



CIRC VET

CIRCULAR ECONOMY PRACTICAL TRAINING MATERIALS
FOR PLASTIC MANUFACTURING INDUSTRIES



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Circular Economy Practical Training Materials for Plastics Manufacturing Industries

General aspects of eco-design: application to the plastic sector
**Guidelines of plastic packaging for minimum waste and efficient
sorting**

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➤ **General aspects of eco-design: application to the plastic sector**

- Introduction
- Eco-design: concepts, objectives, benefits
- Eco-design strategies
- Principles of ISO 14006 and application

➤ **Design guidelines of plastic packaging for minimum waste and efficient sorting**

- Introduction
- Reduce packaging weight
- Reduce environmental impact of packaging waste
- Redesign packaging
- Re-use and recycle packaging

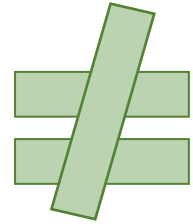


- Eco-design is the **integration of environmental aspects into the product development process** by harmonizing ecological and economic requirements.
- Eco-design is about **minimizing the environmental impact** of the design of products, processes or services throughout their lifecycle.
- ***The role of design in the future impacts of a product*** ⇒ between 80 and 90% of the economic value of a product and its environmental costs are determined in the product design phase.



Eco-design

to **identify the environmental impacts** of any product or service, from the initial design phase to the end, and **minimize** them as much as possible without forgetting manufacturing, transportation, distribution or packaging



Sustainable design

the technological and production needs are identified to **develop and produce a sustainable product**

Sustainability

OR

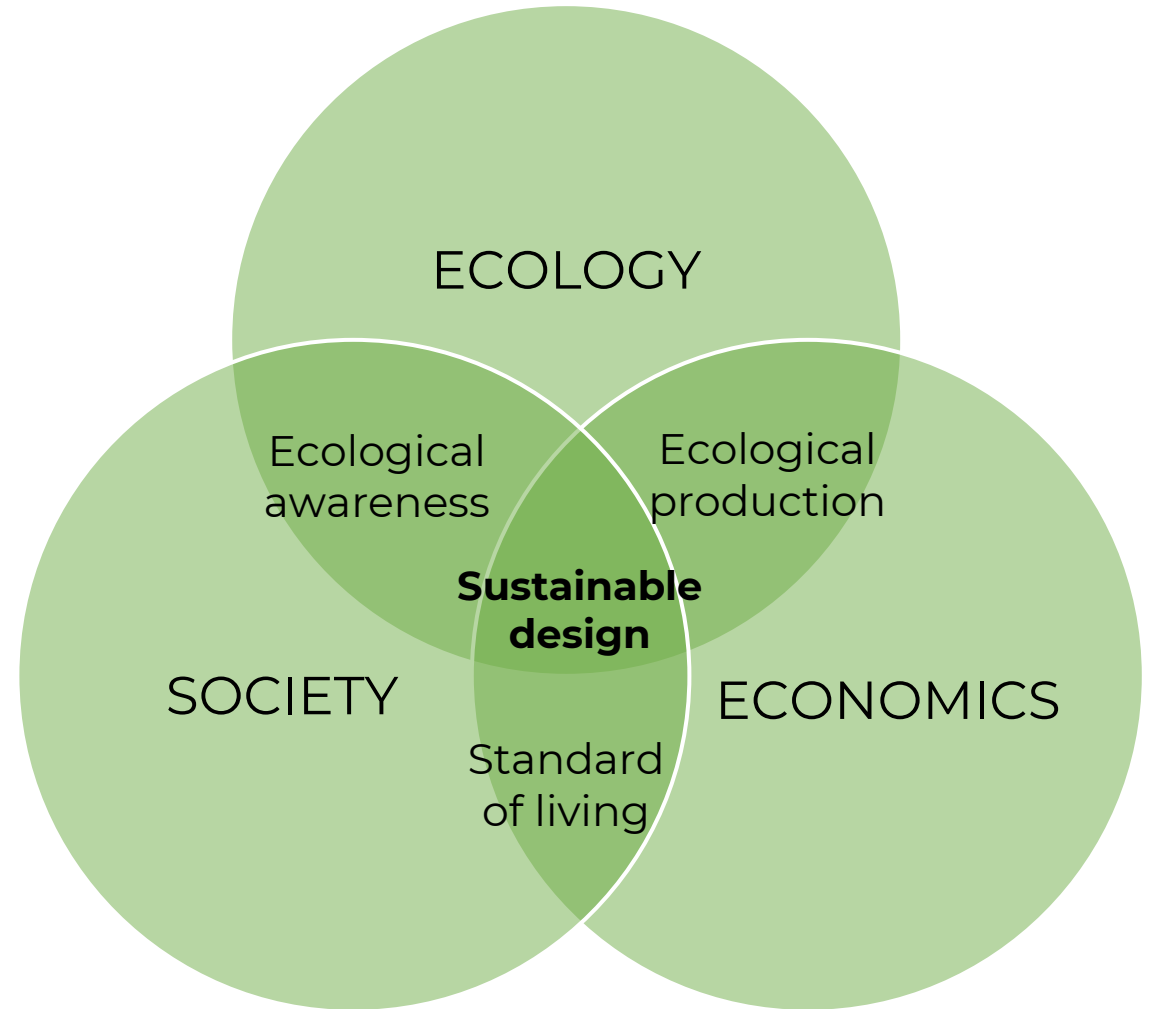
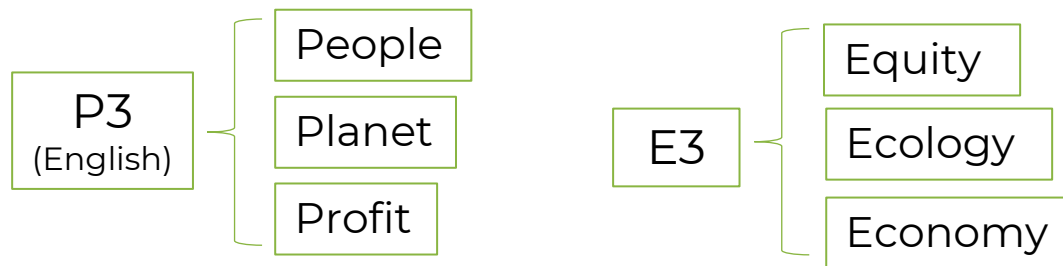
Circular design

focuses on designing for the **circular economy**, with a regenerative perspective and with the aim of rethinking the entire design process from the beginning, so that the **material does not leave the lifecycle** of a product or service but returns to the cycle again and again

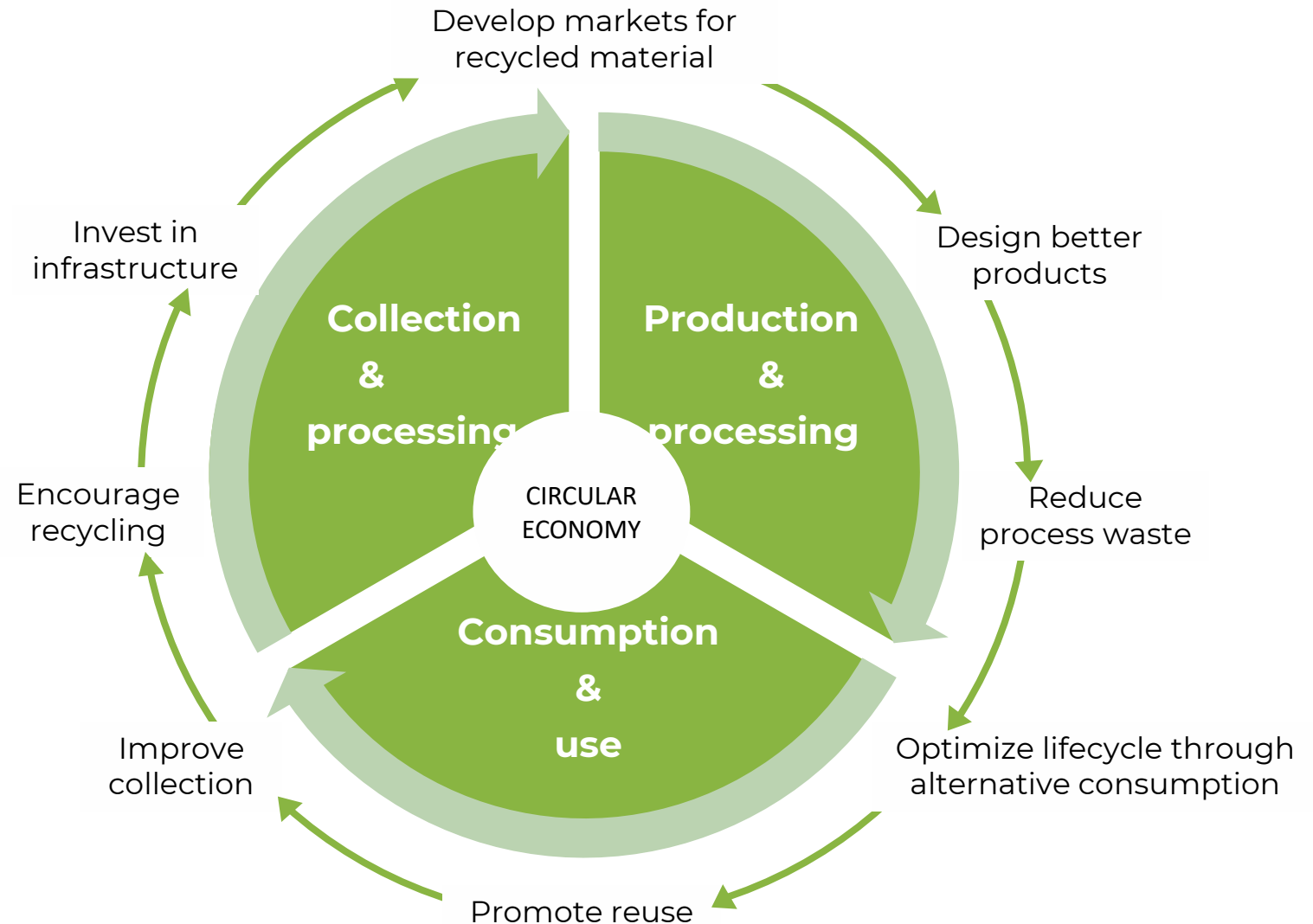
Sustainability ⇒ the use of natural resources to satisfy the needs of present generations without compromising the ability of future generations to meet their own needs.



Design is sustainable if it presents economic, social and environmental sustainability, what designers call the variables P3:

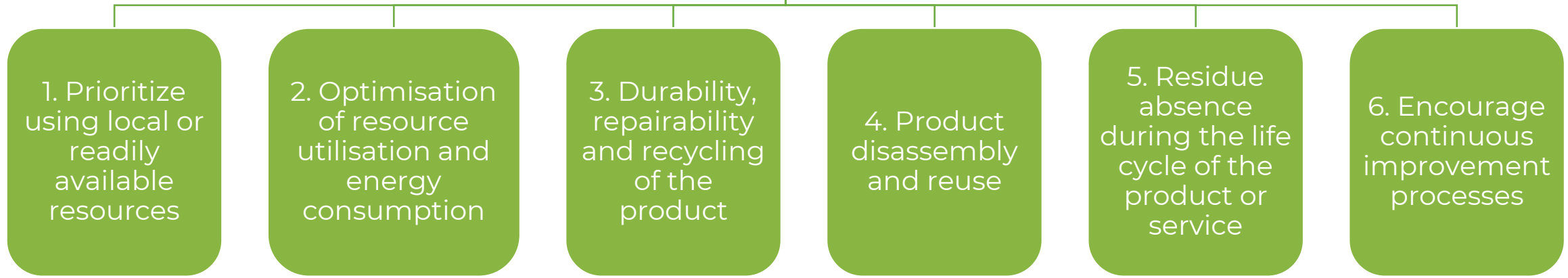


Circular design main objective is to ensure that materials do not exit the life cycle of a product or service but instead are repeatedly reintegrated into either the technical cycle (*Technosphere*) or the biological cycle (*Biosphere*).





Principles of circular design





SUSTAINABLE DESIGN



ECODESIGN



CIRCULAR DESIGN

Analyze social impact: Are workers being paid fair wages? Will your product have health-endangering effects on consumers when it's used?

Analyze environmental impact: Which materials in production are impact intensive? Which processes could be sustainably optimized?

Product stewardship: Take full responsibility for your product's entire lifecycle. And make sure the product does not get lost at the end of its life, but stays in the value system.

Dematerialization: Reduce the weight, size, and number of materials you use in your design.

Designing of inner loops: Materials in your product should maintain the highest value during and after the end of its life.

Moving from products to services: Shifting from ownership to access. Instead of purchasing, you offer products as a service.

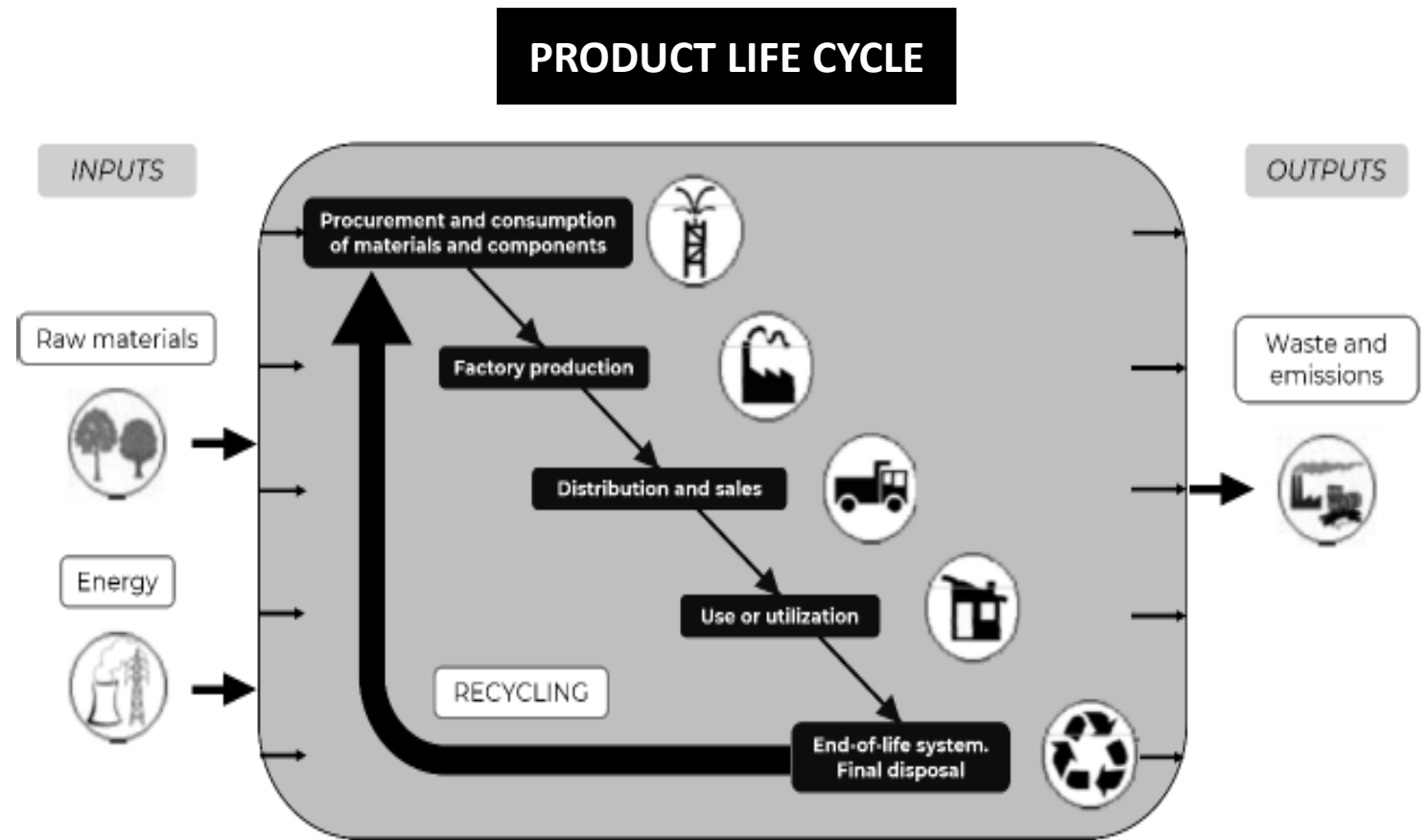


► Concepts, objectives, benefits

Eco-design is an approach to designing products, processes and systems to **minimize their environmental impact throughout their life cycle.**

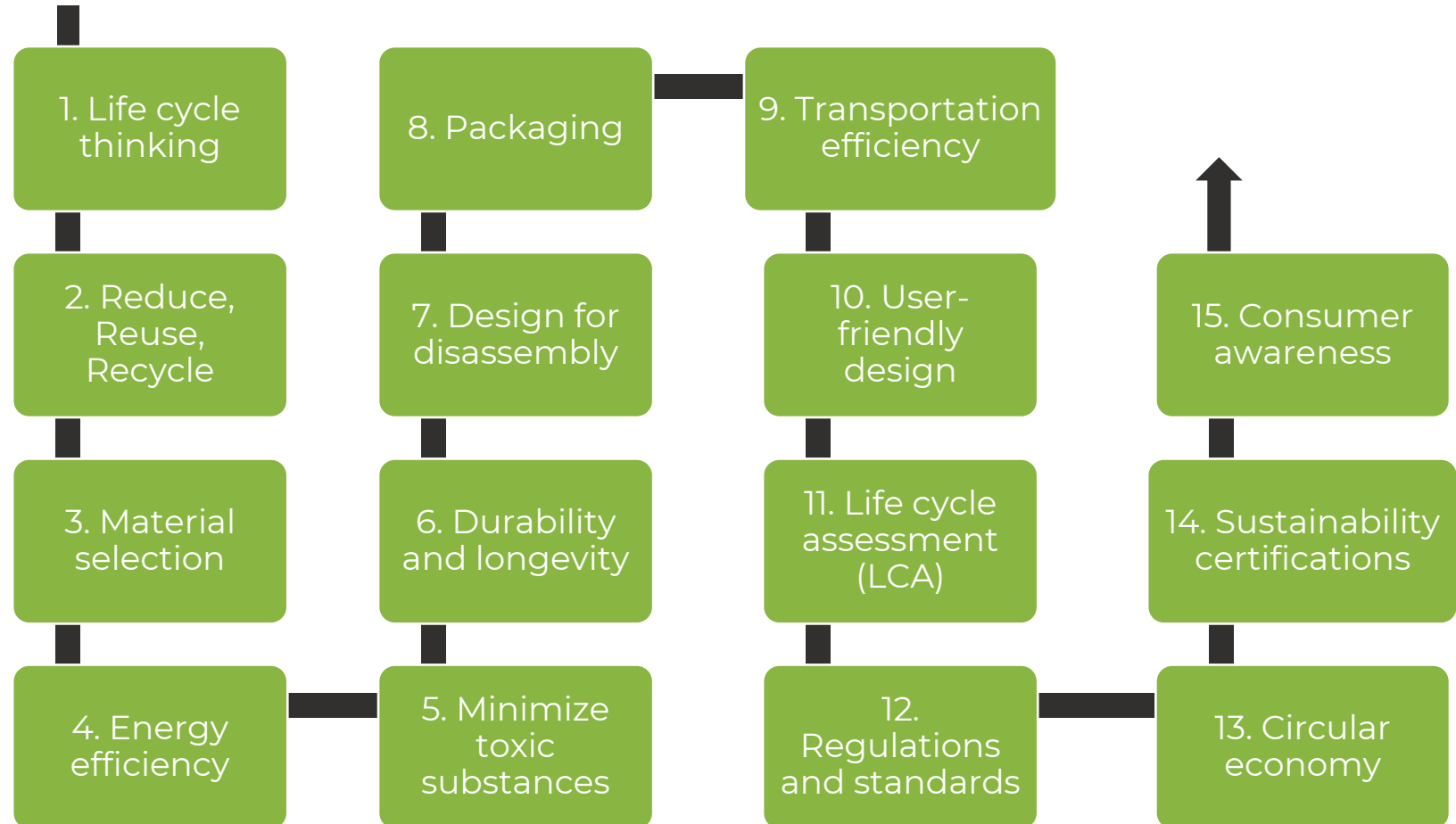
Innovative design solutions that consider the entire life cycle, **from the extraction of raw materials to production, distribution, and use**, including recycling, "repairability", and disposal.

It is considered as an approach to design, but **not as a label for ecological products.**



Concepts, objectives, benefits

**ECO-DESIGN
METHODOLOGY**



Main objectives

Eco-design is a field that seeks to balance the needs of **consumers, industry and the environment**.

It tries to create products and systems that are functional, economically viable, environmentally responsible, and socially beneficial.



Benefits

ECO-DESIGN BENEFITS

The environmental impact is reduced in each of the life cycle phases

The materials used are environmentally friendly

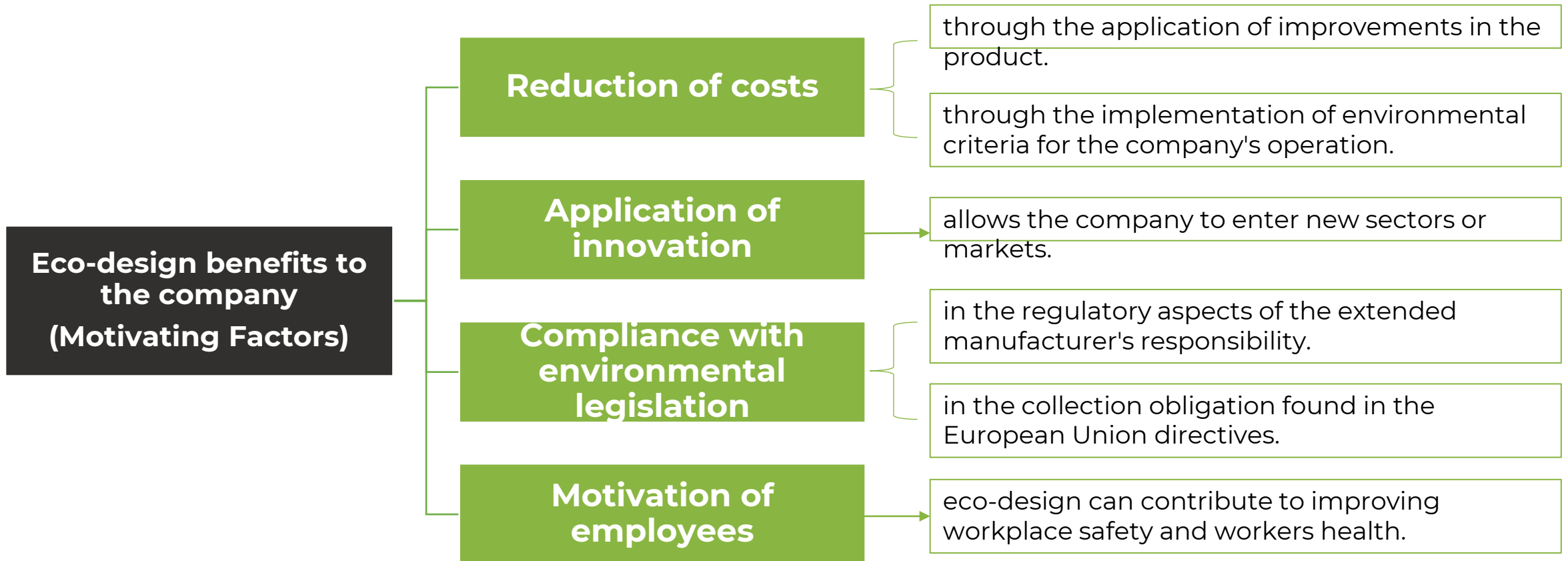
Products are generally of better quality, more durable and innovative

Eco-design allows brands to differentiate themselves from the competition

Eco-design satisfies the needs of consumers looking for planet-friendly alternatives

The circular economy is promoted, and a response is given to legislative changes and the market

Benefits for companies





Challenges

Challenges in applying eco-design principles to product development

Low level of understanding of eco-design by consumers

The possible higher cost

Difficulties in clearly demonstrating the benefits to potential buyers

Risks when trying new materials and approaches

Search for alternative ways to maintain profits by selling longer lasting products

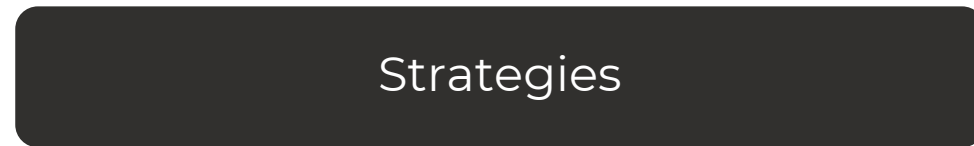
Difficulties in using eco-design in conventional products

Determine the correct stage in the product life cycle or supply chain

Integrate eco-design principles into all business approaches and supply chains



Strategies

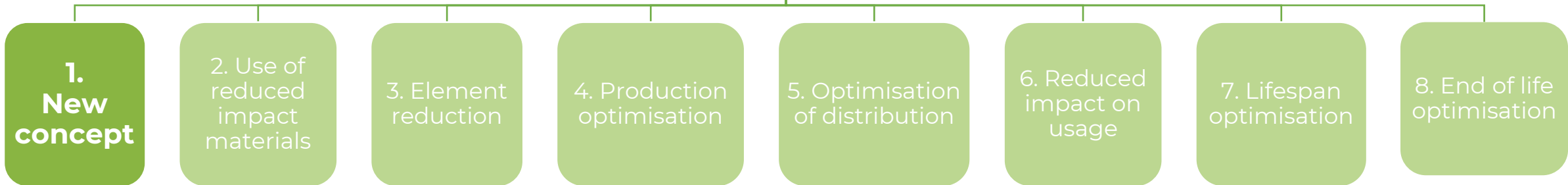


- 1. New concept
- 2. Use of reduced impact materials
- 3. Element reduction
- 4. Production optimisation
- 5. Optimisation of distribution
- 6. Reduced impact on usage
- 7. Lifespan optimisation
- 8. End of life optimisation



Strategies

Strategies

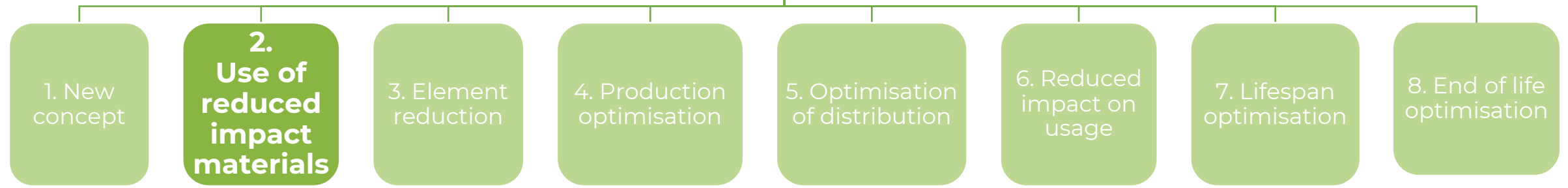


- Dematerialisation
- Multifunctionality
- Product sharing
- Service instead of the product



Strategies

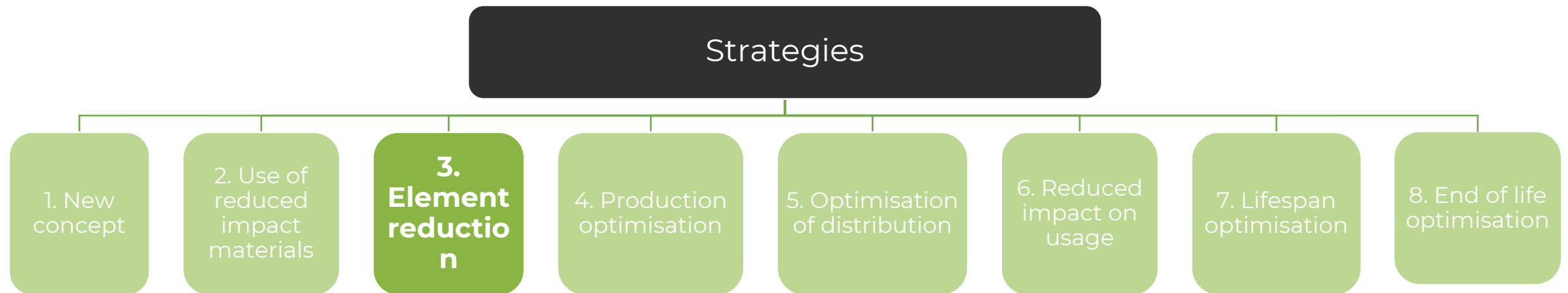
Strategies



- Use of materials:
- derived from natural resources
 - with high recycled or recyclable content
 - free of dangerous substances
 - produced with ecological systems
 - minimum number of different materials
 - from local or nearby supplier



Strategies



- Eliminate or reduce components that do not add value to the product, whether functional, aesthetic or quality
- Optimize the amount of material used without compromising the technical or material viability of the product



Strategies

Strategies



- Reduction in the number of processes or production stages
- Use alternative, cleaner production techniques
- Minimise water and energy consumption and/or use renewable energy
- Reduce the amount of waste or internal recycling of waste



Strategies

Strategies

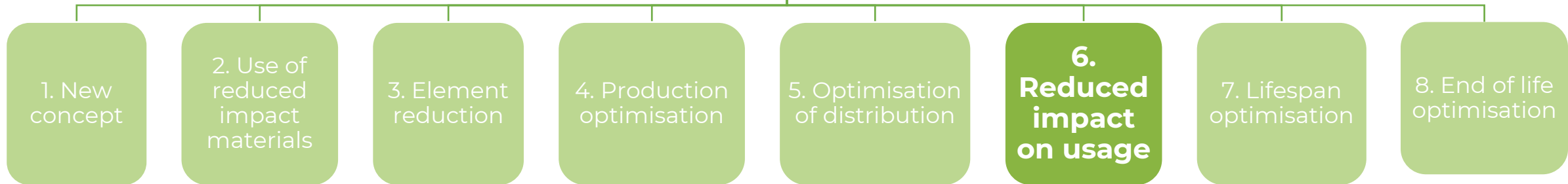


- Minimise the amount of packaging in mass or volume
- Use lower impact materials in packaging or reusable containers
- Reduce the weight of the product
- Optimise the volume for storage and transportation
- Use low-impact and efficient vehicles/fuels



Strategies

Strategies

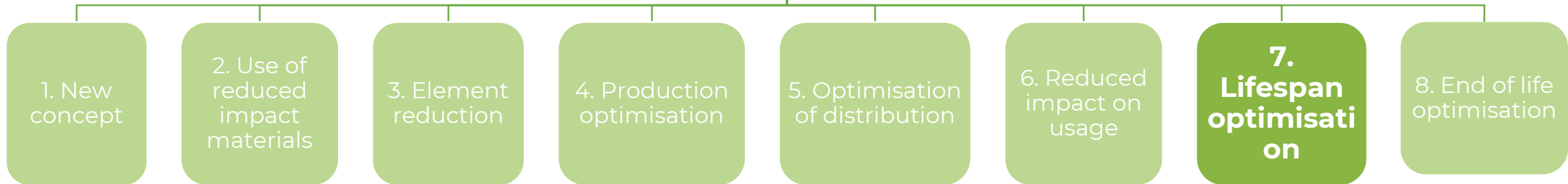



- Minimise the need for maintenance
- Maintenance based on low impact products
- Minimisation of energy/water consumption in use



Strategies

Strategies



- 
- Increase in useful life
 - Reduction in useful life if the product cannot continue to perform its function for a period of time
 - Possibility of repair/upgrade and availability of spare parts



Strategies

Strategies

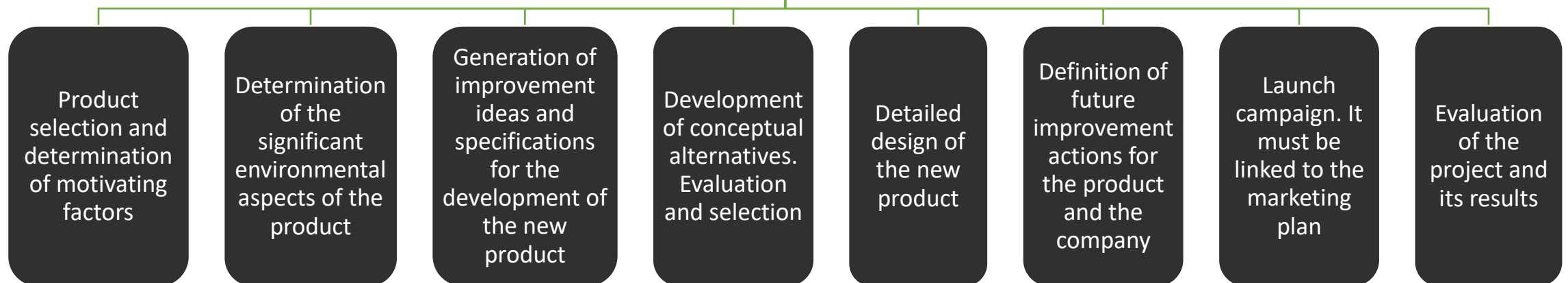


- Ease of disassembly and separation of materials to facilitate correct final management
- Possibility of recycling product materials
- Reuse of the product or its components
- Possibility of energy recovery

ISO 14006:200 Environmental Management System – Guidelines for incorporating ecodesign

- This standard primarily targets companies that have implemented an environmental management system (EMS) in accordance with the ISO 14001, whether integrated with a quality management system (QMS) or not.
- It also applies to organisations that have solely adopted an EMS and those without a formal EMS or QMS but have an interest in reducing the negative environmental impacts associated with their products.

Phases of an eco-design project



ISO 14006:200 Environmental Management System – Guidelines for incorporating ecodesign ⇒ offers brief guidance on integrating eco-design into the product design and development process.

IEC 62430:2019 Environmentally conscious design (ECD) - Principles, requirements and guidance ⇒ provides specific details on this integration.

Reasons why an organization should implement eco-design in its products

a) The growing concern about the damage caused to the environment

b) The recognition of business opportunities related to resource efficiency

c) Life cycle thinking, which facilitates

the identification of environmental requirements related to products

avoids unintentional change of environmental impacts within the life cycle



Design guidelines of plastic packaging for minimum waste and efficient sorting





PACKAGING is the material that protects a product and can be found in its various parts

Types

Primary or sales packaging

Designed to contain and present the product as a sales unit.

Secondary or grouping packaging

Designed to group primary packaging.

Tertiary or transport packaging

Designed to facilitate the logistics and transportation.



PACKAGING is the material that protects a product and can be found in its various parts

Types

Primary or sales packaging

Designed to contain and present the product as a sales unit.

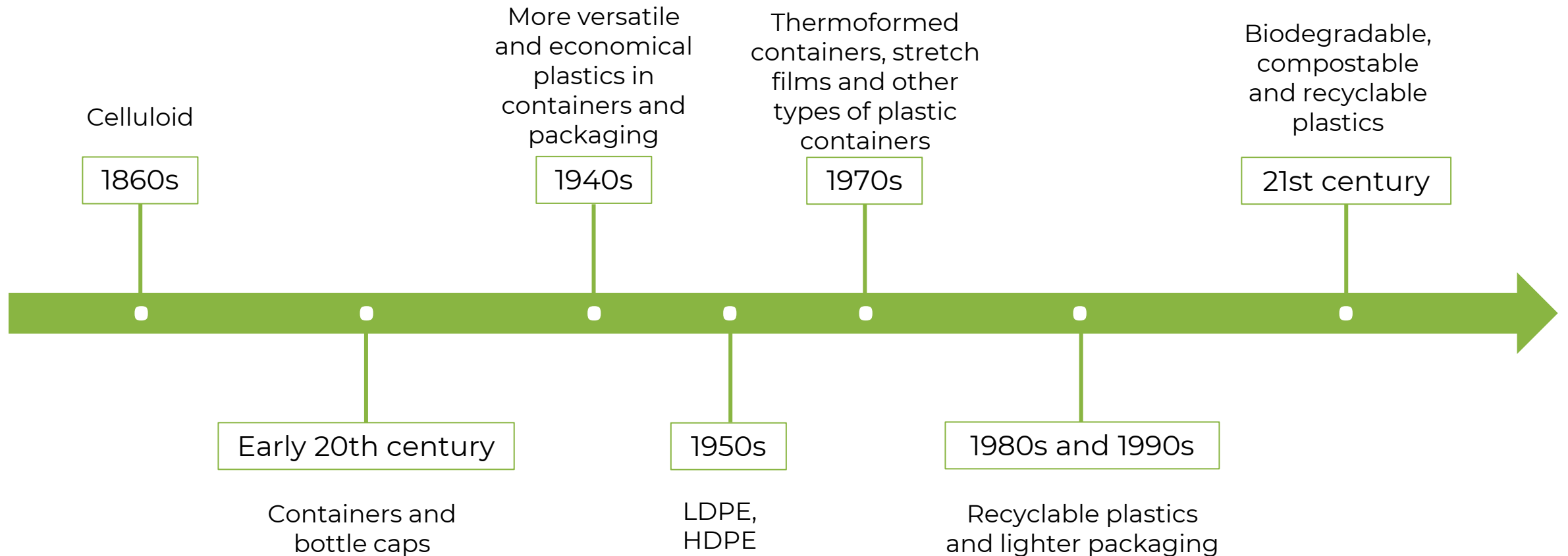
Secondary or grouping packaging

Designed to group primary packaging.

Tertiary or transport packaging

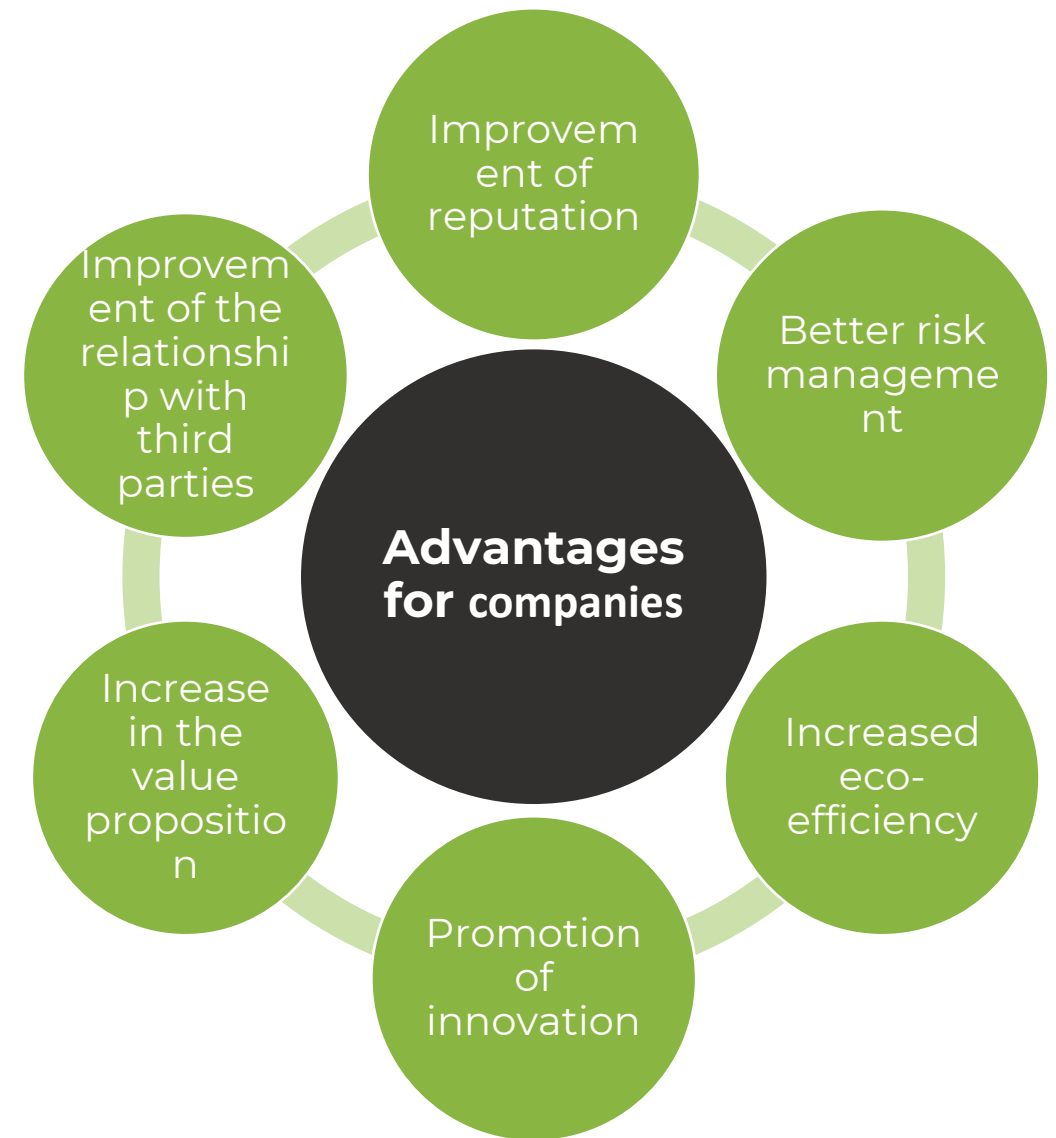
Designed to facilitate the logistics and transportation.

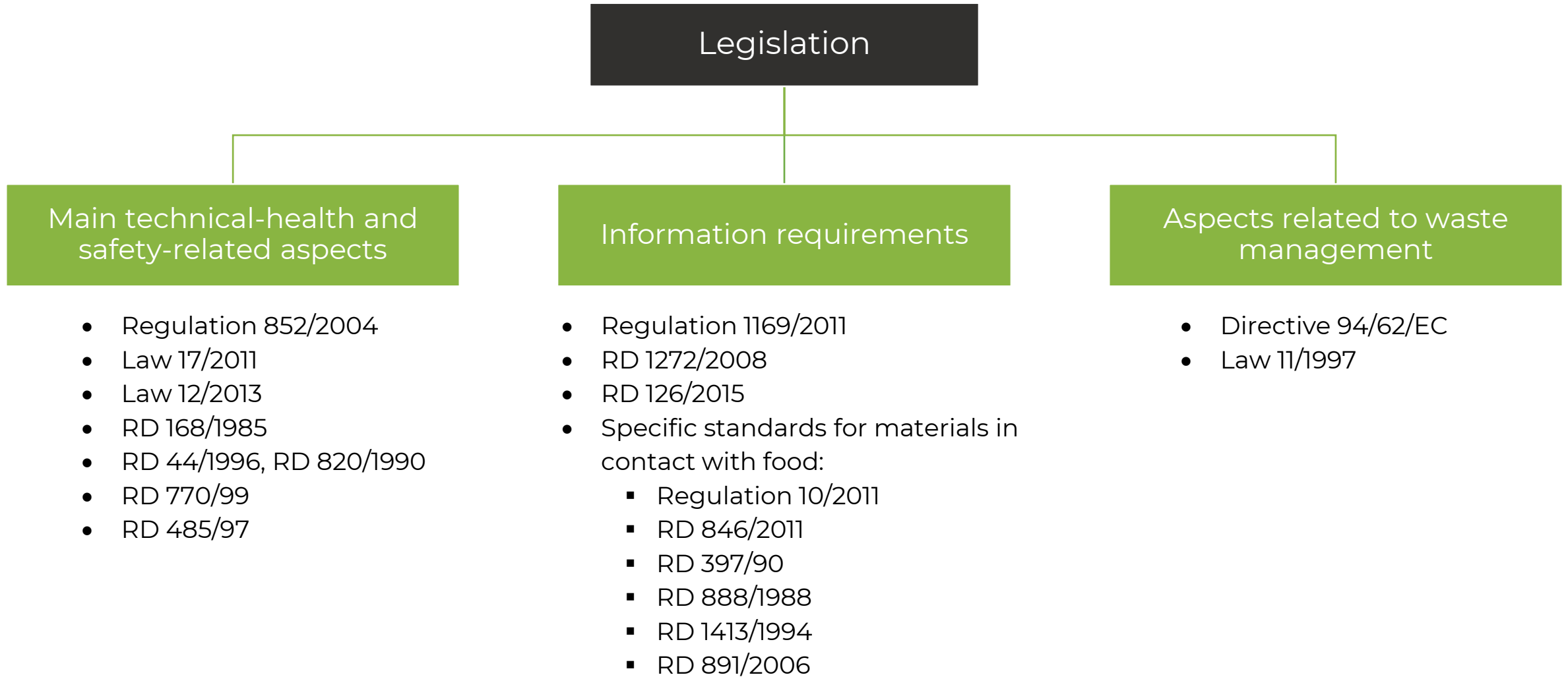
The history of containers and packaging is connected to the development of civilisation and the evolution of the industry



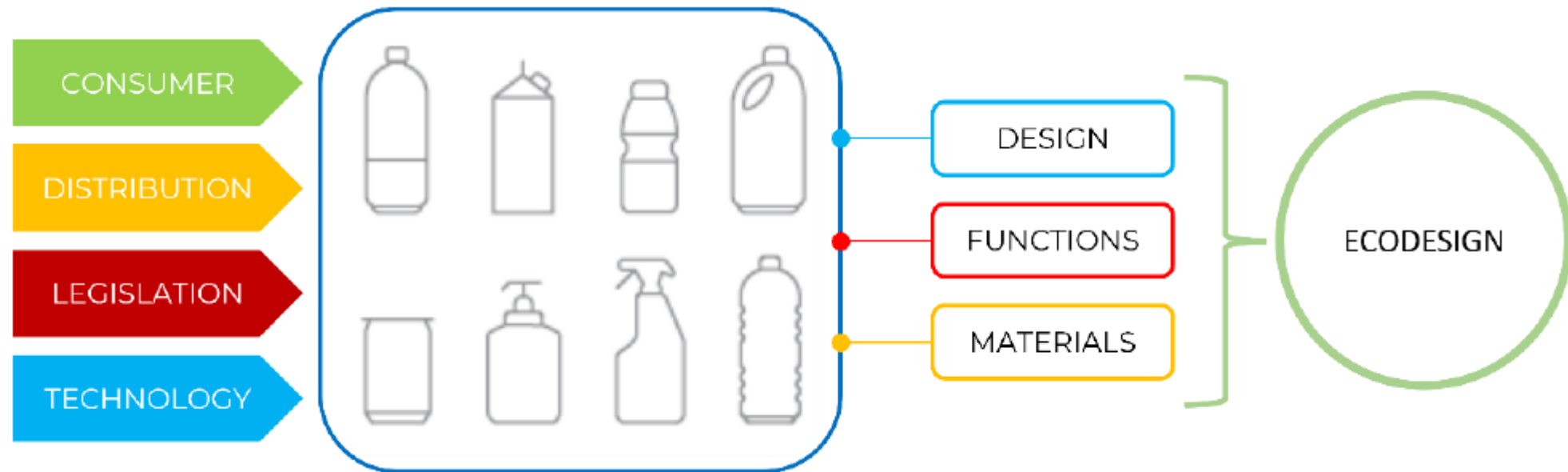
- Eco-design in the packaging sector aims to produce **technically recyclable, financially viable packaging** that makes optimal use of resources and reduces environmental impact.
- However, today this sustainability is not being carried out (e.g. the average recycling rate for plastic bottles is 14%, with 2% is reinserted back into the production cycle).

- To successfully apply eco-design, all **containers and packaging** that comprise the packaging system must be considered.
- The **container manufacturer, packer and distributor** must also be considered.
- Another essential aspect to consider is the **legislation** related to this type of product.

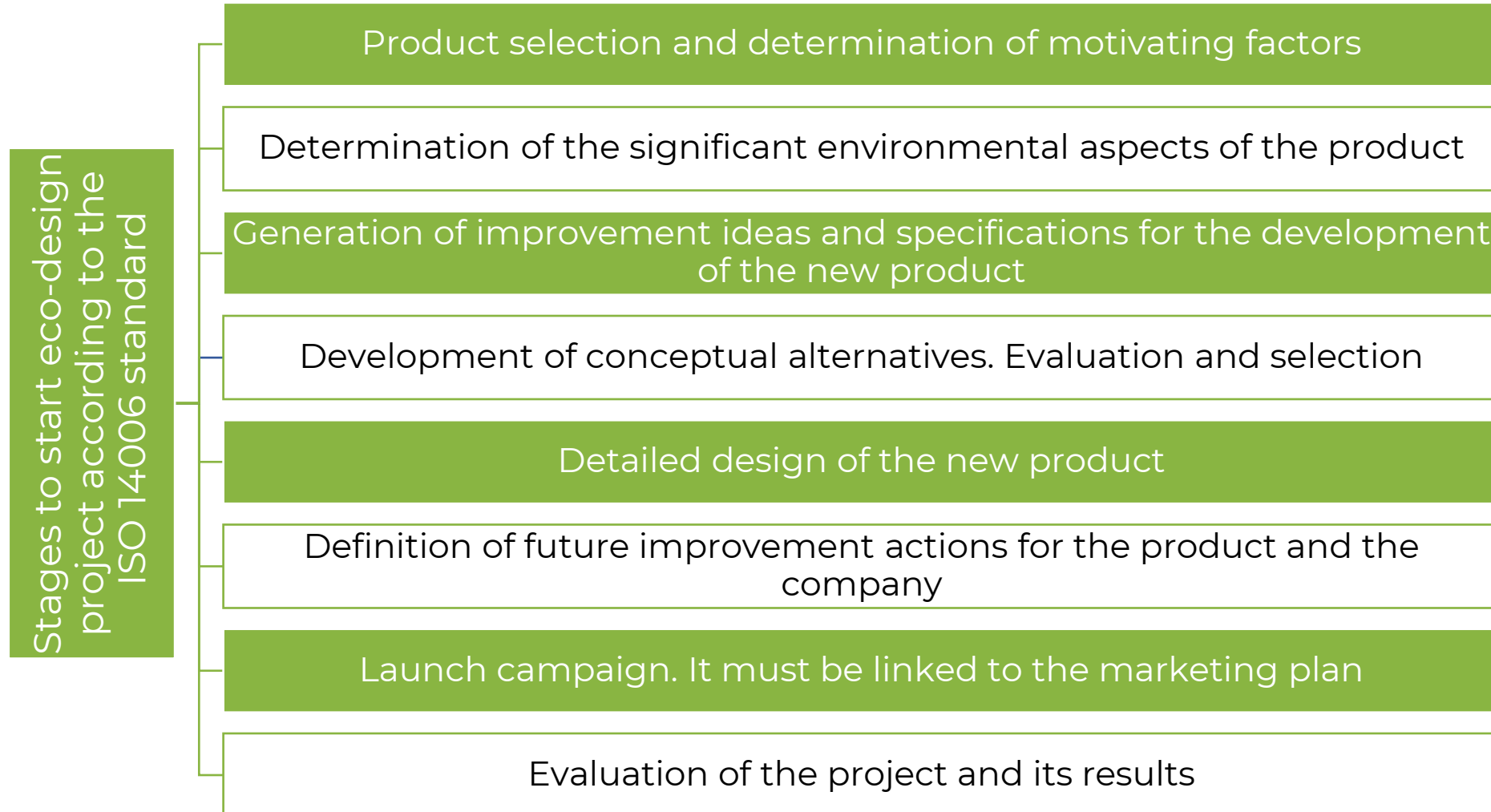




- Eco-design provides the industrial packaging sector with the opportunity for innovations ⇒ to reduce weight, to reduce the environmental impact of waste generated, redesign or reuse or recycle the container or packaging.



Packaging industrial sector





Reduce packaging weight

This eco-design strategy focuses on optimizing the grammage and/or thickness of the packaging to improve the ratio between container and content.

Environmental improvements throughout the life cycle

Cost reduction in the packaging value chain

Eliminating unnecessary non-essential elements



Reduce environmental impact of packaging waste

Eco-design strategy to reduce the impact of packaging waste is the **selection of sustainable raw materials.**

Raw materials certifications ensuring the sustainability



- The origin of the material, such as wood chain of custody certifications (FSC, PEFC, SFI, ISO 38001).
- Compliance with specific environmental requirements, such as environmental labels (ISO 14024 and ISO 14025).
- The environmental profile, such as the environmental product declaration (ISO 14023), product carbon footprint (ISO 14067), water footprint (ISO 14046), or product environmental footprint.

STRATEGY ADVANTAGES

Allows companies to access new markets and/or customers sensitive to sustainability

Reduce issues related to labour risks

Facilitates compliance with air emissions legislation

Improves the recyclability of the packaging

Another aspect to consider in an eco-design project is **cost reduction strategies for packaging production** related to resource consumption and waste and emissions management.

Optimised manufacturing and packaging

Packaging tailored to the filling line

To apply processes that require minimal energy, water, and other material resources and generate minimal emissions and waste.

Designing packaging and selecting materials, optimising resource consumption and minimising waste generation during filling.



STRATEGIES

Replacing the current packaging design with a lighter design option to reduce the amount of material

Involves changes in materials, transformation processes, logistics, or product presentation

Optimizing the relationship between the volume of content and the volume occupied by the packaging to achieve logistical improvements

Arrange the geometry of packaging, reduce transportation costs, secondary packaging, and product storage costs

Redesigning the packaging to maximize product utilization and reduce losses

Packaging design that allows for enhances of packaging functionality.



STRATEGY	GOAL
Replacing single-use packaging with reusable designs	Reduce packaging waste
Packaging design solutions where end-users can easily separate their components	Enhances recycling quality
Minimise adhesives as much as possible	Improve the recycling process and the quality of recycled materials
Increase the compatibility for recycling of the various elements that make up the packaging	It is effective to have plastics with different densities for separation
Avoid dark shades (black, brown, ...) – recommended transparent, translucent or opaque packaging	Ensure correct automatic separation, improve the quality of the recycled material
Avoid multiple materials that cover more than 2/3 of the primary body material	Improve the quality of the recycled material
Design of lightweight plastic packaging that can be folded if it exceeds 30 cm in diameter	Allows end-users to place these containers in the appropriate recycling bins easily
Identify the container where the packaging or its various components should be deposited	Help manual sorting operators in packaging sorting facilities classify by materials.

Proper sorting is essential for the effective implementation of recycling:

- 1) Tracer-based sorting involves:
 - fluorescent pigments added to the plastic substrate,
 - digital watermarks integrated into the packaging design.
- 2) Robotic sorting, which employs artificial intelligence to assist cameras and robotic arms in sorting plastics on conveyor belts.



➤ Eco-design strategies → except New concept are directly related to the product life cycle.

Actions that help the company to outline their eco-design actions on its packaging

Change in thread dimensions in hollow bodies and caps	Change in container geometry to reduce subsequent packaging
Change from rigid packaging to flexible packaging	Use of recycled materials
Use of inks and/or paints with low environmental impact	Use of monomaterials and/or compatible materials
Minimising of the use of dangerous substances	Marking of the plastic materials that make up the container.
Stackable and/or removable containers	Use of compostable materials
Actions on printing	Use of materials of renewable origin
Reusable containers	Avoid overpackaging



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