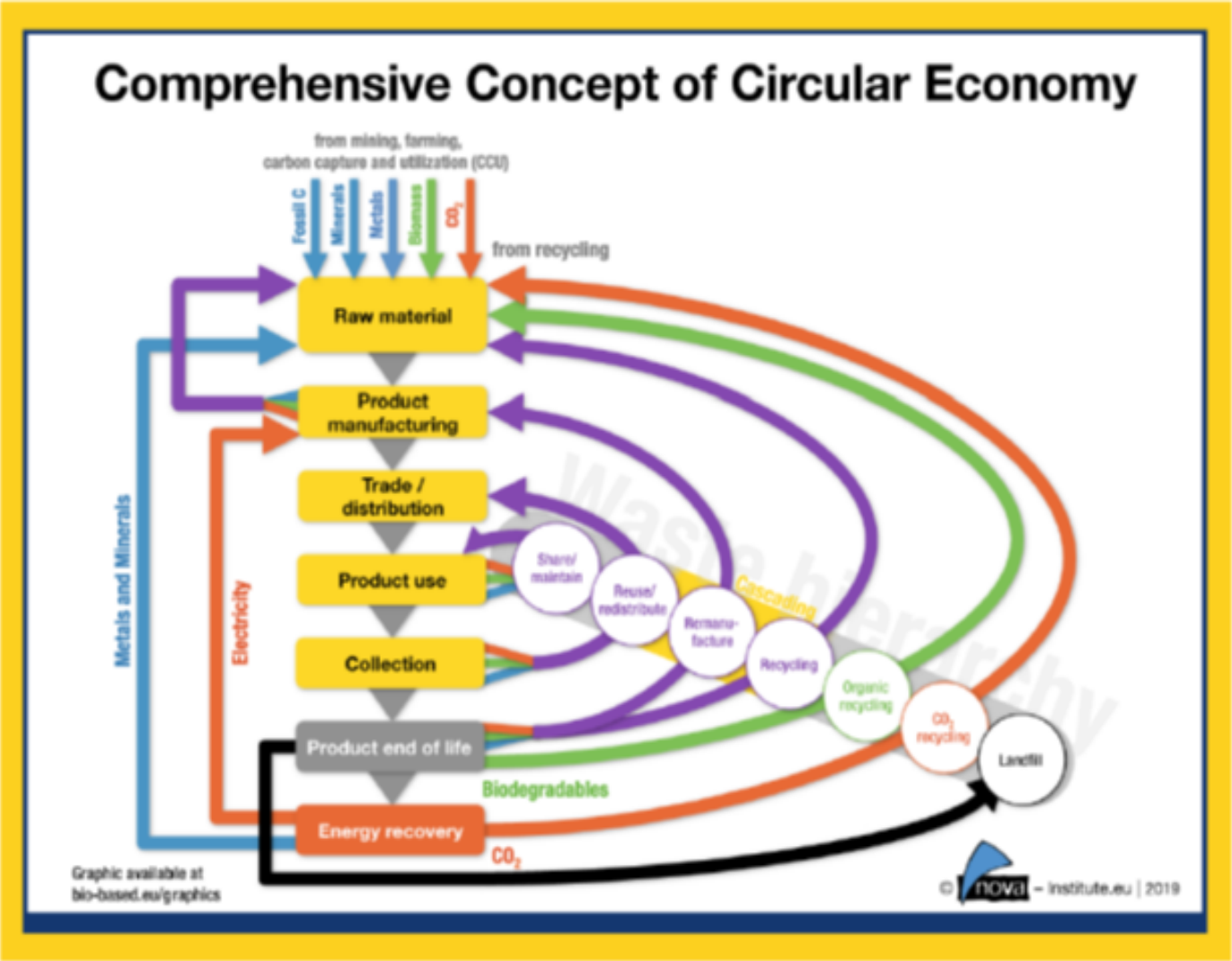
Co-funded by the
Erasmus+ Programme
of the European Union

3.2 Cascading in the circular economy process

Cascading and circular economy are intrinsically related as both pursue the same objective of optimisation and increased use of resource materials for higher efficiency in the production processes.

Cascading is a fundamental component of the circular economy, as it contributes to increased resource efficiency in the whole system. Cascading enable to reuse, recycle and rethink products collected after a first use to extract again raw materials from these product and manufacture a new product. This process can take place one or several time (for a single-stage or multi-stage cascading). Most of the bio-based products can potentially be part of this process, allowing alternative to products end of life, thanks to recollection and new use, and finally, creation of energy.

The following figure, extracted from the Report called "Concept of bio-based and circular economy" of the Road to bio project, shows the place that cascading has in the circular economy process:



3.3 Cascading guiding principles

EC guidance publication on the cascading use of biomass presents 6 guiding principles for cascading:

- Sustainability

The European Commission stresses that if cascading is an economic measure, focused on production chain, it shouldn't forget about the two other pillars of sustainability which are the environmental and social consideration, from a long-term perspective. In particular, it is important to calculare the impact of cascading in terms of emissions, eventual environmental damage or loss of biodiversity.

- Ressource efficiency

It has been seen before that cascading shouldn't be confused with ressource efficiency. However, it is very important that cascading intend to maximise the use of biomass materials in use for as long as it is technically and economically possible.

- Circularity

Cascading is part of the circular economy process, and as such, circularity principle should be applied in every stream and at every step, aiming at keeping in the loop all flows of biomass put to different ressource efficient use. New technologies, innovation and investment should support this principle.

- New products and new markets

The development of new products by innovative companies for multiple uses and purpose should lead to evolutions in the markets, opening new market opportunities, the development of new technologies and advanced high quality products.

- Subsidiarity

Subsidiarity means that a centralised function should take place only if it can not be performed at a more local level. Also, cascading should respect the local and regional level beside the national context, and assess the most economically viable use of biomass.

3.4 Cascading and sustainable development goals

In its first section regarding the sustainability principle, the EC guidance publication on the cascading use of biomass also refer directly to the Sustainable Development Goals, by refering the influence that cascading use of biomass can potentially have on several of the SDG.

SUSTRAINY
Sustainable action Training for Youth

Co-funded by the
Erasmus+ Programme
of the European Union

Box: cascading and the SDGs

The sustainable development goals provide a framework for achieving sustainability. Cascading potentially contributes to several SDGs:

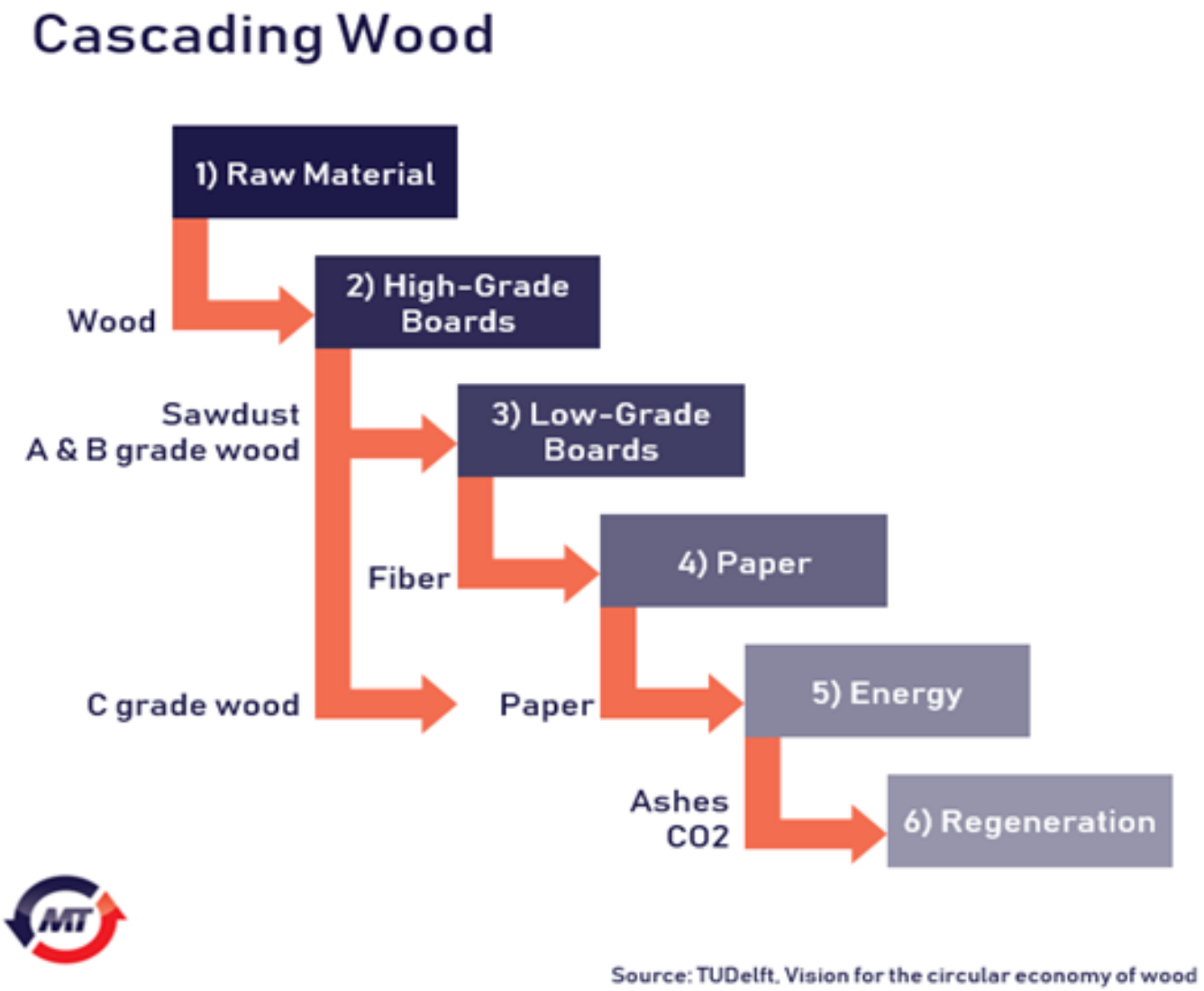
SUSTRAINY
Sustainable action Training for Youth
Co-funded by the Erasmus+ Programme of the European Union

3.5 Example of best practice: Wood Cascading

The most famous example of cascading is wood.

Also, a large number of best practices are available on cascading wood. For instance, publication of the EC: Guidance on cascading use of biomass with selected good practice examples on woody biomass (Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (European Commission, 2019), or best practices presented in the Wood2Good project, funded by the European Commission.

Here is a scheme of cascading applied to wood:



In a research "Evaluation of Wood Cascading", Karin Höglmeier & Gabriele Weber-Blaschke & Klaus Richter (2015) evaluate the concept of Wood cascading, comparing the cascading use of one metric ton of recovered wood to direct incineration of this resource by applying cascading. In the majority of the considered impact categories and variants, cascading proved to be the more environmental-friendly alternative. *"Yet, especially the efficiency of the recovery of wood between the different steps of the cascade influences the performance of the cascading system, thereby demonstrating the importance of improving process efficiency as well when handling renewable resources such as wood".*

Beyond wood, other raw materials and biomass can be used in cascade. For instance, the oceans offer large opportunities for the cascading use, for instance with the use of fisheries discards (which is about 40% of the total fish caught), or the use of seaweed that can be used in cosmetics, pharmaceutical products or others.

In the same line, the European Commission encourages biorefineries to adopt a cascading approach to the use of their inputs. In these sectors, the circular approach is still new and offer a large scope for research and innovation.

Zerocento S.r.l.

ZEROCENTO

An example of best practice regarding cascading would be Zerocento S.r.l., which is a company founded in 2017 that deals with the recovery of a by-product from the steel industry. The company has created a new production chain where their waste material is transformed into a new raw material.

Through the control of the cooling process and chemical-mechanical processing, a new product is obtained: a very hard aggregate, used to replace porphyry and basalt in road and railway infrastructures.

The material production plants are located in Padua and Cremona, and are designed to package an ideal aggregate for conglomerates. The total production capacity of the plants is around 3500 tons per day, while the annual production stands at 700,000 tons.

You can find more information about this example here.

SUSTRAINY
Sustainable action Training for Youth

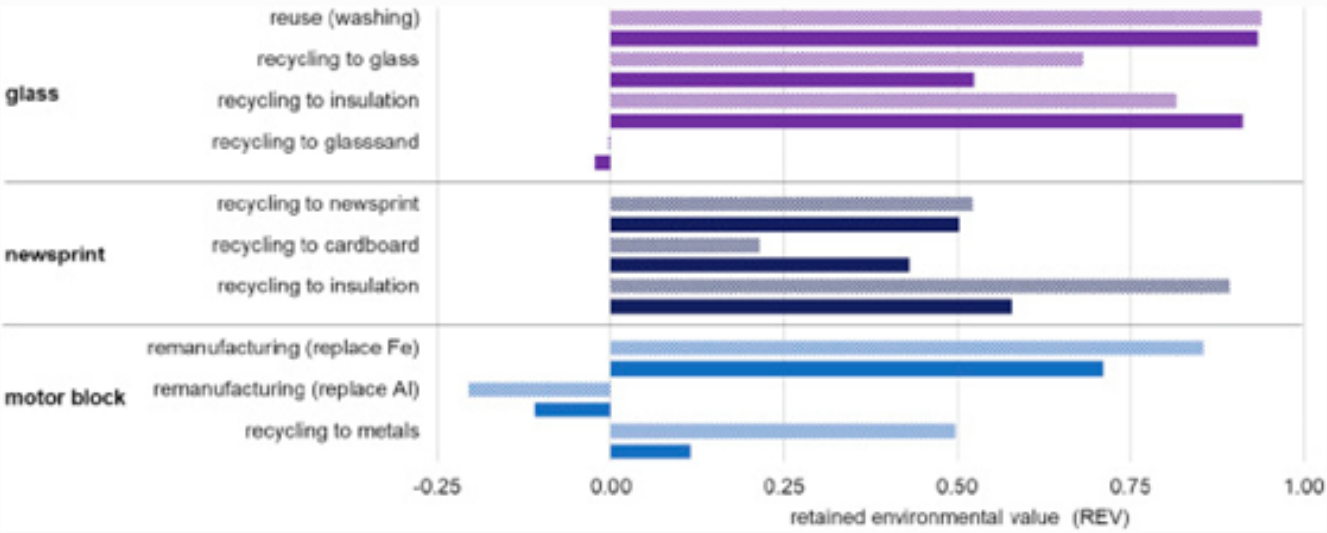
Co-funded by the
Erasmus+ Programme
of the European Union

Chapter 4 – The environmental impact of the circular economy

4.1 How to measure the environmental impact of the circular

The positive impact of circular economy on the environment is not as obvious as it can primarily appear. It is often considered as environmentally friendly by default, as it means an increased resources efficiency compared to a linear economy. However, researchers (Melanie Haupt & Stefanie Hellweg Science Direct, s.f.) highlight that the hierarchy of value retention processes does not always result in the highest environmental benefit. *"Closed-loop recycling is not always more beneficial than open-loop recycling, and remanufacturing is not always environmentally preferable to recycling."*

Researcher have focused on this question, intending to define criteria for the measurement of this environmental impact and evaluate the effects that can be reached thanks to the implementation of circular principles. In the research paper "Measuring the environmental sustainability of a circular economy" (Melanie Haupt & Stefanie Hellweg Science Direct, s.f.), a method is proposed relying on an indicator called REV, for Retained Environmental Value. This indicator measures the share of environmental impact from the production of a material or product that is retained in products and materials recovered from reuse, remanufacturing, or recycling.



As this table shows the REV of different stream products / materials, and while the highest REV means a more favourable retention process, we can see that washing and reuse of glass is for instance much more environmentally friendly than a recycling to glass sand.

REV indicator relies on a quite complex mathematical formula. Other indicators exists such as:
- Efficiency in the use of raw materials (for instance by calculating the rate of valorization of waste, the reduction of energy or water consumption),
- Ecodesign (rate of recylcability of the materials, rate of repairability, durability of the products, etc)
- Product shelf life extention (rates of reuse and repairs, destination after use)
- Circular value chain (% of renewable energies and biomass in the energy mix and in products components, colaboration with the retail sector, local purchases, etc)
- Industrial symbiosis (raw and secondary materials used for production, use of waste water, etc.)
- The promotion of responsible production and consumption (awareness raising campaigns, promotion of circular business models, etc)

In a business perspective, the MCI indicator, developed by circularity Indicators project is probably the most complete measurement proposal. This project aimed to address the lack of a way to measure how effective a company is in making the transition from „linear" to „circular" models, and developed indicators to measure the performance of a product or a company in the context of a circular economy, to assess whether companies are progressing along their linear lines journey.

The developed indices consist of a main indicator, the Material Circularity Indicator, which measures whether the material flows of a product or company are restorative, and complementary indicators, which may take into account additional risks and risks.

The Material Circularity Indicator (MCI) gives a value between 0 and 1 where higher values indicate greater circularity. The following elements are taken into account to calculate the ICM:

Entrance into the production process: How many elements of the entrance come from virgin and recycled materials and reused components?
Usefulness during the use phase: How long and how has the product been used compared to a similar industry average product? This takes into account the greater durability of the products, but also the repair / maintenance and shared consumption models.
Destination after use: How much material goes into landfill (or energy recovery), how much is collected for recycling, what components are collected for reuse?
Recycling efficiency: How efficient are the recycling processes used to produce recycled inputs and to recycle the material after use?

Supplemental indicators are optional indicators that can be used in conjunction with the MCI and provide additional insight into business product management:

• Complementary risk indicators can provide more information on potential risks related to business commitments.
• Complementary impact indicators can provide additional information on how the change in the level of circular materiality affects other problems of the business and its stakeholders.
Examples of complementary risk indicators are the variation in the price of materials, supply chain risks, material shortages and toxicity. Complementary impact indicators may include energy consumption and CO_2 emissions.

Tool from the Ellen Mcarthur Foundation.

As you can see from this section, measuring circular ecoomy impact is complex. However, before starting a circular initiative, a realistic estimation of the impact of this initiative should be developed, in order to check its real positive impact on environment and sustainability. Also, you should alidate your idea by consulting some of the guidelines that we provide to measure the real impact of any action, as environmental value is not always granted. The support of technical and environmental experts can be usefull to go deeper in the analyse.

4.2 The environmental impact of the circular economy: reduction of GHG emissions

The environmental most positive impact is generally measured in tems of a reduction of GHG emissions. The Cambridge Econometrics & BIO Intelligence Service has estimated in a study from 2014 than improving the EU's resource productivity by 3% would lead to a reduction of 25% of GHG emissions by 2030, while the European Environmental Bureau (EEB) estimates that 74,6.5 Mt to 115 Mt of GHG emissions could be avoided by 2030 from reduced food waste and reuse practices in the textiles and furniture sectors.

Indeed, in a report from 2014 called *"Advancing Resource Efficiency in Europe: Indicators and waste policy scenarios to deliver a resource efficient and sustainable Europe"* (European Environmental Bureau, Dr. Jane Beasley & Ray Georgeson, 2014) The European Environmental Bureau present various scenarios for advancing resource efficiency in Europe in several industrial sectors and their possible positive impact in terms of GHG emission, but also reduction of material use, land take and water impact. This study focus on food waste reduction, textile and furniture reuse, chosen as three key examples where greater action is needed and identificable.

According to their findings, here is the impact that could be achieved thanks to reuse principles applied to the textile industry:

Table 11: GHG emissions (tonnes of CO_2 equivalent) - Clothing

Management options	Cotton t-shirt (per tonne)	Wool jumper (per tonne)
Direct reuse	12.8 tonnes saving	9 tonnes saving
Preparing for reuse	11 tonnes saving	8 tonnes saving
100% recycling	Less than 1 tonne saving	Less than 1 tonne saving
100% landfill	0.2 tonnes generated	0.2 tonnes generated

This single example illustrate the huge potential of positive impact of circular principles applied to one sector.

4.3 Beside the environmental impact, the economic and social impact of the circular economy

The European project funded by Easme called CIRCULAR IMPACTS intend to assist the EU and its policy makers in realizing the transition from its current predominantly linear economy to a circular economy, by establishing a flexible and accessible evidence base with concrete data on macro-economic, societal, environmental and labour market impacts of this transition. Here are there main findings about the economic and social impact:

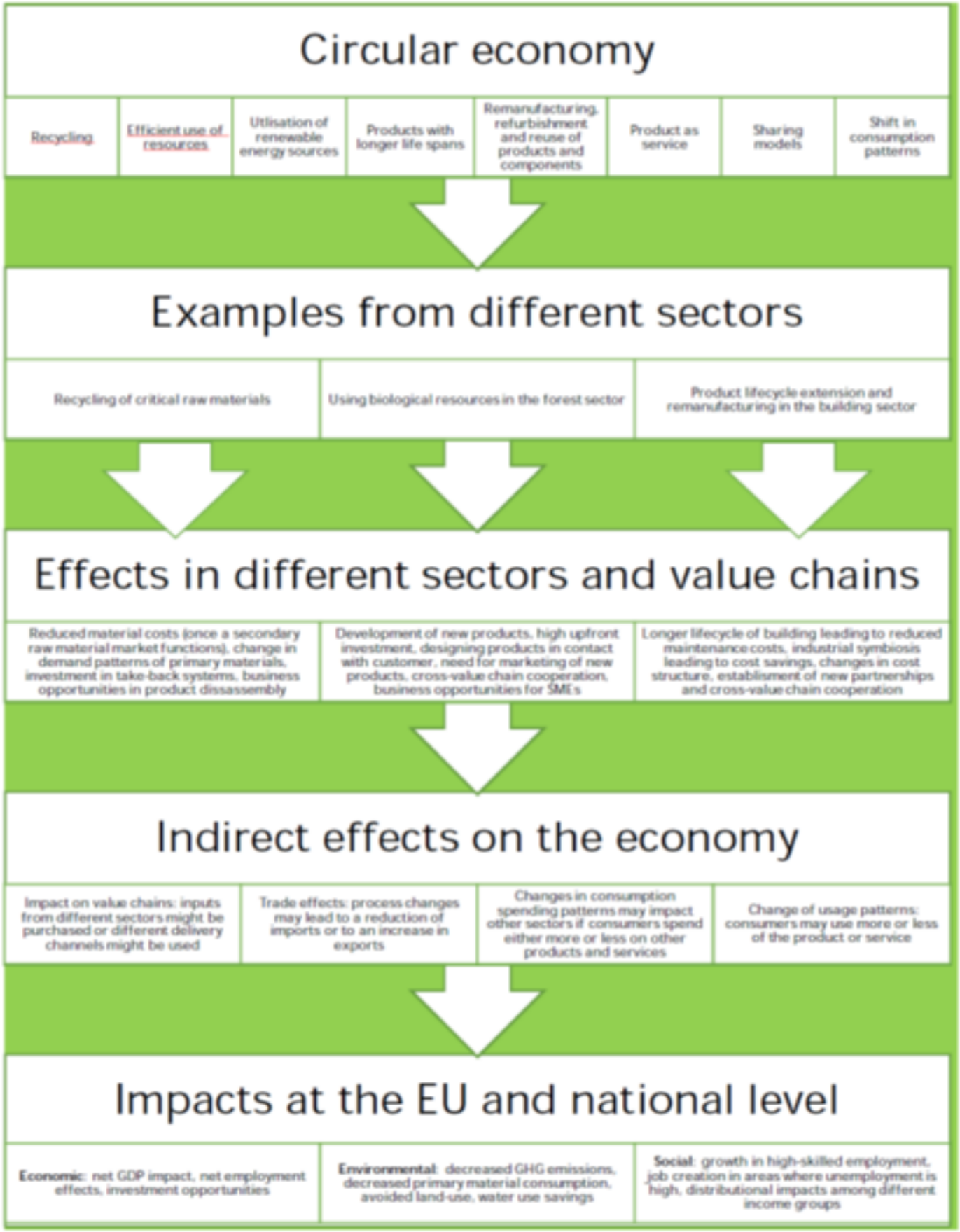
- Economic impact:

The major benefits of circular economy at economic level are its positive impact on job creation and in terms of economic growth and GDP. The potential for job creation is significant, estimated by difference sources, it could help to create from 560.000 and up two million additional jobs by 2030 while improving the EU's resource productivity. In addition, the European commission has estimated that waste management legislation and bans on plastic/paper/glass/metals by 2025 could create up to 178.000 full time jobs by 2025 .

As for the impact on growth, Ellen MacArthur Foundation & McKinsey Center for Business and Environment (2015) estimate that in the mobility, food systems and built environment sectors technological advancements combined with organisational innovations would allow Europe's resource productivity to grow by 3% by 2030, translating to total annual benefits of €1.8 trillion, which would mean a significant GDP increase (7%).

- Social impact:

The main positive impact at social level is, despite it was already mentioned in the economic aspect, the job creation, contributing to a reduction in regional employment disparities.This employment demand will focus mostly on high skilled profiles. It will also impact the way people consume products, with an impact on trade of countries, as it might influence the quantity and nature of imports and exports.



Source: The Circular Economy: A review of definitions, processes and impacts. CIRCULAR IMPACT project, 2017

4.4 Best practices developed to identify the potential impact of material loops

Best practice 1. Viessmann. Identify potential material loops

Viessmann is the oldest organisation registered in the European EMAS register, having joined 22 years ago. The German company is an international producer of individual and industrial heating and cooling systems. Viessman eco-designs products: it uses recycled materials and marks each component so that it can be easily maintained and replaced. The company set up its own take-back system in 1995, inviting clients to bring back products at their end-of-life. More than 90 % of these returned products are recycled. As early as 1997, the company carried out a study on how to implement a circular economy. The project looked at the potential of re-using components, but found that the innovation cy- cles in the industry were unfortunately too short for re- use to be a viable option. By continuously improving its environmental performance, the company increased its productivity by 20 % (lean production), reduced its steel consumption per boiler by 30 %, and achieved a recycling rate above 99 % for all unavoidable waste.[1]

"We try to reduce material consumption all the time. It is natural from a resource and cost point of view. Our research and development focuses on reducing the weight of products, for example by looking at how we could reduce the thickness of tubes made of copper. This is also a great incentive for innovation."
GUIDO SCHWAB
ENVIRONMENT REPRESENTATIVE VIESSMANN

More info: viessmann

Best practice 2. Seacourt. Identify potential material loops

Seacourt Ltd, the 2017 EMAS Award winner in the category "Small and Medium Private Organisations", was one of the world's first printing companies to achieve "zero waste to landfill". The company systematically looks for reuse or recycling options for all waste produced. Paper and cardboard waste is re-pulped into paper and the company reuses its aluminium printing plates. Seacourt also sends food waste to wormeries that transform the waste into fertiliser, which is then offered to clients to grow chilli plants.

More info: seacourt

1 Speech of Mr. Greis, Chief Representative of Viessmann at the EMAS high level conference in November 2015: www.ec.europa.eu/environment/emas/pdf/pdf_and_images_HLC_Site/Speeches/Greis_plenary.pdf

Chapter 5 – JOIN THE MOVE

1. CIRCFASH programme

The general objective of this action, funded by the COSME programme of the European Commission is to enhance the competitiveness and improve the environmental performance of European fashion industry by building capacity and supporting small businesses (SMEs, designers and start-ups). This is with the aim to become more sustainable and turn their business model into a more circular one. Intermediary organisation over Europe will organise the CIRCFASH calls and fund initiatives proposed by transnational partnerships.

2. JA Europe Enterprise Challenge

The JA Europe Enterprise Challenge brings together the best student companies at the post-secondary level (aged 18 to 30) from all across Europe. Those teams have won the national competitions of the JA Start Up Programme. A special jury composed of business representatives and experts in entrepreneurship will assess all startups and evaluate their value proposition (financial, social or cultural) as well as its potential to grow.

3. Erasmus for Young Entrepreneurs

Erasmus for Young Entrepreneurs is a cross-border exchange programme which gives new or aspiring entrepreneurs the chance to learn from experienced entrepreneurs running small businesses in other Participating Countries. The exchange of experience takes place during a stay with the experienced entrepreneur, which helps the new entrepreneur acquire the skills needed to run a small firm. The host benefits from fresh perspectives on his/her business and gets the opportunities to cooperate with foreign partners or learn about new markets.

4. Referenced tools to develop action.

CANVAS business model generation

Twenergy

We are Sustainn

Workbook for developing Circular Business Models

SUSTRAINY
Sustainable action Training for Youth

Co-funded by the Erasmus+ Programme of the European Union

Chapter 6 – TO GO FURTHER

About the 3Rs and 7Rs:

The circular economy: New or Refurbished as CE 3.0? (Reike 2017)
Moving towards a circular economy with EMAS

Cascading use of biomass:
Road to bio project – Report Concept of bio-based and circular economy

Guidance on cascading use of biomass with selected good practice examples on woody biomass

Mapping study of cascading use of wood products, by WWF and Mondi

Canvas

Video Business Model Canvas explained:
We are sustainn
Finchandbeak
Video Business Model Canvas adapted to Circular Economy

Circular business model and environmental impact:
Circular Impacts project. Report: The Circular Economy, A review of definitions, processes and impacts

CIRCULARITY INDICATORS An Approach to Measuring Circularity, from the Ellen Mac Arthur foundation.

ADVANCING RESOURCE EFFICIENCY IN EUROPE, from the European Environmental Bureau

In Spanish:

La medición de la economía circular, from Foretica

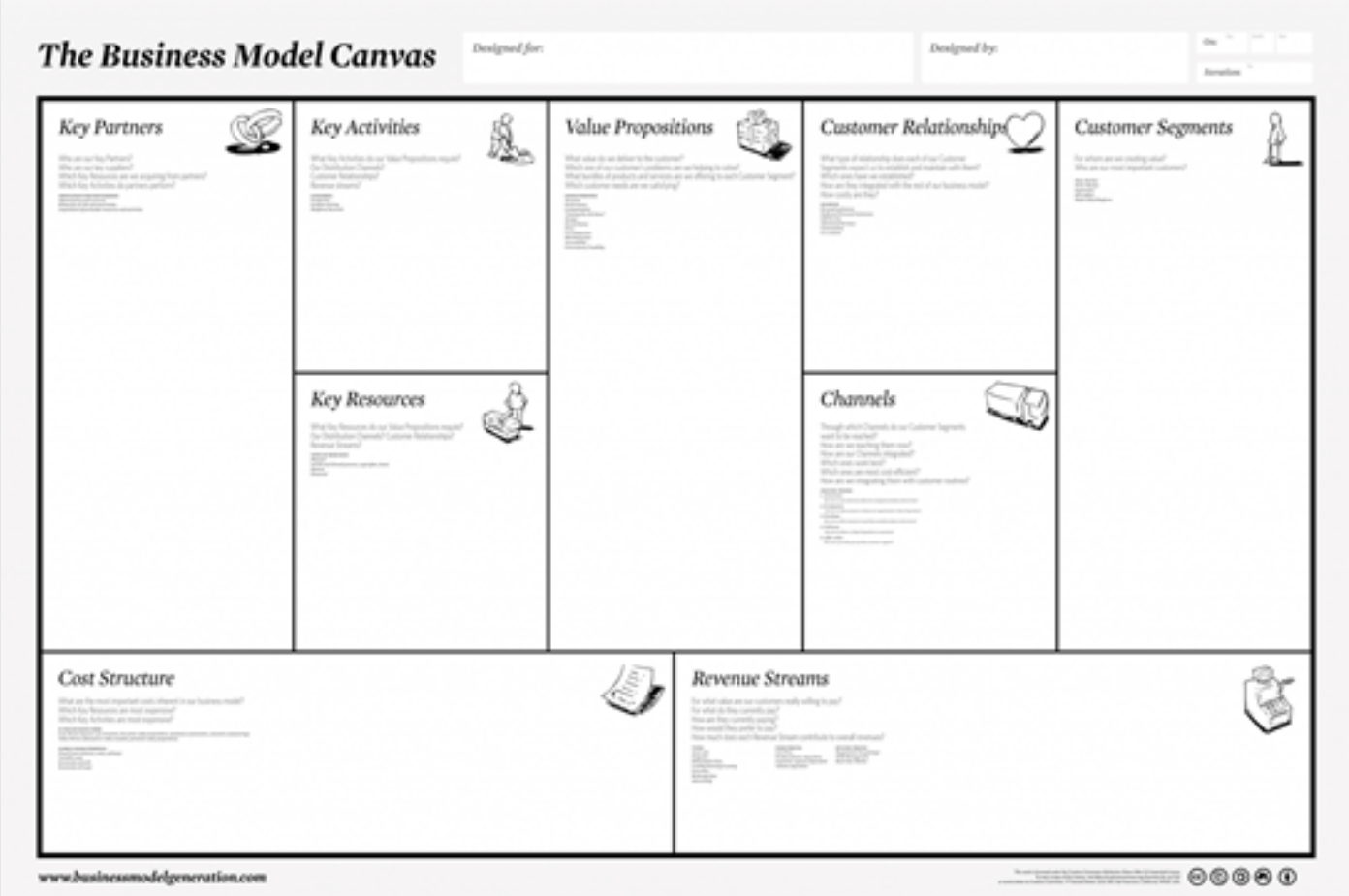
SUSTRAINY
Sustainable action Training for Youth

Co-funded by the Erasmus+ Programme of the European Union

Chapter 7 - PRACTICAL ACTIVITIES

7.1 Circular Business Model Canvas Activity

Any project in mind? Intend to design it according to circular principle. Using the following template and applying the recommendations given in section 22 and 2.3, think about how to create or to turn your own project into a circular model. This will help you to define better your ideas and the way of implementing them.



7.2 Aplying the 7Rs

Think about how apply the 7Rs in your life. You might think at a specific project, initiative or business idea that you have, or simply about your daily behaviour as a youth consumer:

• Rethink. Rethink your consumption and evaluate if you really need that purchase — Refusing to consume what you don't need to.

• Reduce. Reduce your consumption of energy by switching to low-consumption appliances, turning off unused appliances, and reducing your consumption to a "need only" basis. Invest in quality products, with ethically sourced materials, that will last you longer.

• Re-use. Sell the products you no longer use to other users and consider purchasing second-hand instead of brand new. Find new uses for products (old bottles can be used as flower vases!).

• Repair. Consider repairing small appliances, like toasters, instead of purchasing new ones when the old ones fail. Invest in quality clothing and take pieces to mended if needed.

• Refurbish. Upcycle old products by giving them new life: recover old furniture and give it a new life with new paint, re-use old pieces of clothing by sewing a transforming them into updated models.

• Recycle. Separate and recycle!

SUSTRAINY
Sustainable action Training for Youth

Co-funded by the
Erasmus+ Programme
of the European Union

Conclusion: This is a beginning - My action

We've given you some advice; now it is time to turn this info into action… your action!
Write here your own remarks: