MOVECO

CIRCULAR ECONOMY INNOVATION TOOLS
Schools of Thought – Natural Capitalism

Qualification Programme Handbook

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1. TABLE OF CONTENTS

2. INTRODUCTION

2.1. INTRODUCTION

This document can either be used as background material for trainers and participants in a **workshop** or also by individual readers (**self-study** or within a self-formed study-group). For both cases, there are notes provided that guide through the material.

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Indicative questions encourage you to reflect what you have just read.

In addition, throughout the text, you will find some indicative questions framed and marked by "?" that encourage to reflect what you have just read

Cross-references to the case studies and further MOVECO materials help to deepen your knowledge about circular economy.

Moreover, there are cross-references to the case studies or other MOVECO material (such as the fact sheets) marked by "💡".

Practical exercises are pointed out for trainer-led workshops or self-study by individual readers or a self-formed study group

Further, the pencil sign points out practical exercises that can be done as part of a trainer-led workshop or in self-study by individual readers or a self-formed study group.

For the **practical** work, there are several **case studies** that invite discussion or reflection – paired with empty templates for worksheets that encourage looking at a self-chosen practical product example. In the end, there is a short quiz to test the knowledge gained in this section of the toolbox. You will find any specific terminology explained in the **glossary**. If you use this section as part of a workshop, there is an **evaluation form** at the very end that can be used to collect feedback at the end of the workshop.

The material of the schools of thoughts section of the MOVECO toolbox is designed in a modular way, so that you can tailor the workshop to the SMEs in the audience and the time available. The way you can do it is described in the Module 5 New materials Pathways – Chapter 3 Notes.

3. CONTENT

3.1. NATURAL CAPITALISM – GENERAL OVERVIEW

Industry makes things. It takes materials – generally out of the ground – and processes them into desired forms[1]. During the history we witnessed different industrial revolutions. They started by water and steam power (first 1800); electricity (second 1900); IT systems (third 2000); and Internet of things, Internet 4.0, and cloud technology – Fourth Revolution now.

All these steps, over centuries, have led to the creation of capital "accumulated wealth in the form of investments, factories, and equipment. Actually, an economy needs four types of capital to function properly:

. human capital, in the form of labour and intelligence, culture, and organisation
. financial capital, consisting of cash, investments, and monetary instruments
. manufactured capital, including infrastructure, machines, tools, and factories
. natural capital, made up of resources, living systems, and ecosystem services"[2]

Natural capital is modelled and transformed (using the first three capital types) into the goods we need without considering the way resources are used, on one hand and the services that the ecosystem offers us, free of charge, cannot be artificially replaced, on the other hand.

3.2. NATURAL CAPITALISM – DEFINITION

Natural capitalism: „Any economic system that incentivizes profit based on proper care of the environment. In other words, natural capitalism assigns an economic value to stewardship of the planet. Income from natural capital includes yield from trees and plants. Natural capitalism assumes that goods and services have a value apart from their potential sale price on the market."[3]

NATURAL CAPITALISM - Increase resource productivity, shift to closed-loop systems and reinvest in natural capital: Recognising the interdependencies between production and use of human-made capital and flows of natural capital.[4]

The difference between the classic term industrial capitalism and natural capitalism is, in fact, that the first one values money and goods and the second one values natural resources as well as human resources.

To track these elements a company should include in its business plan environmental services that, unfortunately, are not accounted for by the effect of the legislation.

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[1] Lovins, A.B, & Lovins L.H & Hawken P. (2007) - A Road Map for Natural Capitalism Harvard Business Review https://hbr.org/2007/07/a-road-map-for-natural-capitalism (visited 19.03.2018)
[2] The Next Industrial Revolution - http://www.natcap.org/sitepages/pid57.phpBb (visited 18.03.2018)
[3] The free dictionary By Farley - https://financial-dictionary.thefreedictionary.com/Natural+Capitalism (visted 19.03.2018)
[4] Schools Of Thought - https://www.ellenmacarthurfoundation.org/circular-economy/schools-of-thought/natural-capitalism (visited 09.02.2018)

?

Please reflect on what is happening in the company you belong to. What is most important value: money and goods or natural resources and human resources?

Based on the respons you get please think about what changes should be done?

.

Natural Capitalism became more popular since 1999, with the launch of the book co-authored by Paul Hawken, Amory Lovins and Hunter Lovins, named "Natural Capitalism: Creating the Next Industrial Revolution". According to authors, there are four central strategies that can be used by companies when defining their sustainability strategy:

1. "Radical resource productivity"
2. "Biomimicry"
3. "Service and flow economy"
4. "Investing in natural capital" [5]

1. Radical resource productivity, the first principle, - is based on "fundamental changes in production design and technology"[6] that can maintain the natural resources in use for a longer period, decrease in natural resources depletion and environmental pollution, create savings in costs, capital and time with positive effects upon companies and environment;
Using new and innovative technologies companies can stretch the natural resources by many times and that results in profit for companies.

?

Can you think about how technology can make the difference?

You can check the study case of ROMBAT/Romania, which, through a very sophisticated recycling process, keeps lead in automotive beacons in the economic circuit for a long time with beneficial effects on the environment.

[5] Hawken,P., Lovins, A.B., Lovins, L.H. (1999). Natural Capitalism: Creating the Next Industrial Revolution. US Publication (visited 09.02.2018)
[6] The Co-Intelligence Institute: Natural Capitalism - http://www.co-intelligence.org/P-naturalcapitalism.html (visited 26.03.2018)

Beyond changes in the ways we think about extraction, process, transport, and dispose of a huge quantity of resources it is important to understand and sustain, through design for efficiency, the capacity of the ecosystem to provide services. By doing so we will find the appropriate technologies and solutions to have efficient factories, efficient vehicles, efficient buildings, efficient energy and efficiently grown food that will create a better life for us and less pressure upon the ecosystem services[7]. That is why resource productivity seems to be the cornerstone of natural capitalism and if companies use primary resources in an effective way they can get three main benefits:

- Should not harm the ecosystem through decrease in resource depletion and will be prepared to face the legal system in the country of origin or the country where they operate;
- Low level of pollution – by waste reduction and the decrease of associated costs
- New jobs – control and monitoring should be included as well as environmental friendly processes, new technologies, digitization, so;

2. **"Biomimicry"** the second principle - Innovation inspired by nature: Study and apply nature's designs and processes to solve human problem[8]. Nature does not produce waste and Natural Capitalism proposes to eliminate the concept of waste. In nature, each output is returned to either the biological system (biosphere) or the technical system (techno sphere). It is important that the materials used are not toxic to any of the two environments

For more information concerning Biomimicry please check Moveco Handbook Schools of Thought section Biomimicy

[7] the important benefits for human beings that arise from healthily functioning ecosystems, notably production of oxygen, soil genesis, and water detoxification/ Collins English Dictionary - Complete & Unabridged 2012 Digital Edition © William Collins Sons & Co. Ltd. 1979, 1986 © HarperCollins

[8] Ellen MacArthur Foundation: www.ellenmacarthurfoundation.org (visted 09.02.2018)

3. **"Service and flow economy"** - is the third principle of natural capitalism. It represents a new business model based on a very important change from classical production processes of goods and selling them to a new way of doing business based on selling services instead of goods. In the first business model the client has the responsibility for goods usage and for discarding them after use (landfill). Using second solution product ownership is not transferred to client and that encourages "take back process" when product lifecycle is over. Using the second solution create easier ways of closing the loop.

Practical activity 1: Do you know take - back schemes in your country? Please think about them and the benefits for environment and natural resources.

Look to the Extended Producer Responsibility process and the take back schemes in your country. According to the reports delivered by MOVECO consortium there are, in all Danube Region, good practice examples in WEEE sector for take-back of large WEEE upon delivery of new goods.

For more information concerning services and flow economy please check MOVECO Handbook Schools of Thought section Performance economy

4. Reinvest in natural capital, the fourth principle – the new pattern of consumption expands human needs and pressures, on natural capital, increase dramatically. Hence regeneration or wise use of natural resources become a must. This principle is based on reward and invest in businesses that achieve the first three principles i.e. sustainable businesses.

As well as other schools of thought, Natural Capitalism shows us that changes (which are not necessarily difficult to achieve) are needed at the level of business management. Advanced technologies (Internet of things and Internet 4.0) can make primary resources more productive, which will benefit not only owners but also those involved in the process. By implementing resource productivity, at the company level, ones can get a lot of positive results such as:

- Lower costs for business and society (for primary resources through material consumption decrease based on design by efficiency and manufacturing)
- Lower costs for environmental damages (polluter pays principle, scrap recovery, reuse, remanufacturing, recycling, and materials savings through better quality)

- Low costs for social disruption (stewardship[9], Social corporate responsibility)

3.3. LEAN THINKING FOR BUSINESS

From entrepreneurial point of view natural capitalism has a strong connection to lean thinking that works in the direction of eliminating all kind of waste in the manufacturing process. The waste can be produced, during manufacturing phase by: different mistakes which need to be corrected (both during design process or manufacturing process), by corrective measures that generate waste (material or human resources are wasted), by production of components or goods that are not wanted by customers, longer manufacturing processes generated by a weak organization of work or weak logistics. All these points create, for the business and companies, huge losses that are found not only in the decrease of profit but also in diminishing other resources such as time material and human. Design for efficiency need to be used to improve the processes and reduce waste.

But this is not all, to implement lean management a company must understand:

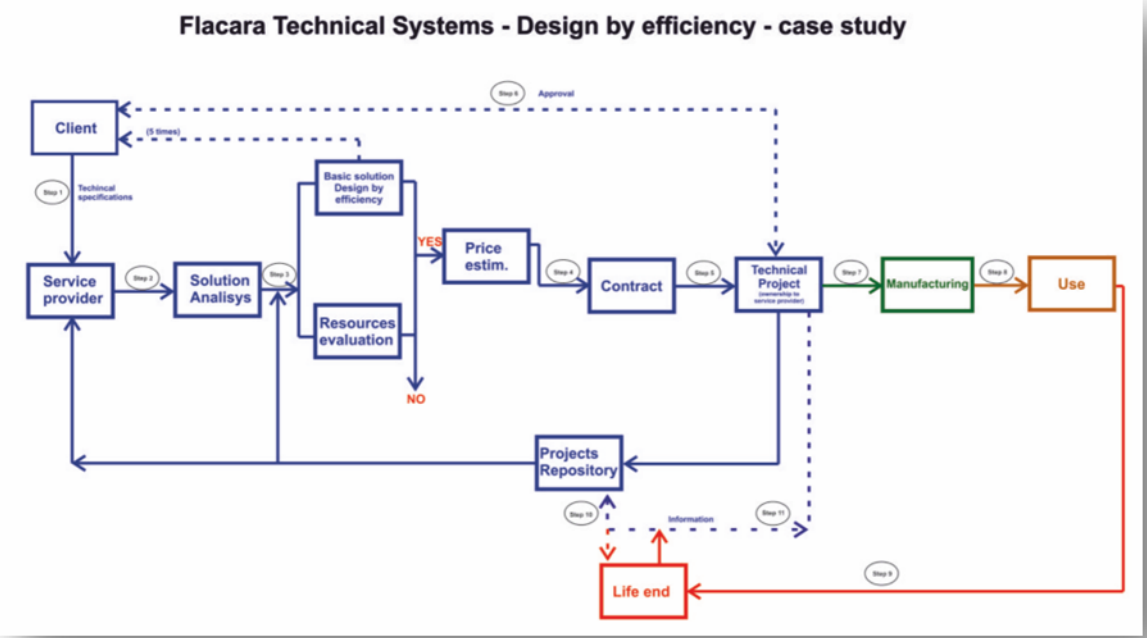
- The way relationships between materials, resources information, data, and finance are chainging and how it affects the company and the rules of competition?
- Which organisational structures are more suited to implement circular strategies
- Which skills, capabilities and ways of thinking are needed to support the transition towards a CE?

3.4. CASE STUDY - COMPANY: FLACARA TECHNICAL SYSTEMS,

To better understand the process created under design for efficiency the following case study is suggested:

Company: Flacara Technical Systems,
Company Type – start up - design and assembly of machinery / equipment for industry (automotive, sports equipment, advertising companies etc.)
Location: Bistrita/Romania

[9] See the definition of social disruption/ https://en.wikipedia.org/wiki/Social_disruption (visited 19.03.2018)



The new approach has been adopted as a result of a large consumption of materials necessary to achieve models that meet the needs of the customer.

Old approach: Up to five simulation activities were done to create a physical good for costumer generating great resource consumption and waste.

New approach: In this new approach, virtually, up to 5 simulations are performed that should lead to the final version, approved by the client. Therefore, the new design for efficiency process is thought for resource economy (time, human, material).

After the completion of the project it enters the manufacturing process where it can still undergo minor changes that are included into the final project and sent to a company repository.

Some parts and components of the electrical equipment are made by a 3D printer saving energy, resources and producing no waste.

Every single part of the equipment can be: reused, remanufactured, and recycled.

Creating a repository is an innovative idea that helps the company use the projects entirely or partially when:

- A new project (similar) starts
- Components are used in another projects: redistribute/remanufacture
- Components are up-cycle
- Maintenance - keeping the equipment in working order, in repair, etc.
- The end of life process – create no waste

Services:

- 12 months guaranty
- Low level of materials consumption
- Better exploitation based on the project repository

Conclusions

- Less materials consumption
- Less energy consumption
- Less component in product architecture
- Easy to desassembly for goods
- Easy to repair
- Easy to reuse

3.5. EXERCISE 1

Exercise 1 – think about two natural resources your company use: water and energy. Think how you could use resources more productively, to bring four to ten times more benefit from each unit of energy, water to your

Working in small groups create a "to do" list through brainstorming.

Please consider, within your exercise the following natural services:

- Production of oxygen
- Maintenance of biological diversity
- Purification of water and air
- Regulation of the chemical composition of the atmosphere
- Decomposition of organic wastes
- Regulation of the local and global climate
- Maintenance of soil fertility
- Storage and recycling of nutrients

4. QUESTIONS & ANSWERS

4.1. QUIZ – QUESTIONS

1. Should the services provided to your business, by nature, be included in the balance sheet?

Yes, it should be

No, is not necessary

I do not know

2. Primary resources productivity can be increased based on

new technologies (IoT, I 4.0....)

smart production design

both

3. Natural capitalism is

a process

a new business model

a philosopy

4. To reinvest in natural capital as business means:

that your business is more visible

that you are up to date

that you provide value to actual stakeholders and future generations

5. Which of the following are natural services

production of oxygen, maintenance of biological diversity, purification of water and air

storage and recycling of nutrients

decomposition of organic waste

4.2. QUIZ – SOLUTIONS

1. Should the services provided to your business, by nature, be included in the balance sheet?

x Yes, it should be

No, is not necessary

I do not know

2. Primary resources productivity can be increased based on

new technologies (IoT, I 4.0....)

smart production design

x both

3. Natural capitalism is

a process

X a new business model

a philosopy

4. To reinvest in natural capital as business means:

that your business is more visible

that you are up to date

x that you provide value to actual stakeholders and future generations

5. Which of the following are natural services

x production of oxygen, maintenance of biological diversity, purification of water and air

x storage and recycling of nutrients

x decomposition of organic waste

5. GLOSSARY

- **Bio-based material:** ""Bio -"is Greek for life. Bio-based material refers to a products main constituent consisting of a substance, or substances, originally derived from living organisms. These substances may be natural or synthesized organic compounds that exist in nature. This definition could include natural materials such as leather and wood, but typically refers to modern materials. Many of the modern innovations use bio-based materials to create products that biodegrade. Some examples are: cornstarch, derived from a grain and now being used in the creation of packaging pellets; bio-plastics created with soybean oil, now being used in the creation of many modern products like tractors, water bottles, and take away cutlery." [10] **Biodegradable material**: "A material which microorganisms can break down into natural elements (i.e. water, biomass, etc.)."[11]
- **Biological metabolism** - The natural processes of ecosystems are a biological metabolism, making safe and healthy use of materials in cycles of abundance[12]
- **Biological Nutrient** - A material used by living organisms or cells to carry on life processes such as growth, cell division, synthesis of carbohydrates and other complex functions. Biological Nutrients are materials that can biodegrade safely and return to the soil to feed environmental processes[13]
- **Cascading**: see MOVECO fact sheet "Circular Economy: Terms & Definitions"
- **Compostable material**: "Materials that can be disposed with biological materials and decay into nutrient-rich material."[14] **Circular economy** - regenerative economy in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing energy and material loops
- **Cradle-to-Cradle®:** see MOVECO fact sheet "Supporting Tools for a Circular Economy"
- **Cradle to Grave** – "A Cradle to Grave system is a linear model for materials that begins with resource extraction, moves to product manufacturing, and, ends with a "grave" – when the product is disposed of in a landfill or incinerator"[15]
- **Decision** – "shall be binding in its entirety. A decision which specifies those to whom it is addressed shall be binding only on them"[16]
- **Directive** – "shall be binding, as to the result to be achieved, upon each Member State to which it is addressed, but shall leave to the national authorities the choice of form and methods"[17]

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[10] https://sustainabilitydictionary.com/2006/02/17/bio-based-material/ (26.03.2018) // "A material that is partially, or entirely made of biomass." https://www.ceguide.org/Glossary (26.03.2018)
[11] https://www.ceguide.org/Glossary (26.03.2018)
[12] Cradle to Cradle terminology – MBDC-http://www.c2cproducts.com/detail.aspx?linkid=1&sublink=26
[13] Cradle to Cradle terminology – MBDC-http://www.c2cproducts.com/detail.aspx?linkid=1&sublink=26
[14] https://www.ceguide.org/Glossary (26.03.2018)
[15] Cradle to Cradle terminology – MBDC-http://www.c2cproducts.com/detail.aspx?linkid=1&sublink=26
[16] European Network of Environmental law Organizations 2012 Implementation of the Waste Framework Directive in the EU Member States
[17] European Network of Environmental law Organisations 2012 Implementation of the Waste Framework Directive in the EU Member States

- **Down-cycle** - to recycle (something) in such a way that the resulting product is of a lower value than the original item : to create an object of lesser value from (a discarded object of higher value)[18] see: MOVECO fact sheet "Circular Economy: Terms & Definitions"
- **Eco-Effectiveness** – "The central strategy in the cradle-to-cradle development method and seeks to create industrial systems that emulate healthy natural systems. The central principle of eco-effectiveness is that "waste equals food." The concept was developed in response to some of the perceived limitations of eco-efficiency which critics claim only slow down the rate of environmental depletion and don't reverse the production of unused or non-recycled waste".[19]
- **Eco efficiency** – "Management philosophy that aims at minimizing ecological damage while maximizing efficiency of the firm's production processes, such as through the lesser use of energy, material, and water, more recycling, and elimination of hazardous emissions or by-products."[20]
- **Ecological sustainability** – "a bio-centric school of sustainability thinking that, based on ecology and living systems principles, focuses on the capacity of ecosystems to maintain their essential functions and processes, and retain their biodiversity in full measure over the long-term contrasts with technological sustainability based on technical and engineering approaches to sustainability"[21]
- **Ecosystem** - the interactive system of living things and their non-living habitat[22]
- **Ecosystem redesign** - a coherent framework for redesigning our landscapes, buildings, cities, and systems of energy, water, food, manufacturing and waste through the effective adaptation to and integration with nature's processes[23]
- **Energy efficiency**: "Energy efficiency improvements refer to a reduction in the energy used for a given service (heating, lighting, etc.) or level of activity. The reduction in the energy consumption is usually associated with technological changes, but not always since it can also result from better organization and management or behavioral changes ("non-technical factors")."[24]
- **Energetic use**: incineration of waste material that includes the use of the generated heat and energy for other processes
- **(Final) disposal**: see MOVECO fact sheet "Circular Economy: Terms & Definitions"

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[18] Merriam Webster dictionary

[19] https://sustainabilitydictionary.com/2005/12/03/eco-effectiveness/visited 26/02/2018

[20] http://www.businessdictionary.com/definition/eco-efficiency.html -visited 01.03.2018

[21] Orr D (1992) Ecological literacy: education and the transition to a post-modern world. State University of New York Press, Albany.

[22] Tansley AG (1935) The use and abuse of vegetational concepts and terms. Ecology 16:284–307 doi:10.2307/1930070

[23] with adaptations from https://www.researchgate.net/publication/301966198_Regenerative_Development_regenerative_development_and_Design (26.06.2018)

[24] https://hub.globalccsinstitute.com/publications/energy-efficiency-recipe-success/definition-and-scope-energy-efficiency (26.03.2018)

- **Incineration**: Waste destruction in a furnace by controlled burning at high temperatures. Incineration removes water from hazardous sludge, reduces its mass and/or volume, and converts it to a non-burnable ash that can be safely disposed of on land, in some waters, or in underground pits. However, it is a highly contentious method because incomplete incineration can produce carbon monoxide gas, gaseous dioxins, and/or other harmful substances.[25]
- **Innovation** - production or adoption, assimilation, and exploitation of a value-added novelty in economic and social areas[26]
- **Landfilling**: "The disposal and burying of solid waste. The degradation of the waste results in the creation of local air and water pollution."[27]
- **Lean production** - approach to management that focuses on cutting out waste, whilst ensuring quality[28]
- **Life-cycle** - series of stages in form and functional activity through which a system passes between successive recurrences of a specified primary stage[29]
- **Life-cycle analysis**: see MOVECO fact sheet "Supporting Tools for a Circular Economy"
- **Life-time** - the duration of the existence of a given particular system[30]
- **Locational patterns** - the patterns that depict the distinctive character and potential of a place and provide a dynamic mapping for designing human structures and systems that align with the living systems of a place[31]
- **Negative externality** - occurs when production and/or consumption imposes external costs on third parties outside of the market for which no appropriate compensation is paid[32]
- **Optimization** - finding an alternative with the most cost effective or highest achievable performance under the given constraints, by maximizing desired factors and minimizing undesired ones[33]
- **Permaculture** - a system of agricultural and social design principles centered around simulating or directly utilizing the patterns and features observed in natural ecosystems[34]
- **Place** - the unique, multi-layered network of ecosystems within a geographic region that results from the complex interactions through time of the natural ecology (climate, mineral and other deposits, soil, vegetation, water and wildlife, etc.) and culture (distinctive customs,

[25] http://www.businessdictionary.com/definition/incineration.html (27.06.2018)
[26] with adaptations from http://www.ericshaver.com/the-many-definitions-of-innovation/ (27.06.2018)
[27] https://www.ceguide.org/Glossary (26.03.2018)
[28] with adaptations from https://www.tutor2u.net/business/reference/introduction-to-lean-production (27.06.2018)
[29] https://www.merriam-webster.com/dictionary/life%20cycle (26.06.2018)
[30] With adaptations from https://en.wikipedia.org/wiki/Lifetime (26.06.2018)
[31] https://www.researchgate.net/publication/273379786_Regenerative_Development_and_Design (25.06.2018)
[32] with adaptations from https://www.economicshelp.org/micro-economic-essays/marketfailure/negative-externality/ (26.06.2018)
[33] http://www.businessdictionary.com/definition/optimization.html (26.06.2018)
[34] https://en.wikipedia.org/wiki/Permaculture (27.06.2018)

expressions of values, economic activities, forms of association, ideas for education, traditions, etc.)[35]

- **Recommendations and opinions** - shall have no binding force [36]
- **Recycling:** see MOVECO fact sheet "Circular Economy: Terms & Definitions"
- **Refurbishment:** "The refurbishment of something is the act or process of cleaning it, decorating it, and providing it with new equipment or facilities."[37]
- **Regenerative design** - a system of technologies and strategies, based on an understanding of the inner working of ecosystems that generates designs to regenerate rather than deplete underlying life support systems and resources within socio-ecological wholes[38]
- **Regenerative development** - a system of technologies and strategies for generating the patterned whole system understanding of a place, and developing the strategic systemic thinking capacities, and the stakeholder engagement/commitment required to ensure regenerative design processes to achieve maximum systemic leverage and support, that is self-organizing and self-evolving[39]
- **Regulation** - shall have general application. It shall be binding in its entirety and directly applicable in all Member States. – Source - Article 288 TFEU, [40]
- **Remanufacturing:** "The process of cleaning and repairing used products and parts to be used again for replacements."[41]
- **Restorative design** - sometimes called restorative environmental design; a design system that combines returning polluted, degraded or damaged sites back to a state of acceptable health through human intervention[42]
- **Resource efficiency**: "A percentage of the total resources consumed that make up the final product or service."[43] re-use: see MOVECO fact sheet "Circular Economy: Terms & Definitions"
- **Secondary resource/ secondary raw materials:** "Waste materials that are recovered, recycled and reprocessed for use as raw materials."[44]
- **Servitization** - refers to industries using their products to sell "outcome as a service" rather than a one-off sale[45]

[35] https://www.researchgate.net/publication/273379786_Regenerative_Development_and_Design (25.06.2018)
[36] http://eur-lex.europa.eu/summary/chapter/environment.html?root_default=SUM_1_CODED%3D20,SUM_2_CODED%3D2003&locale=en
[37] https://www.collinsdictionary.com/de/worterbuch/englisch/refurbishment (26.03.2018)
[38] Mang, Pamela & Reed, Bill. (2017). Update Regenerative Development and Design 2nd edition.
[39] https://www.sciencedirect.com/science/article/pii/S2212609015300327 (26.06.2018)
[40] http://eur-lex.europa.eu/legal-content/en/TXT/HTML/?uri=CELEX:12016E288
[41] https://sustainabilitydictionary.com/2005/12/03/remanufacturing/ (26.03.2018)
[42] https://www.researchgate.net/publication/273379786_Regenerative_Development_and_Design (24.06.2018)
[43] https://sustainabilitydictionary.com/2005/12/03/remanufacturing/ (26.03.2018)
[44] https://sustainabilitydictionary.com/2005/12/03/remanufacturing/ (26.03.2018)
[45] https://www.k3syspro.com/servitization/ (24.06.2018)

- **Source to sink** - simple linear flows from resource sources (farms, mines, forests, watershed, oilfields, etc.) to sinks (air, water, land) that deplete global sources and overload/pollute global sinks[46]
- **Stewardship** - ethic of companies, organizations and individuals that embodies the responsible planning and management of resources[47]
- **Sourcing:** "the act of getting something, especially products or materials, from a particular place"[48]
- **System thinking** - holistic approach of analysis and planning that focuses on the way the parts of a system interrelate each other and how systems work over time and within the context of larger systems[49]
- **Technical metabolism** - "Modelled on natural systems, the technical metabolism is MBDC's term for the processes of human industry that maintain and perpetually reuse valuable synthetic and mineral materials in closed loops"[50]
- **Technical nutrient** – "A material that remains in a closed-loop system of manufacture, reuse, and recovery called the technical metabolism, maintaining its value through infinite product life cycles "[51]
- **Upcycle** – "to recycle (something) in such a way that the resulting product is of a higher value than the original item: to create an object of greater value from (a discarded object of lesser value)"[52]
- **Upcycling**: see MOVECO fact sheet "Circular Economy: Terms & Definitions"
- **Waste**: see MOVECO fact sheet "Circular Economy: Terms & Definitions"

More: https://www.ceguide.org/Glossary

6. RESOURCES

Future reading

- Lovins, A. B., & Lovins L.H & Hawken P. (2007) - A Road Map for Natural Capitalism Harvard Business Review https://hbr.org/2007/07/a-road-map-for-natural-capitalism (visited 19.03.2018)

- The Next Industrial Revolution - http://www.natcap.org/sitepages/pid57.phpBb (visited 18.03.2018)

- The free dictionary By Farley - https://financial-dictionary.thefreedictionary.com/Natural+Capitalism (visited 19.03.2018)

[46] https://www.researchgate.net/publication/273379786_Regenerative_Development_and_Design (25.06.2018)
[47] https://en.wikipedia.org/wiki/Stewardship (24.06.2018)
[48] https://dictionary.cambridge.org/dictionary/english/sourcing (26.03.2018)
[49] https://searchcio.techtarget.com/definition/systems-thinking (27.06.2018)
[50] Cradle to Cradle terminology – MBDC-http://www.c2cproducts.com/detail.aspx?linkid=1&sublink=26
[51] Cradle to Cradle terminology – MBDC-http://www.c2cproducts.com/detail.aspx?linkid=1&sublink=26
[52] Merriam Webster dictionary

- https://www.ellenmacarthurfoundation.org/circular-economy/schools-of-thought/natural-capitalism (visited 09.02.2018)
- Hawken, P., Lovins, A. B., & Lovins, L. H. (1999). Natural capitalism: Creating the next industrial revolution. Boston: Little, Brown and Co.
- The Co-Intelligence Institute: Natural Capitalism - http://www.co-intelligence.org/P-naturalcapitalism.html (visited 26.03.2018)
- Ellen MacArthur Foundation: www.ellenmacarthurfoundation.org (visited 09.02.2018)

On line resources

Natural capital – valuing the planet – London Schol of Economics-
https://www.youtube.com/watch?v=oHjv_HDlAFs

Natural Capitalism (taking natural capital into account) -
https://www.youtube.com/watch?v=Cq7Yn5pUJ3A

A Good Disruption - Disruptive Innovation Festival 2017
https://www.youtube.com/watch?v=uT66CRYkSM8&t=187s

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7. IMPRINT

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1. TABLE OF CONTENTS

2. INTRODUCTION

2.1. INTRODUCTION

This document can either be used as background material for trainers and participants in a **workshop** or also by individual readers (**self-study** or within a self-formed study-group). For both cases, there are notes provided that guide through the material.

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Indicative questions encourage you to reflect what you have just read.

In addition, throughout the text, you will find some indicative questions framed and marked by "?" that encourage to reflect what you have just read

Cross-references to the case studies and further MOVECO materials help to deepen your knowledge about circular economy.

Moreover, there are cross-references to the case studies or other MOVECO material (such as the fact sheets) marked by "💡".

Practical exercises are pointed out for trainer-led workshops or self-study by individual readers or a self-formed study group

Further, the pencil sign points out practical exercises that can be done as part of a trainer-led workshop or in self-study by individual readers or a self-formed study group.

For the **practical** work, there are several **case studies** that invite discussion or reflection – paired with empty templates for worksheets that encourage looking at a self-chosen practical product example. In the end, there is a short quiz to test the knowledge gained in this section of the toolbox. You will find any specific terminology explained in the **glossary**. If you use this section as part of a workshop, there is an **evaluation form** at the very end that can be used to collect feedback at the end of the workshop.

The material of the schools of thoughts section of the MOVECO toolbox is designed in a modular way, so that you can tailor the workshop to the SMEs in the audience and the time available. The way you can do it is described in the Module 5 New materials Pathways – Chapter 3 Notes.

3. CONTENT

3.1. NATURAL CAPITALISM – GENERAL OVERVIEW

Industry makes things. It takes materials – generally out of the ground – and processes them into desired forms[1]. During the history we witnessed different industrial revolutions. They started by water and steam power (first 1800); electricity (second 1900); IT systems (third 2000); and Internet of things, Internet 4.0, and cloud technology – Fourth Revolution now.

All these steps, over centuries, have led to the creation of capital "accumulated wealth in the form of investments, factories, and equipment. Actually, an economy needs four types of capital to function properly:

. human capital, in the form of labour and intelligence, culture, and organisation
. financial capital, consisting of cash, investments, and monetary instruments
. manufactured capital, including infrastructure, machines, tools, and factories
. natural capital, made up of resources, living systems, and ecosystem services"[2]

Natural capital is modelled and transformed (using the first three capital types) into the goods we need without considering the way resources are used, on one hand and the services that the ecosystem offers us, free of charge, cannot be artificially replaced, on the other hand.

3.2. NATURAL CAPITALISM – DEFINITION

Natural capitalism: „Any economic system that incentivizes profit based on proper care of the environment. In other words, natural capitalism assigns an economic value to stewardship of the planet. Income from natural capital includes yield from trees and plants. Natural capitalism assumes that goods and services have a value apart from their potential sale price on the market."[3]

NATURAL CAPITALISM - Increase resource productivity, shift to closed-loop systems and reinvest in natural capital: Recognising the interdependencies between production and use of human-made capital and flows of natural capital.[4]

The difference between the classic term industrial capitalism and natural capitalism is, in fact, that the first one values money and goods and the second one values natural resources as well as human resources.

To track these elements a company should include in its business plan environmental services that, unfortunately, are not accounted for by the effect of the legislation.

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[1] Lovins, A.B, & Lovins L.H & Hawken P. (2007) - A Road Map for Natural Capitalism Harvard Business Review https://hbr.org/2007/07/a-road-map-for-natural-capitalism (visited 19.03.2018)
[2] The Next Industrial Revolution - http://www.natcap.org/sitepages/pid57.phpBb (visited 18.03.2018)
[3] The free dictionary By Farley - https://financial-dictionary.thefreedictionary.com/Natural+Capitalism (visted 19.03.2018)
[4] Schools Of Thought - https://www.ellenmacarthurfoundation.org/circular-economy/schools-of-thought/natural-capitalism (visited 09.02.2018)

?

Please reflect on what is happening in the company you belong to. What is most important value: money and goods or natural resources and human resources?

Based on the respons you get please think about what changes should be done?

.

Natural Capitalism became more popular since 1999, with the launch of the book co-authored by Paul Hawken, Amory Lovins and Hunter Lovins, named "Natural Capitalism: Creating the Next Industrial Revolution". According to authors, there are four central strategies that can be used by companies when defining their sustainability strategy:

1. "Radical resource productivity"
2. "Biomimicry"
3. "Service and flow economy"
4. "Investing in natural capital" [5]

1. Radical resource productivity, the first principle, - is based on "fundamental changes in production design and technology"[6] that can maintain the natural resources in use for a longer period, decrease in natural resources depletion and environmental pollution, create savings in costs, capital and time with positive effects upon companies and environment;
Using new and innovative technologies companies can stretch the natural resources by many times and that results in profit for companies.

?

Can you think about how technology can make the difference?

You can check the study case of ROMBAT/Romania, which, through a very sophisticated recycling process, keeps lead in automotive beacons in the economic circuit for a long time with beneficial effects on the environment.

[5] Hawken,P., Lovins, A.B., Lovins, L.H. (1999). Natural Capitalism: Creating the Next Industrial Revolution. US Publication (visited 09.02.2018)
[6] The Co-Intelligence Institute: Natural Capitalism - http://www.co-intelligence.org/P-naturalcapitalism.html (visited 26.03.2018)

Beyond changes in the ways we think about extraction, process, transport, and dispose of a huge quantity of resources it is important to understand and sustain, through design for efficiency, the capacity of the ecosystem to provide services. By doing so we will find the appropriate technologies and solutions to have efficient factories, efficient vehicles, efficient buildings, efficient energy and efficiently grown food that will create a better life for us and less pressure upon the ecosystem services[7]. That is why resource productivity seems to be the cornerstone of natural capitalism and if companies use primary resources in an effective way they can get three main benefits:

- Should not harm the ecosystem through decrease in resource depletion and will be prepared to face the legal system in the country of origin or the country where they operate;
- Low level of pollution – by waste reduction and the decrease of associated costs
- New jobs – control and monitoring should be included as well as environmental friendly processes, new technologies, digitization, so;

2. **"Biomimicry"** the second principle - Innovation inspired by nature: Study and apply nature's designs and processes to solve human problem[8]. Nature does not produce waste and Natural Capitalism proposes to eliminate the concept of waste. In nature, each output is returned to either the biological system (biosphere) or the technical system (techno sphere). It is important that the materials used are not toxic to any of the two environments

For more information concerning Biomimicry please check Moveco Handbook Schools of Thought section Biomimicy

[7] the important benefits for human beings that arise from healthily functioning ecosystems, notably production of oxygen, soil genesis, and water detoxification/ Collins English Dictionary - Complete & Unabridged 2012 Digital Edition © William Collins Sons & Co. Ltd. 1979, 1986 © HarperCollins

[8] Ellen MacArthur Foundation: www.ellenmacarthurfoundation.org (visted 09.02.2018)

3. "Service and flow economy" - is the third principle of natural capitalism. It represents a new business model based on a very important change from classical production processes of goods and selling them to a new way of doing business based on selling services instead of goods. In the first business model the client has the responsibility for goods usage and for discarding them after use (landfill). Using second solution product ownership is not transferred to client and that encourages "take back process" when product lifecycle is over. Using the second solution create easier ways of closing the loop.

Practical activity 1: Do you know take - back schemes in your country? Please think about them and the benefits for environment and natural resources.

Look to the Extended Producer Responsibility process and the take back schemes in your country. According to the reports delivered by MOVECO consortium there are, in all Danube Region, good practice examples in WEEE sector for take-back of large WEEE upon delivery of new goods.

For more information concerning services and flow economy please check MOVECO Handbook Schools of Thought section Performance economy

4. Reinvest in natural capital, the fourth principle – the new pattern of consumption expands human needs and pressures, on natural capital, increase dramatically. Hence regeneration or wise use of natural resources become a must. This principle is based on reward and invest in businesses that achieve the first three principles i.e. sustainable businesses.

As well as other schools of thought, Natural Capitalism shows us that changes (which are not necessarily difficult to achieve) are needed at the level of business management. Advanced technologies (Internet of things and Internet 4.0) can make primary resources more productive, which will benefit not only owners but also those involved in the process. By implementing resource productivity, at the company level, ones can get a lot of positive results such as:

- Lower costs for business and society (for primary resources through material consumption decrease based on design by efficiency and manufacturing)
- Lower costs for environmental damages (polluter pays principle, scrap recovery, reuse, remanufacturing, recycling, and materials savings through better quality)

- Low costs for social disruption (stewardship[9], Social corporate responsibility)

3.3. LEAN THINKING FOR BUSINESS

From entrepreneurial point of view natural capitalism has a strong connection to lean thinking that works in the direction of eliminating all kind of waste in the manufacturing process. The waste can be produced, during manufacturing phase by: different mistakes which need to be corrected (both during design process or manufacturing process), by corrective measures that generate waste (material or human resources are wasted), by production of components or goods that are not wanted by customers, longer manufacturing processes generated by a weak organization of work or weak logistics. All these points create, for the business and companies, huge losses that are found not only in the decrease of profit but also in diminishing other resources such as time material and human. Design for efficiency need to be used to improve the processes and reduce waste.

But this is not all, to implement lean management a company must understand:

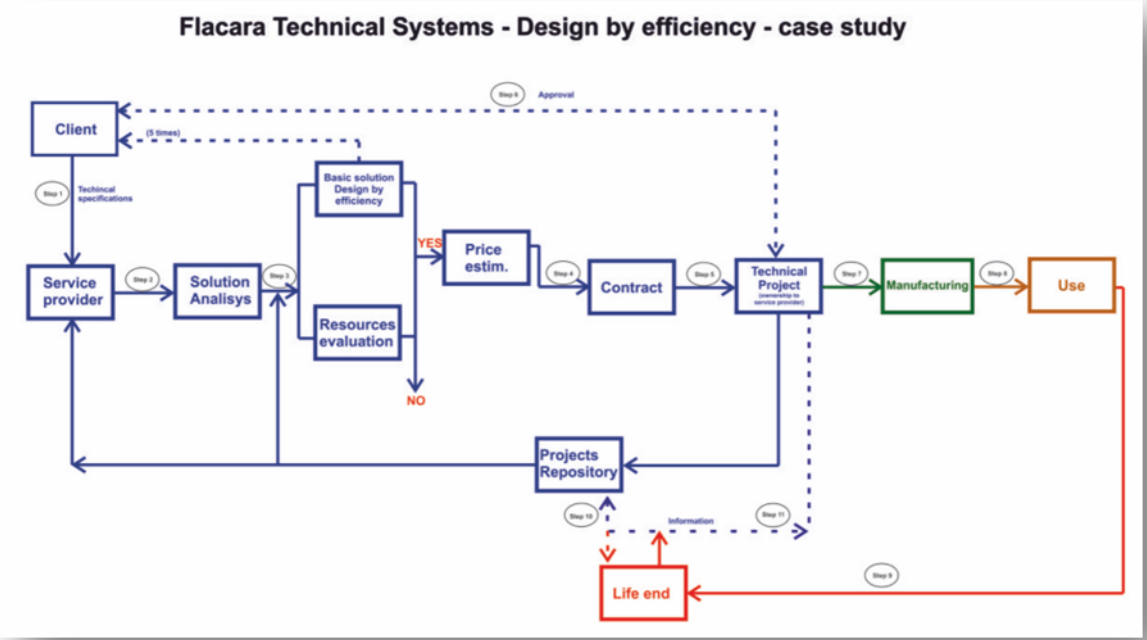
- The way relationships between materials, resources information, data, and finance are chainging and how it affects the company and the rules of competition?
- Which organisational structures are more suited to implement circular strategies
- Which skills, capabilities and ways of thinking are needed to support the transition towards a CE?

3.4. CASE STUDY - COMPANY: FLACARA TECHNICAL SYSTEMS,

To better understand the process created under design for efficiency the following case study is suggested:

Company: Flacara Technical Systems,
Company Type – start up - design and assembly of machinery / equipment for industry (automotive, sports equipment, advertising companies etc.)
Location: Bistrita/Romania

[9] See the definition of social disruption/ https://en.wikipedia.org/wiki/Social_disruption (visited 19.03.2018)



The new approach has been adopted as a result of a large consumption of materials necessary to achieve models that meet the needs of the customer.

Old approach: Up to five simulation activities were done to create a physical good for costumer generating great resource consumption and waste.

New approach: In this new approach, virtually, up to 5 simulations are performed that should lead to the final version, approved by the client. Therefore, the new design for efficiency process is thought for resource economy (time, human, material).

After the completion of the project it enters the manufacturing process where it can still undergo minor changes that are included into the final project and sent to a company repository.

Some parts and components of the electrical equipment are made by a 3D printer saving energy, resources and producing no waste.

Every single part of the equipment can be: reused, remanufactured, and recycled.

Creating a repository is an innovative idea that helps the company use the projects entirely or partially when:

- A new project (similar) starts
- Components are used in another projects: redistribute/remanufacture
- Components are up-cycle
- Maintenance - keeping the equipment in working order, in repair, etc.
- The end of life process – create no waste

Services:

- 12 months guaranty
- Low level of materials consumption
- Better exploitation based on the project repository

Conclusions

- Less materials consumption
- Less energy consumption
- Less component in product architecture
- Easy to desassembly for goods
- Easy to repair
- Easy to reuse

3.5. EXERCISE 1

Exercise 1 – think about two natural resources your company use: water and energy. Think how you could use resources more productively, to bring four to ten times more benefit from each unit of energy, water to your

Working in small groups create a "to do" list through brainstorming.

Please consider, within your exercise the following natural services:

- Production of oxygen
- Maintenance of biological diversity
- Purification of water and air
- Regulation of the chemical composition of the atmosphere
- Decomposition of organic wastes
- Regulation of the local and global climate
- Maintenance of soil fertility
- Storage and recycling of nutrients

4. QUESTIONS & ANSWERS

4.1. QUIZ – QUESTIONS

1. Should the services provided to your business, by nature, be included in the balance sheet?

Yes, it should be

No, is not necessary

I do not know

2. Primary resources productivity can be increased based on

new technologies (IoT, I 4.0....)

smart production design

both

3. Natural capitalism is

a process

a new business model

a philosopy

4. To reinvest in natural capital as business means:

that your business is more visible

that you are up to date

that you provide value to actual stakeholders and future generations

5. Which of the following are natural services

production of oxygen, maintenance of biological diversity, purification of water and air

storage and recycling of nutrients

decomposition of organic waste

4.2. QUIZ – SOLUTIONS

1. Should the services provided to your business, by nature, be included in the balance sheet?

x Yes, it should be

No, is not necessary

I do not know

2. Primary resources productivity can be increased based on

new technologies (IoT, I 4.0....)

smart production design

x both

3. Natural capitalism is

a process

X a new business model

a philosopy

4. To reinvest in natural capital as business means:

that your business is more visible

that you are up to date

x that you provide value to actual stakeholders and future generations

5. Which of the following are natural services

x production of oxygen, maintenance of biological diversity, purification of water and air

x storage and recycling of nutrients

x decomposition of organic waste

5. GLOSSARY

- **Bio-based material:** ""Bio -"is Greek for life. Bio-based material refers to a products main constituent consisting of a substance, or substances, originally derived from living organisms. These substances may be natural or synthesized organic compounds that exist in nature. This definition could include natural materials such as leather and wood, but typically refers to modern materials. Many of the modern innovations use bio-based materials to create products that biodegrade. Some examples are: cornstarch, derived from a grain and now being used in the creation of packaging pellets; bio-plastics created with soybean oil, now being used in the creation of many modern products like tractors, water bottles, and take away cutlery." [10] **Biodegradable material**: "A material which microorganisms can break down into natural elements (i.e. water, biomass, etc.)."[11]
- **Biological metabolism** - The natural processes of ecosystems are a biological metabolism, making safe and healthy use of materials in cycles of abundance[12]
- **Biological Nutrient** - A material used by living organisms or cells to carry on life processes such as growth, cell division, synthesis of carbohydrates and other complex functions. Biological Nutrients are materials that can biodegrade safely and return to the soil to feed environmental processes[13]
- **Cascading**: see MOVECO fact sheet "Circular Economy: Terms & Definitions"
- **Compostable material**: "Materials that can be disposed with biological materials and decay into nutrient-rich material."[14] **Circular economy** - regenerative economy in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing energy and material loops
- **Cradle-to-Cradle®:** see MOVECO fact sheet "Supporting Tools for a Circular Economy"
- **Cradle to Grave** – "A Cradle to Grave system is a linear model for materials that begins with resource extraction, moves to product manufacturing, and, ends with a "grave" – when the product is disposed of in a landfill or incinerator"[15]
- **Decision** – "shall be binding in its entirety. A decision which specifies those to whom it is addressed shall be binding only on them"[16]
- **Directive** – "shall be binding, as to the result to be achieved, upon each Member State to which it is addressed, but shall leave to the national authorities the choice of form and methods"[17]

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[10] https://sustainabilitydictionary.com/2006/02/17/bio-based-material/ (26.03.2018) // "A material that is partially, or entirely made of biomass." https://www.ceguide.org/Glossary (26.03.2018)
[11] https://www.ceguide.org/Glossary (26.03.2018)
[12] Cradle to Cradle terminology – MBDC-http://www.c2cproducts.com/detail.aspx?linkid=1&sublink=26
[13] Cradle to Cradle terminology – MBDC-http://www.c2cproducts.com/detail.aspx?linkid=1&sublink=26
[14] https://www.ceguide.org/Glossary (26.03.2018)
[15] Cradle to Cradle terminology – MBDC-http://www.c2cproducts.com/detail.aspx?linkid=1&sublink=26
[16] European Network of Environmental law Organizations 2012 Implementation of the Waste Framework Directive in the EU Member States
[17] European Network of Environmental law Organisations 2012 Implementation of the Waste Framework Directive in the EU Member States

- **Down-cycle** - to recycle (something) in such a way that the resulting product is of a lower value than the original item : to create an object of lesser value from (a discarded object of higher value)[18] see: MOVECO fact sheet "Circular Economy: Terms & Definitions"
- **Eco-Effectiveness** – "The central strategy in the cradle-to-cradle development method and seeks to create industrial systems that emulate healthy natural systems. The central principle of eco-effectiveness is that "waste equals food." The concept was developed in response to some of the perceived limitations of eco-efficiency which critics claim only slow down the rate of environmental depletion and don't reverse the production of unused or non-recycled waste".[19]
- **Eco efficiency** – "Management philosophy that aims at minimizing ecological damage while maximizing efficiency of the firm's production processes, such as through the lesser use of energy, material, and water, more recycling, and elimination of hazardous emissions or by-products."[20]
- **Ecological sustainability** – "a bio-centric school of sustainability thinking that, based on ecology and living systems principles, focuses on the capacity of ecosystems to maintain their essential functions and processes, and retain their biodiversity in full measure over the long-term contrasts with technological sustainability based on technical and engineering approaches to sustainability"[21]
- **Ecosystem** - the interactive system of living things and their non-living habitat[22]
- **Ecosystem redesign** - a coherent framework for redesigning our landscapes, buildings, cities, and systems of energy, water, food, manufacturing and waste through the effective adaptation to and integration with nature's processes[23]
- **Energy efficiency**: "Energy efficiency improvements refer to a reduction in the energy used for a given service (heating, lighting, etc.) or level of activity. The reduction in the energy consumption is usually associated with technological changes, but not always since it can also result from better organization and management or behavioral changes ("non-technical factors")."[24]
- **Energetic use**: incineration of waste material that includes the use of the generated heat and energy for other processes
- **(Final) disposal**: see MOVECO fact sheet "Circular Economy: Terms & Definitions"

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[18] Merriam Webster dictionary
[19] https://sustainabilitydictionary.com/2005/12/03/eco-effectiveness/visited 26/02/2018
[20] http://www.businessdictionary.com/definition/eco-efficiency.html -visited 01.03.2018
[21] Orr D (1992) Ecological literacy: education and the transition to a post-modern world. State University of New York Press, Albany.
[22] Tansley AG (1935) The use and abuse of vegetational concepts and terms. Ecology 16:284–307 doi:10.2307/1930070
[23] with adaptations from https://www.researchgate.net/publication/301966198_Regenerative_Development_regenerative_development_and_Design (26.06.2018)
[24] https://hub.globalccsinstitute.com/publications/energy-efficiency-recipe-success/definition-and-scope-energy-efficiency (26.03.2018)

- **Incineration**: Waste destruction in a furnace by controlled burning at high temperatures. Incineration removes water from hazardous sludge, reduces its mass and/or volume, and converts it to a non-burnable ash that can be safely disposed of on land, in some waters, or in underground pits. However, it is a highly contentious method because incomplete incineration can produce carbon monoxide gas, gaseous dioxins, and/or other harmful substances.[25]
- **Innovation** - production or adoption, assimilation, and exploitation of a value-added novelty in economic and social areas[26]
- **Landfilling**: "The disposal and burying of solid waste. The degradation of the waste results in the creation of local air and water pollution."[27]
- **Lean production** - approach to management that focuses on cutting out waste, whilst ensuring quality[28]
- **Life-cycle** - series of stages in form and functional activity through which a system passes between successive recurrences of a specified primary stage[29]
- **Life-cycle analysis**: see MOVECO fact sheet "Supporting Tools for a Circular Economy"
- **Life-time** - the duration of the existence of a given particular system[30]
- **Locational patterns** - the patterns that depict the distinctive character and potential of a place and provide a dynamic mapping for designing human structures and systems that align with the living systems of a place[31]
- **Negative externality** - occurs when production and/or consumption imposes external costs on third parties outside of the market for which no appropriate compensation is paid[32]
- **Optimization** - finding an alternative with the most cost effective or highest achievable performance under the given constraints, by maximizing desired factors and minimizing undesired ones[33]
- **Permaculture** - a system of agricultural and social design principles centered around simulating or directly utilizing the patterns and features observed in natural ecosystems[34]
- **Place** - the unique, multi-layered network of ecosystems within a geographic region that results from the complex interactions through time of the natural ecology (climate, mineral and other deposits, soil, vegetation, water and wildlife, etc.) and culture (distinctive customs,

[25] http://www.businessdictionary.com/definition/incineration.html (27.06.2018)
[26] with adaptations from http://www.ericshaver.com/the-many-definitions-of-innovation/ (27.06.2018)
[27] https://www.ceguide.org/Glossary (26.03.2018)
[28] with adaptations from https://www.tutor2u.net/business/reference/introduction-to-lean-production (27.06.2018)
[29] https://www.merriam-webster.com/dictionary/life%20cycle (26.06.2018)
[30] With adaptations from https://en.wikipedia.org/wiki/Lifetime (26.06.2018)
[31] https://www.researchgate.net/publication/273379786_Regenerative_Development_and_Design (25.06.2018)
[32] with adaptations from https://www.economicshelp.org/micro-economic-essays/marketfailure/negative-externality/ (26.06.2018)
[33] http://www.businessdictionary.com/definition/optimization.html (26.06.2018)
[34] https://en.wikipedia.org/wiki/Permaculture (27.06.2018)

expressions of values, economic activities, forms of association, ideas for education, traditions, etc.)[35]

- **Recommendations and opinions** - shall have no binding force [36]
- **Recycling:** see MOVECO fact sheet "Circular Economy: Terms & Definitions"
- **Refurbishment:** "The refurbishment of something is the act or process of cleaning it, decorating it, and providing it with new equipment or facilities."[37]
- **Regenerative design** - a system of technologies and strategies, based on an understanding of the inner working of ecosystems that generates designs to regenerate rather than deplete underlying life support systems and resources within socio-ecological wholes[38]
- **Regenerative development** - a system of technologies and strategies for generating the patterned whole system understanding of a place, and developing the strategic systemic thinking capacities, and the stakeholder engagement/commitment required to ensure regenerative design processes to achieve maximum systemic leverage and support, that is self-organizing and self-evolving[39]
- **Regulation** - shall have general application. It shall be binding in its entirety and directly applicable in all Member States. – Source - Article 288 TFEU, [40]
- **Remanufacturing:** "The process of cleaning and repairing used products and parts to be used again for replacements."[41]
- **Restorative design** - sometimes called restorative environmental design; a design system that combines returning polluted, degraded or damaged sites back to a state of acceptable health through human intervention[42]
- **Resource efficiency**: "A percentage of the total resources consumed that make up the final product or service."[43] re-use: see MOVECO fact sheet "Circular Economy: Terms & Definitions"
- **Secondary resource/ secondary raw materials:** "Waste materials that are recovered, recycled and reprocessed for use as raw materials."[44]
- **Servitization** - refers to industries using their products to sell "outcome as a service" rather than a one-off sale[45]

[35] https://www.researchgate.net/publication/273379786_Regenerative_Development_and_Design (25.06.2018)
[36] http://eur-lex.europa.eu/summary/chapter/environment.html?root_default=SUM_1_CODED%3D20,SUM_2_CODED%3D2003&locale=en
[37] https://www.collinsdictionary.com/de/worterbuch/englisch/refurbishment (26.03.2018)
[38] Mang, Pamela & Reed, Bill. (2017). Update Regenerative Development and Design 2nd edition.
[39] https://www.sciencedirect.com/science/article/pii/S2212609015300327 (26.06.2018)
[40] http://eur-lex.europa.eu/legal-content/en/TXT/HTML/?uri=CELEX:12016E288
[41] https://sustainabilitydictionary.com/2005/12/03/remanufacturing/ (26.03.2018)
[42] https://www.researchgate.net/publication/273379786_Regenerative_Development_and_Design (24.06.2018)
[43] https://sustainabilitydictionary.com/2005/12/03/remanufacturing/ (26.03.2018)
[44] https://sustainabilitydictionary.com/2005/12/03/remanufacturing/ (26.03.2018)
[45] https://www.k3syspro.com/servitization/ (24.06.2018)

- **Source to sink** - simple linear flows from resource sources (farms, mines, forests, watershed, oilfields, etc.) to sinks (air, water, land) that deplete global sources and overload/pollute global sinks[46]
- **Stewardship** - ethic of companies, organizations and individuals that embodies the responsible planning and management of resources[47]
- **Sourcing:** "the act of getting something, especially products or materials, from a particular place"[48]
- **System thinking** - holistic approach of analysis and planning that focuses on the way the parts of a system interrelate each other and how systems work over time and within the context of larger systems[49]
- **Technical metabolism** - "Modelled on natural systems, the technical metabolism is MBDC's term for the processes of human industry that maintain and perpetually reuse valuable synthetic and mineral materials in closed loops"[50]
- **Technical nutrient** – "A material that remains in a closed-loop system of manufacture, reuse, and recovery called the technical metabolism, maintaining its value through infinite product life cycles "[51]
- **Upcycle** – "to recycle (something) in such a way that the resulting product is of a higher value than the original item: to create an object of greater value from (a discarded object of lesser value)"[52]
- **Upcycling**: see MOVECO fact sheet "Circular Economy: Terms & Definitions"
- **Waste**: see MOVECO fact sheet "Circular Economy: Terms & Definitions"

More: https://www.ceguide.org/Glossary

6. RESOURCES

Future reading

- Lovins, A. B., & Lovins L.H & Hawken P. (2007) - A Road Map for Natural Capitalism Harvard Business Review https://hbr.org/2007/07/a-road-map-for-natural-capitalism (visited 19.03.2018)

- The Next Industrial Revolution - http://www.natcap.org/sitepages/pid57.phpBb (visited 18.03.2018)

- The free dictionary By Farley - https://financial-dictionary.thefreedictionary.com/Natural+Capitalism (visited 19.03.2018)

[46] https://www.researchgate.net/publication/273379786_Regenerative_Development_and_Design (25.06.2018)
[47] https://en.wikipedia.org/wiki/Stewardship (24.06.2018)
[48] https://dictionary.cambridge.org/dictionary/english/sourcing (26.03.2018)
[49] https://searchcio.techtarget.com/definition/systems-thinking (27.06.2018)
[50] Cradle to Cradle terminology – MBDC-http://www.c2cproducts.com/detail.aspx?linkid=1&sublink=26
[51] Cradle to Cradle terminology – MBDC-http://www.c2cproducts.com/detail.aspx?linkid=1&sublink=26
[52] Merriam Webster dictionary

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On line resources

Natural capital – valuing the planet – London Schol of Economics-
https://www.youtube.com/watch?v=oHjv_HDlAFs

Natural Capitalism (taking natural capital into account) -
https://www.youtube.com/watch?v=Cq7Yn5pUJ3A

A Good Disruption - Disruptive Innovation Festival 2017
https://www.youtube.com/watch?v=uT66CRYkSM8&t=187s

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