BIMEPD

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ADAPTED SENIOR TRAINING PROGRAM ON BIM METHODOLOGIES FOR THE INTEGRATION OF EPD IN SUSTAINABLE CONSTRUCTION STRATEGIES

2020-1-ES01-KA204-083128

Module 06

Environmental management and documentation of a BIM project.

COAMU Colegio Oficial de Arquitectos Región de Murcia

iED institute of Entrepreneurship Development

Centro Tecnológico del mármol, piedra y materiales

Warsaw University of Technology

Bulgarian Green Building Council

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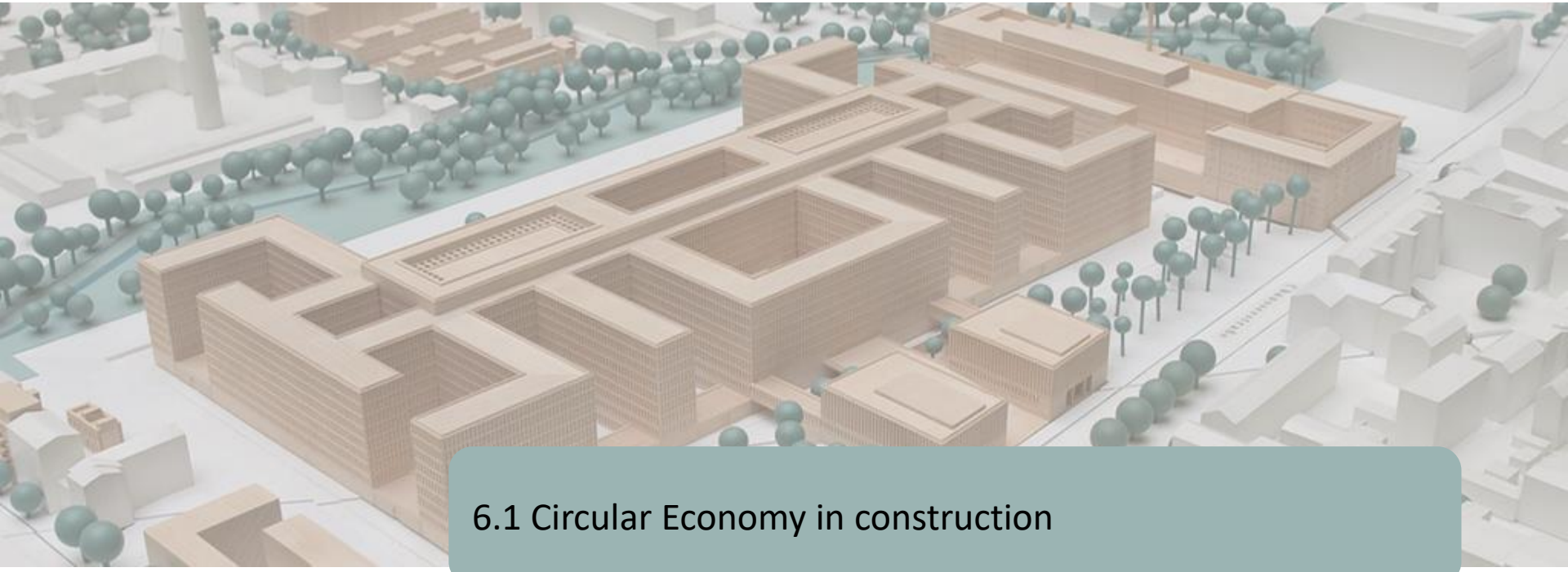

6.1 Circular Economy in construction

6.2 Environmental management

6.3 BIM document management

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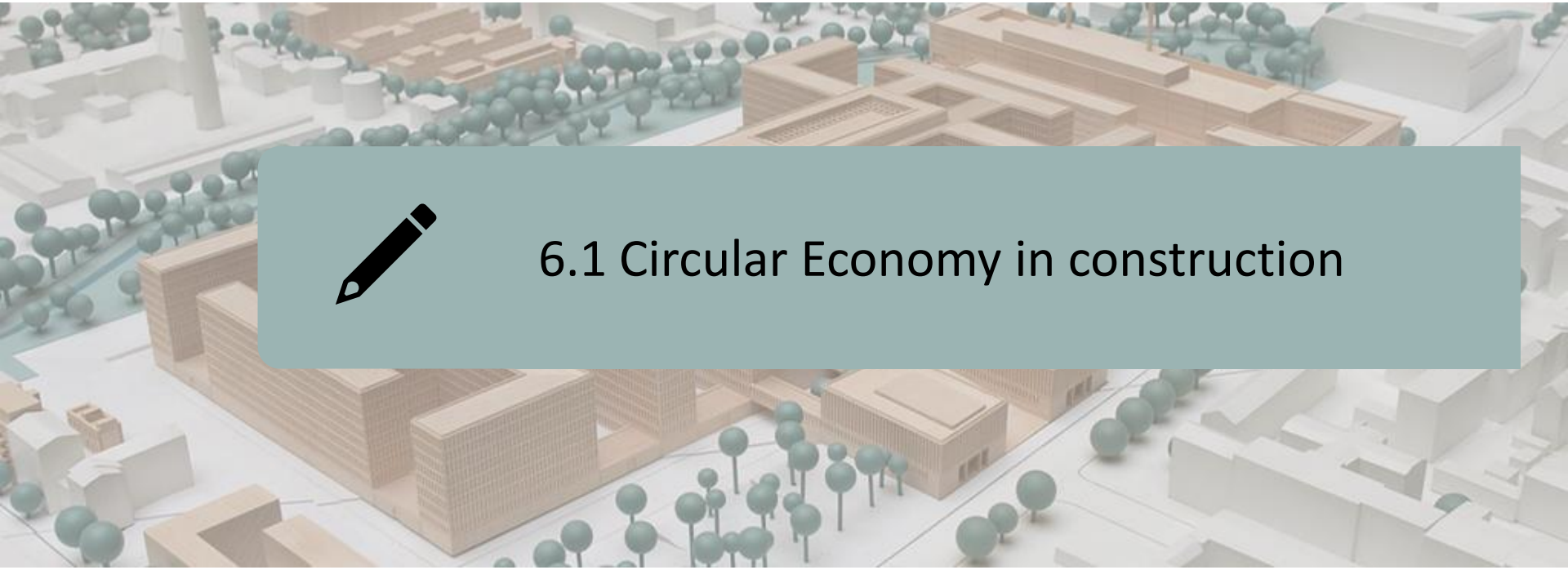

6.1 Circular Economy in construction

DEFINITION OF CIRCULAR ECONOMY

IMPORTANCE OF THE CIRCULAR ECONOMY

DEVELOPMENTS IN THE CONSTRUCTION SECTOR

DEVELOPMENT OF THE CIRCULAR ECONOMY IN CONSTRUCTION

THE ROLE OF STAKEHOLDERS

CHALLENGES AND BARRIERS

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DEFINITION OF CIRCULAR ECONOMY

INCLUSIVE DEFINITION OF CIRCULAR ECONOMY

Economic model that:

- Minimises the amount of natural resources needed, including water and energy, to meet the needs required at any given time.
- Selects resources intelligently, minimising non-renewable resources and critical raw materials, and favouring the use of recycled materials wherever possible.
- Efficiently manages the resources used, maintaining and recirculating them in the economic system for as long as possible and minimising waste generation.

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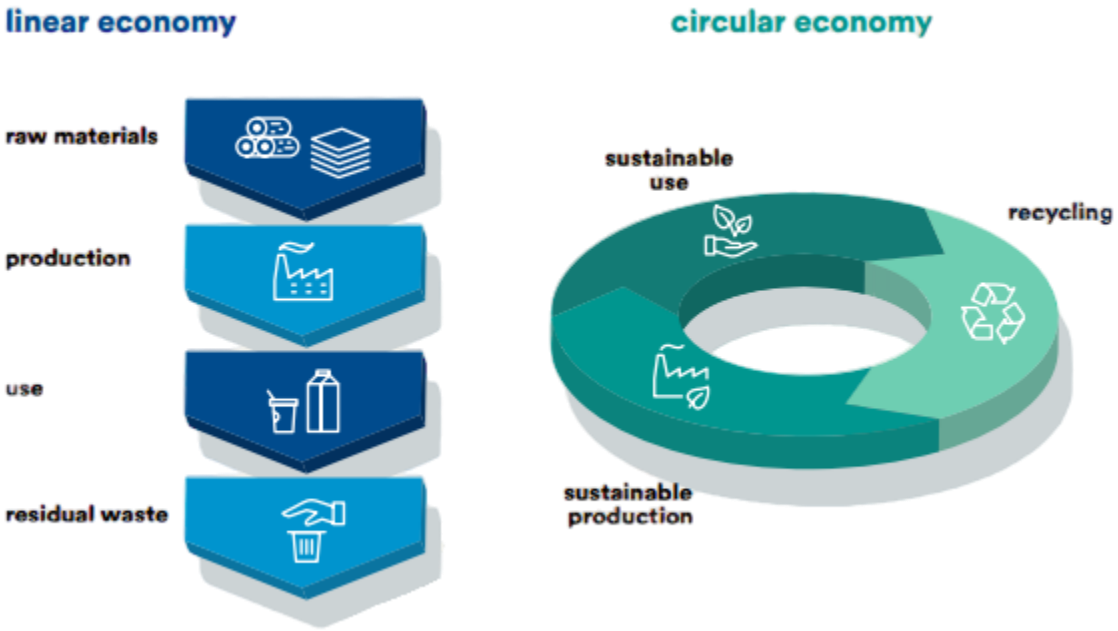
DEFINITION OF CIRCULAR ECONOMY

INCLUSIVE DEFINITION OF CIRCULAR ECONOMY



Source: https://www.tomra.com/en/discover/reverse-vending/feature-articles/what-is-circular-economy

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DEFINITION OF CIRCULAR ECONOMY

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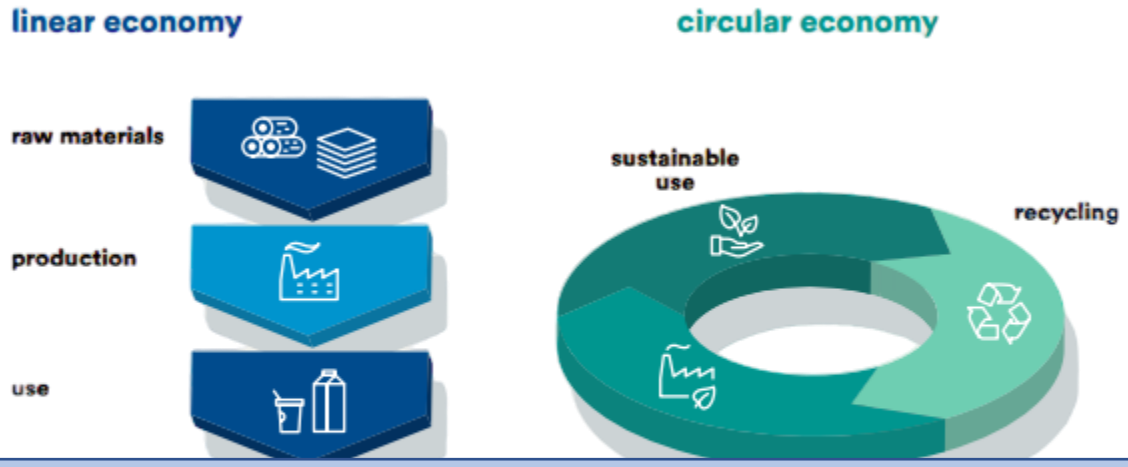

EXPLANATORY NOTE

The current new economy model, based on "take, make and throw away", is unsustainable, and a change of model towards a circular economy is necessary.

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IMPORTANCE OF THE CIRCULAR ECONOMY

The construction sector in Europe has a major impact, both economically and environmentally.

Europe 2014 construction and use of buildings

50% of the materials extracted.

50% of the energy used.

25% of the water consumed.

25% of the waste generated.

C&DW is the largest waste stream in the EU in terms of mass (374 million tonnes in the EU-28, in 2016, excluding excavated soil). Data on C&DW generation, although not entirely credible, show that it has been relatively stable in recent years at the European level but that large variations in per capita generation exist across countries.

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IMPORTANCE OF THE CIRCULAR ECONOMY

Construction sector

+

CIRCULAR ECONOMY

→

Reduction **natural resources** and **environmental impact**

Competitive **economic** advantage

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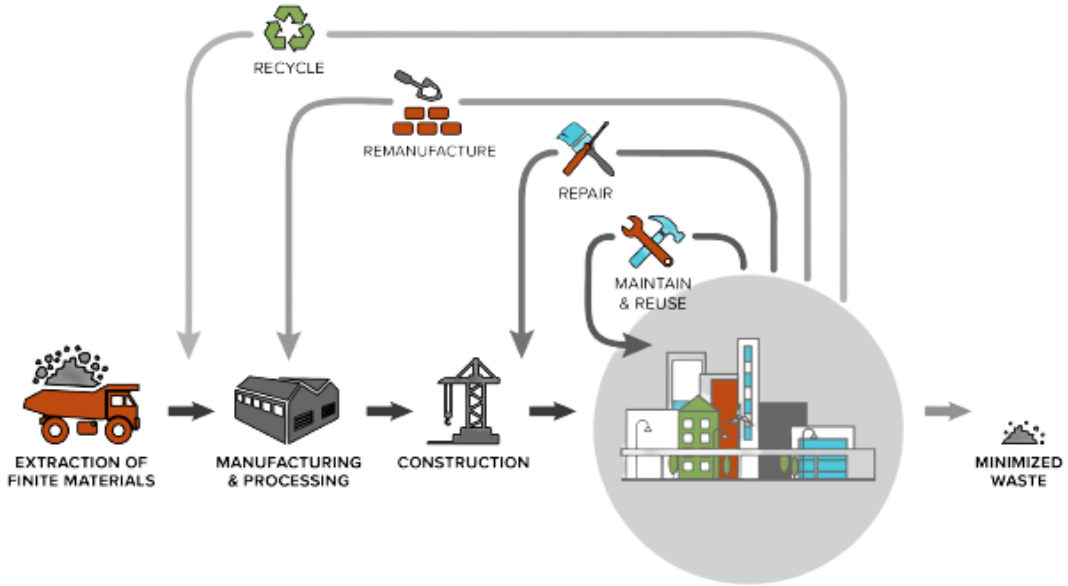
IMPORTANCE OF THE CIRCULAR ECONOMY

The transition of the construction sector towards a circular economy will not only imply a significant reduction of natural resources and environmental impact but will also mean an economic opportunity derived from competitive advantage, as well as a better restitution and regeneration of natural capital, if the necessary restoration processes are developed.



THE CIRCULAR ECONOMY AS APPLIED TO THE BUILT ENVIRONMENT

Source: https://hickokcole.com/ilab-microgrants/waste-less/

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DEVELOPMENTS IN THE CONSTRUCTION SECTOR

CONCEPTUAL FRAMEWORK OF THE CIRCULAR ECONOMY IN THE CONSTRUCTION SECTOR.

Life Cycle Approach to Construction, consider all aspects of the construction sector:

Processes

- Raw material extraction and production
- Planning and design
- Execution
- Use and maintenance
- Demolition at end of life
- Waste management

Agents

- Raw material extractors and manufacturers
- Technicians (engineers, architects, ...)
- Construction companies and developers
- Users
- CDW managers

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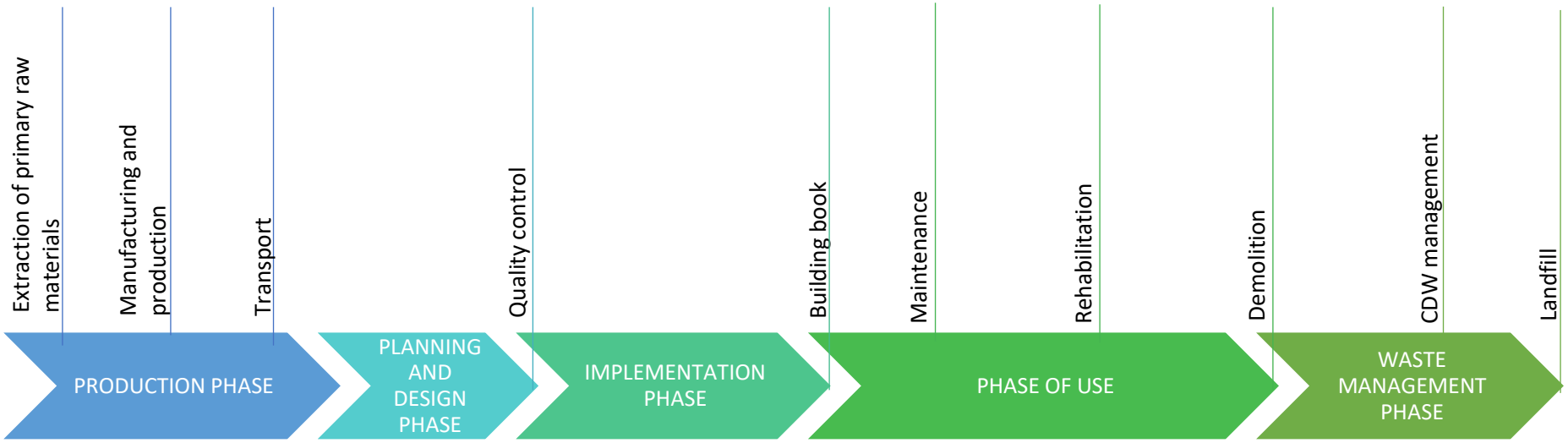
DEVELOPMENTS IN THE CONSTRUCTION SECTOR

Currently Construction sector → **LINEAR PROCESS**

At the end of the useful life of the construction, separation at source is NOT always carried out in demolition and a large amount of CDW ends up in landfill. There is NO transfer of information between professionals in each phase. This places the sector far from the circular economy model.



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DEVELOPMENTS IN THE CONSTRUCTION SECTOR

- The construction sector today, although it has some processes where materials, elements or flows are reused, is in general a linear process sector.
- Where cycle closure most commonly occurs during the production phase within the manufacture and production of building materials and/or components, but not between phases. At the end of the construction lifetime, the demolition process today does not result in a remarkable recovery rate of materials or components. Separation at source does not always exist and the management of CDW largely ends up in landfill. On the other hand, the transfer of knowledge and information between the professionals involved in each phase does not always exist. All of this means that the sector is currently far from having a model based on the circular economy.

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DEVELOPMENTS IN THE CONSTRUCTION SECTOR

Currently Construction sector → **LINEAR PROCESS**

To do this, the production phase and the planning and design phase must PREPARE what happens in the implementation phase.

Source:
https://www.supplychainschool.co.uk/topics/sustainability/waste-and-resource-efficiency/

The transfer of information and the joint work of the professionals involved in these three phases is essential.

New technologies such as BIM methodology in the sector

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DEVELOPMENTS IN THE CONSTRUCTION SECTOR

Currently Construction sector → **LINEAR PROCESS**

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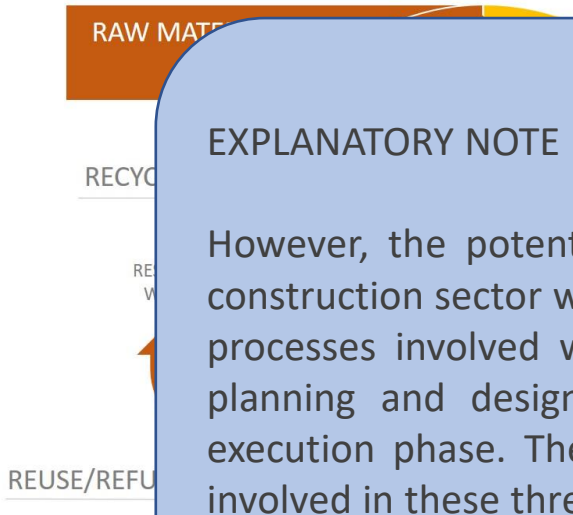
The transfer of information and the joint work of the



EXPLANATORY NOTE

However, the potential to achieve this model is enormous. In the near future, the construction sector will have to change its economic model and the different actors and processes involved will have to adapt. Schematically, the production phase and the planning and design phase must jointly prepare everything that happens in the execution phase. The transfer of knowledge and the joint work of the professionals involved in these three phases, as well as the supervision and regulation of the different administrations involved, are essential.

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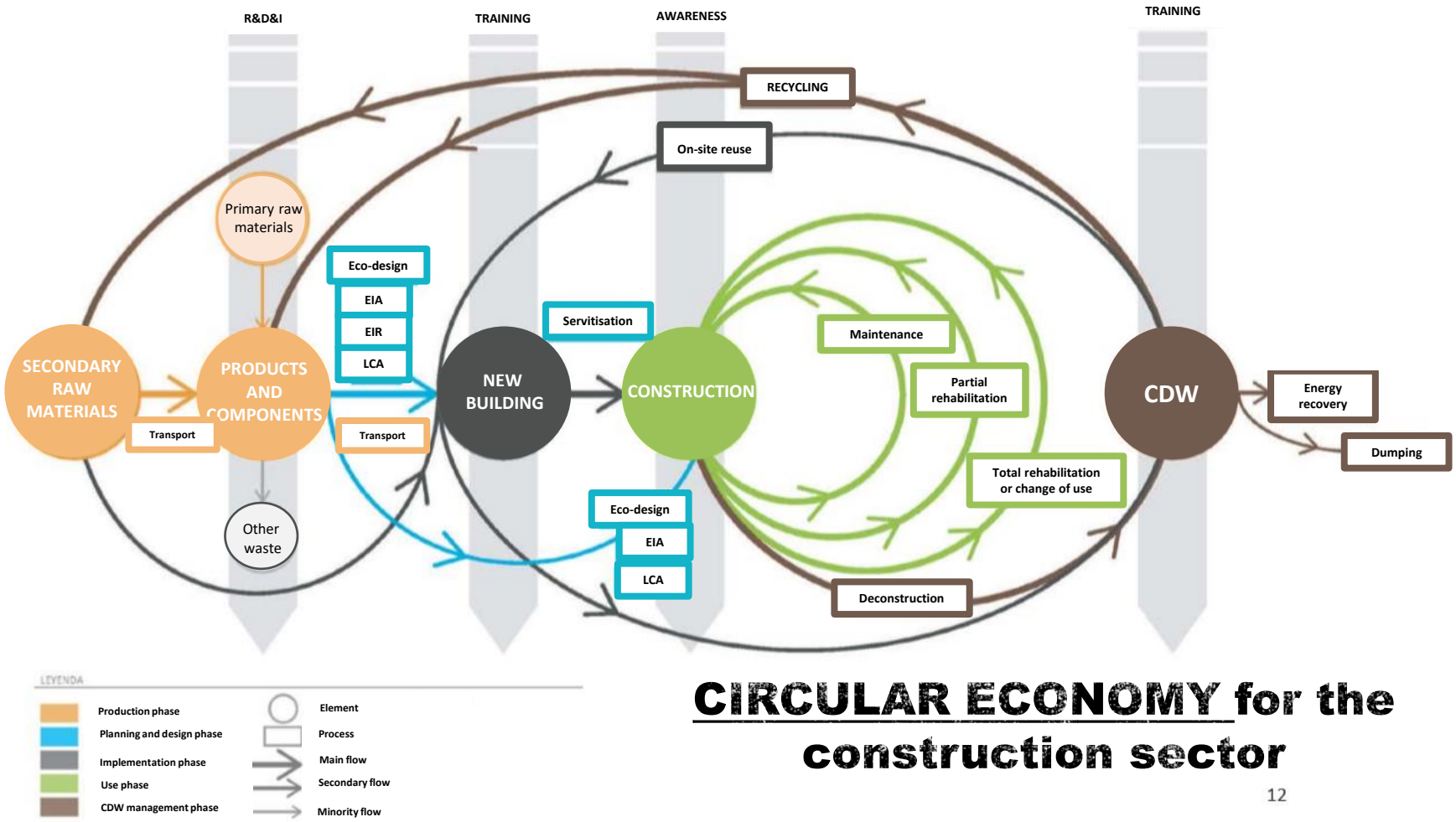
DEVELOPMENTS IN THE CONSTRUCTION SECTOR



CIRCULAR ECONOMY for the construction sector

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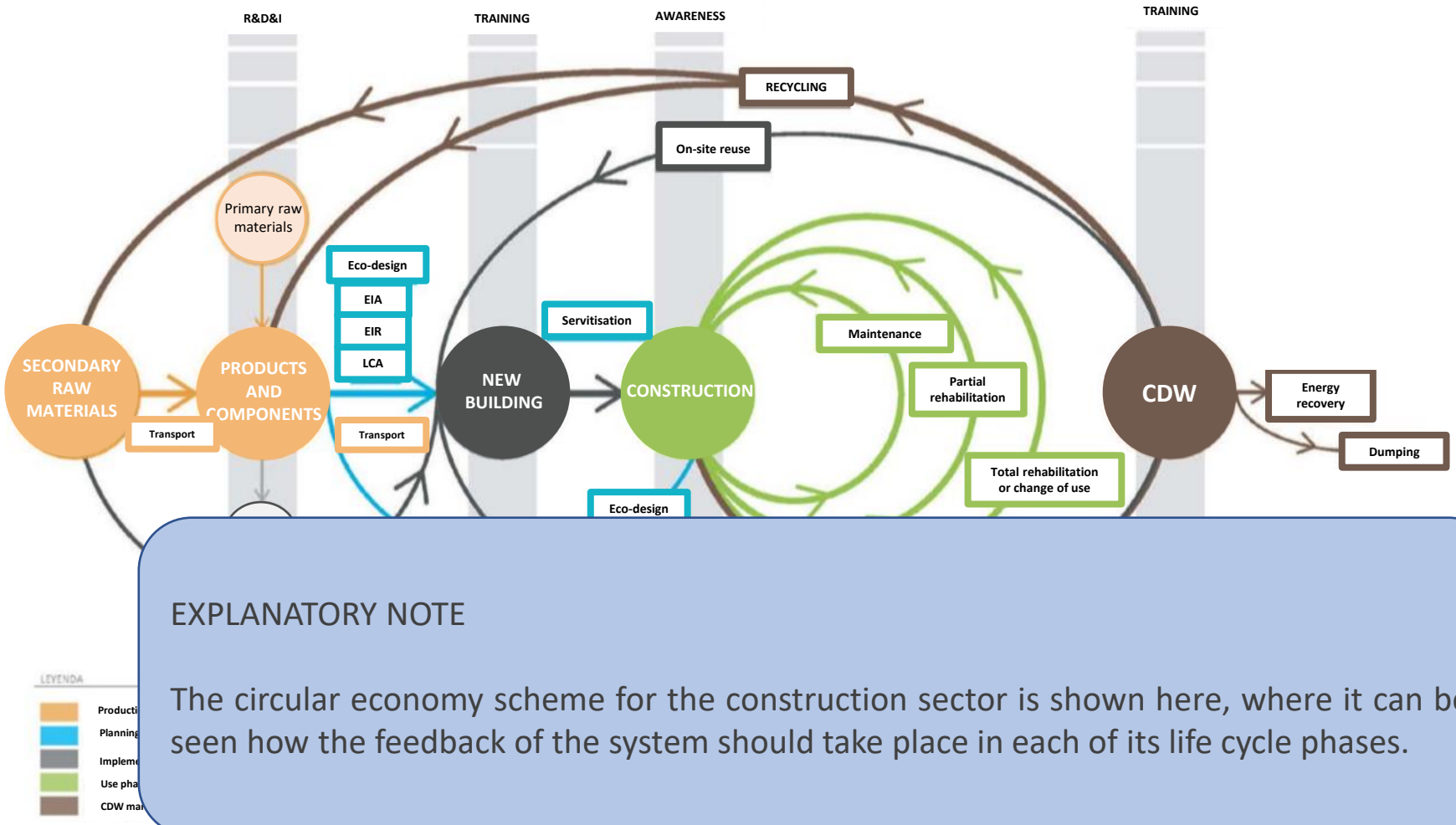
DEVELOPMENTS IN THE CONSTRUCTION SECTOR



EXPLANATORY NOTE

The circular economy scheme for the construction sector is shown here, where it can be seen how the feedback of the system should take place in each of its life cycle phases.

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DEVELOPMENT OF THE CIRCULAR ECONOMY IN CONSTRUCTION

CIRCULAR ECONOMY IN THE EUROPEAN COMMISSION

Circular Economy Action Plan (March 2020).

- Objective:

Measures that will be introduced under the new action plan aim 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 (35 actions).

- Acting on:

The different stages of the life cycle of products/services (design and production, consumption, waste management ...).

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DEVELOPMENT OF THE CIRCULAR ECONOMY IN CONSTRUCTION

TOWARDS A SPANISH CIRCULAR ECONOMY STRATEGY

European policies are transmitted and translated to Spain:

- Royal Decree 105/2008, of 1 February, regulating the production and management of construction and demolition waste.
- State Framework Programme for Waste Management PEMAR (2016-2020)
- Spanish Urban Agenda 2019
- . . .
- Spanish Circular Economy Strategy (Approved 2 June 2020).

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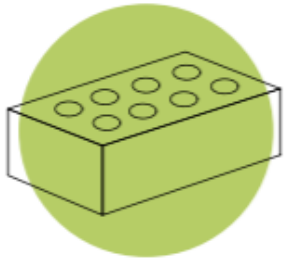
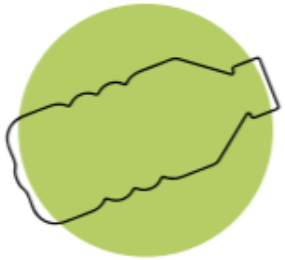
Objectives: Spanish Circular Economy Strategy Spain Circular 2030

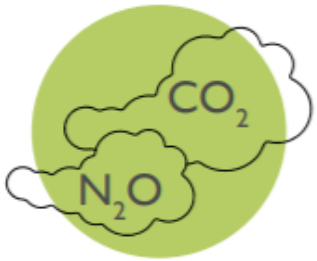
- **Reduce national material** consumption in relation to GDP by **30%,** using 2010 as a baseline year.



- **Reduce waste** generation by **15%** compared to 2010

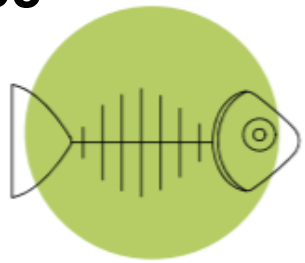


Reduce GHG emissions to below 10 thousand tonnes of CO_2 eq.



Improve water use efficiency by 10%.

- **Reduce food waste generation : 50%** reduction per capita at household level and retail consumption, and **20%** in production and supply chains from 2020 onwards.



Increase reuse and preparation for reuse to **10%** of municipal waste generated.

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EXPLANATORY NOTE

OBJECTIVES

It is estimated that our country needs more than two and a half times its surface area to supply the needs of our economy. In addition to the environmental impacts that this entails, the data demonstrate the inefficiency of the model and the aggravated dependence on the outside world, which makes our economy more dependent, vulnerable and less competitive.

Spain Circular 2020 sets the following targets for the year 2030:

- Reduce the national consumption of materials in relation to GDP by 30%, taking 2010 as a reference year.
- Reduce waste generation by 15% compared to 2010.
- Reduce food waste generation throughout the food chain: 50% reduction per capita at household and retail level and 20% reduction in production and supply chains from 2020 onwards.
- Increase reuse and preparation for reuse to 10% of municipal waste generated.
- Improve water efficiency by 10%.
- Reduce greenhouse gas emissions to below 10 million tonnes of CO2 equivalent.

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DEVELOPMENT OF THE CIRCULAR ECONOMY IN CONSTRUCTION

SPANISH CIRCULAR ECONOMY STRATEGY ESPAÑA CIRCULAR 2030

Six PRIORITY SECTORS: Although the Circular Economy Strategy is cross-cutting in nature, it identifies six priority sectors:

- Construction
- Agri-food
- Fisheries and forestry
- Industrial
- Consumer goods
- Tourism
- Textiles and clothing

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DEVELOPMENT OF THE CIRCULAR ECONOMY IN CONSTRUCTION

SPANISH CIRCULAR ECONOMY STRATEGY ESPAÑA CIRCULAR 2030

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- Construction
- Agri-food
- Fisheries and forestry
- Industrial
- Consumer goods
- Tourism
- Textile

EXPLANATORY NOTE

It is essential to take advantage of the opportunities offered by the circular economy to develop a Spanish industry focused on recycling.

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THE ROLE OF STAKEHOLDERS

INTERACTIONS BETWEEN ACTORS INVOLVED IN THE PROCESS:

High number of professionals from different areas of knowledge, belonging to **different sectors.**

Their **work** is **intertwined in different phases** of the **production process.**

Difficulties faced by **actors** during the **project** may be **caused** by the **intervention** of **another actor** at an earlier stage.

Ensure proper interaction between actors

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THE ROLE OF STAKEHOLDERS

INTERACTIONS BETWEEN ACTORS INVOLVED IN THE PROCESS:

High number knowledge

The **pro**

EXPLANATORY NOTE

The construction sector as such, brings together a very large number of professionals from different areas of knowledge who, in many cases, belong to different sectors, e.g. engineers and industrialists.

Their work is intertwined at some points in the construction process, but not all of them are in direct contact as they belong to different phases of the process (e.g. users and managers of CDW), however, the difficulties faced by the agents during the project may be caused by the intervention of another agent in a previous phase. Also, the opportunities of each sector and/or stakeholder may have repercussions for others at a later stage.

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THE ROLE OF STAKEHOLDERS

MAIN ACTORS INVOLVED:

- Raw material extractors
- Manufacturers
- Technicians (engineers, architects, ...)
- Construction companies
- Development companies
- Users
- CDW managers

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THE ROLE OF STAKEHOLDERS

Raw material extractors

- The extraction of raw materials used in construction is made up of different industries such as forestry and mining.
- The importance of these industries is indisputable, as they are the first agents to extract, manage and transform very valuable resources such as aggregates and wood.
- Inadequate management produces serious environmental consequences such as increased scarcity of resources, pollution, landscape impacts, ...

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THE ROLE OF STAKEHOLDERS

Manufacturers:

Heterogeneous industrial conglomerate, involved in the manufacturing process of all the elements and components used during the construction process of both buildings and infrastructures, as well as those used during the useful life of the constructions.

Two main groups of manufacturers can be distinguished:

- Manufacturers of materials
- Component manufacturers

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THE ROLE OF STAKEHOLDERS

Manufacturers:

- Manufacturers of materials: of natural or synthetic origin. Flooring and cladding (tiles, paints, plasters, rubbers, vinyls, terrazzo, boards, etc.); precast concrete structural elements; enclosures; insulation; sheets; cables; etc.
- Component manufacturers: finished elements to be installed on site such as carpentry; sanitary ware; lighting; piping; installation panels or even furniture and ornamental elements.

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THE ROLE OF STAKEHOLDERS

Manufacturers:

Eco-design is key to the evolution and adaptation of these industries to sustainable production processes.

What do they need to do?

- Introduce new technologies in the design and manufacturing process.
- Use recycled materials in their processes

How?

- With verifiable tools to communicate environmental indicators in the life cycle, such as EPDs.

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THE ROLE OF STAKEHOLDERS

Technicians (engineers, architects, ...):

All technical professionals involved throughout the construction cycle → without distinction.

Why?

- Because the teams that carry out projects, both in construction and in other sectors, are multidisciplinary.

How to make the construction process sustainable?

- The technicians (each from their own approach) must receive common training in circular economy and sustainability.
- The joint work of the different technicians allows the sector to close cycles, optimise resources and make progress in environmental matters.

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THE ROLE OF STAKEHOLDERS

Construction companies:

Key actor in decision-making on the origin and destination of materials and waste.

Why?

- The circular economy will be key to reducing costs and improving the construction process.

How?

- By including Corporate Social Responsibility (CSR) tools in its processes.

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THE ROLE OF STAKEHOLDERS

Development companies:

Agent in charge of promoting and managing building works in order to sell them or manage their use.

Why are they important in the circular economy?

- Bridging agent between the agents in the construction process (technicians, construction companies, operators, etc.) and end users.
- Adaptation of their business model to the change in society's mentality, which will demand more sustainability in buildings.

How?

- Fundamental role, to ensure a sustainable and environmentally friendly process, as they have the power to demand quality standards for materials and processes.

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THE ROLE OF STAKEHOLDERS

Users:

Citizens who live, work or use the building stock → must play a greater role in the development of a circular economy in the construction sector:

Why?

- They should be aware of building maintenance and renovation work to increase durability and minimise resource consumption.

How?

- When carrying out maintenance and refurbishment work, they must be advised (technicians, contractors, etc.) to make decisions based on circular economy criteria: energy efficiency, secondary raw materials, CDW management, etc.

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THE ROLE OF STAKEHOLDERS

CDW managers:

CDW → one of the most important waste streams in Europe.

Why?

- Because of its high production rate per capita and the technical and economic feasibility of recycling it.
- Due to its high volume, it represents approximately one third of all waste generated in the EU.

How?

- By ensuring the correct management of CDW, 80% by weight, materials of stone origin, and are the basic raw material for Recycling Plants to produce aggregates and recycled materials for the construction sector.

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CHALLENGES AND BARRIERS

To ensure the development of the circular economy in the sector, the actors involved must overcome a number of challenges at each stage of the life cycle of the construction process.

- Extraction of raw materials
- Production
- Planning and design
- Execution
- Use, maintenance and refurbishment
- Demolition at end of life
- CDW management

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CHALLENGES AND BARRIERS

Extraction of raw materials:

First phase of the cycle → key to ensure the circular economy

What should be done?

- The correct selection of materials (quality, durability, ...), ensures the reduction of the impact on the life cycle, as it contributes to the first principle of waste management: prevention.
- Ensure the use of 100% recyclable materials after the demolition or deconstruction process.

Challenge:

- Development of exploitation projects that must be approved by the mining and environmental administrations, including a section on how the backfilling of spaces degraded by the extractive industry is carried out.

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CHALLENGES AND BARRIERS

Production:

Design and creation of construction products is a key step as it conditions the application of circular economy criteria.

What should be done?

- It is necessary to promote eco-design, to generate more sustainable products, considering all environmental variables (energy consumption, CO2 emissions, durability, reuse, etc.).

Challenge:

- Lack of acceptance of new materials from secondary raw materials.

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CHALLENGES AND BARRIERS

Planning and design:

This is a fundamental decision-making stage that conditions the entire construction process → will determine the implementation of many of the circular economy measures.

What should be done?

- Apply eco-design principles to construction, both in new construction and renovation:
  - ✓ High durability and quality
  - ✓ Easy to maintain
  - ✓ Repairable
  - ✓ Refurbishment
  - ✓ Flexibility of use: reconversion to another use
  - ✓ Deconstructable: selective demolition for reuse and recycling of components
  - ✓ High performance (intensity of use, no empty spaces), high comfort, low consumption

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CHALLENGES AND BARRIERS

Planning and design:

Challenge:

- Promote the application of life cycle analysis (LCA) in accordance with International Standards ISO 14040 and ISO 14044 in construction, applying the reference standards for products (EN 1580419) and building (EN 1597820).
- Design to facilitate maintenance, for this purpose it is necessary to integrate the life cycle vision and the global cost of the building, assuming from the project the activities of use, operation and maintenance that the building will require.
- Incorporate design criteria for deconstruction in the project phase, applying models of demountable buildings, which favours the reuse of components.
- Incorporate circular economy criteria in the sector's legislation, especially in the Technical Building Code (CTE).

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CHALLENGES AND BARRIERS

Planning and design:

Challenge:

- Incorporating new technologies into design processes in the sector, such as BIM methodology, which allows for collaborative work between professionals and generates greater efficiency in the design process, which can be an important opportunity. There is also simulation software such as DesignBuilder, Ecotect, EnergyPlus, OpenStudio, etc. that allow valuable calculations to be made to improve the design.
- Lack of design criteria and/or knowledge to achieve nearly zero energy buildings.
- It is considered necessary to support with funding or promote incentives in eco-design.

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CHALLENGES AND BARRIERS

Execution:

The phase of the cycle that generates most waste, grouped into two chapters → excavated soil and CDW

What should be done?

- Waste management and quality control and management of the process leading to reduce materials, reuse on site, avoid cost overruns in time, materials, energy, water or economic, etc.

Challenge:

- With Law 22/2011 on Waste, clean soils (managed until then as reuse) are again considered waste when they are not reused in situ.
- Fate of CDW uncertain, more and more treatment plants, there are still places where the only alternative is landfill.
- Reuse of CDW in situ, restricted due to the interpretation of the communities of art. 9 RD 105/2008, obliging the construction company to register as an authorised manager, impossible for the purposes of the execution deadline.

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CHALLENGES AND BARRIERS

Use, maintenance and refurbishment:

Key step → maintain resources for as long as possible

MAINTENANCE

What should be done?

- To promote general awareness of the need, importance and benefits of a good maintenance system.

Challenge:

- To ensure compliance with owners' obligations on building maintenance and conservation, through inspection of preventive maintenance operations and rehabilitation actions listed in the building book.
- Encourage a change in society's mentality towards maintenance operations and understand that the costs associated with these operations are ultimately beneficial.

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CHALLENGES AND BARRIERS

Use, maintenance and refurbishment:

Key step → maintain resources for as long as possible

REFURBISHMENT

What should be done?

- Apply different circular economy criteria in the building stock:
  - ✓ Increasing the durability of products
  - ✓ Use fewer natural resources
  - ✓ Efficient use of resources
  - ✓ Efficiency in the useful life of the building (energy, water, etc.).
  - ✓ Redesigning the building to make it more modular and repairable
  - ✓ Reuse of building components
  - ✓ Introduction of renewable or recycled materials
  - ✓ Criteria for identifying, classifying and managing waste correctly.

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CHALLENGES AND BARRIERS

Use, maintenance and refurbishment:

Key step → maintain resources for as long as possible

REFURBISHMENT

Challenge:

- Apply circular economy criteria in calls for rehabilitation grants and in technical specifications in public tenders.
- Encourage the use of reused or recycled products, given that there is currently no advantage over new components.
- Consider VAT exemption for recycled products.
- Increase the knowledge and training of professionals in this area.

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CHALLENGES AND BARRIERS

Demolition at end of life:

Last phase of the cycle → depends on the previous phases

What should be done?

- For this selective dismantling or demolition to be possible, it is necessary that in the previous phases, this point has been taken into account.

Challenge:

- To achieve total selective demolition; that the end of the useful life of a building can mean its dismantling into parts or elements that can be separated at source and managed to achieve high recycling or recovery rates.

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CHALLENGES AND BARRIERS

CDW management:

What should be done?

- Increase demand for materials from CDW.
- Increase cooperation throughout the life cycle of CDW.
- Move towards harmonised European markets for recycled construction and demolition materials.
- Generate reliable statistics on construction and demolition waste in the EU.
- Reducing environmental impacts and contributing to resource efficiency.

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CHALLENGES AND BARRIERS

CDW management:

Challenge:

- Lack of control and monitoring

The regional and local administrations, which are responsible for the control and monitoring of waste, do not have sufficient resources to carry out adequate surveillance. As a result:

✓ Numerous uncontrolled illegal discharges are produced, coming from minor works, repairs, rehabilitation works, etc., sometimes with hazardous waste content, and without the possibility of identifying those responsible for the discharges.

✓ Difficulty on the part of local authorities to carry out municipal control of minor domestic repair work, whether carried out by professionals or private individuals.

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CHALLENGES AND BARRIERS

CDW management:

Challenge:

- Clean points. Reconfiguration

The clean points only collect waste from household repairs carried out by users, but not by professionals.

✓ It is proposed to increase the collection of CDW from minor works, thus avoiding illegal dumping.

✓ It is considered whether it is possible to increase the level of reception of this type of waste and to allow professionals to take the CDW, up to certain limits and taking responsibility for the total costs of management.

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CHALLENGES AND BARRIERS

CDW management:

Challenge:

- Figures of by-product and End of Waste Status.

According to Law 22/2011, of 28 July, on waste and contaminated soils:

Article 4. By-products.

Substance or object, resulting from a production process, may be considered as a by-product and not as waste, when the following conditions are met:

a) That it is certain to be used subsequently.

(b) It can be used directly without further processing.

c) It is produced as an integral part of a production process.

(d) the use complies with all relevant requirements relating to the protection of human health and the environment.

The waste coordination committee shall evaluate the consideration of these substances or articles as by-products.

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CHALLENGES AND BARRIERS

CDW management:

Challenge:

- Figures of by-product and End of Waste Status.

According to Law 22/2011, of 28 July, on waste and contaminated soils:

Article 4. End of waste status.

Specific criteria may be established so that certain types of waste that have been subjected to a recovery operation may cease to be considered as such. The substances or objects concerned shall be counted as recycled and recovered waste. Provided that

(a) The resulting substances or objects are in regular use; and

(b) There is a demand for the substances or objects in question

(c) they meet the technical requirements for specific purposes, existing legislation and applicable standards

d) Their use does not generate environmental or health impacts.

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CHALLENGES AND BARRIERS

CDW management:

Challenge:

- By-product figures and End of Waste Status

✓ In order to consider a substance or object as a by-product, all conditions of Article 4 must be fulfilled simultaneously. Currently not many applications have been approved and many dossiers are still pending.

✓ No procedure is foreseen for individuals to apply for end-of-waste application, as is the case for by-products. The Ministry prioritises waste streams with the highest environmental relevance. There are currently few Ministerial end-of-waste orders approved.

✓ The administrative difficulty for the development of these figures generates a barrier identified in the sector that must be analysed with the competent administrative body.

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CHALLENGES AND BARRIERS

CDW management:

Challenge:

- Implementation of the EU CDW Management Protocol.

Objective: to increase confidence in the CDW management process, as well as confidence in the quality of recycled materials from both activities.

Phases:

a) Waste identification, source separation and collection.

b) Waste logistics

c) Waste processing

d) Quality management

e) Appropriate framework conditions and policies

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CHALLENGES AND BARRIERS

CDW management:

Challenge:

- Implementation of the EU CDW Management Protocol.

a) Identification of waste, separation at source and collection.

- It is essential that the waste management plan identifies the type, quantity and quality of waste, indicating the appropriate location, separation at source and management of each type of waste, with special attention to hazardous waste.
- Appropriate application of the waste hierarchy, identifying those that can be reused, those that can be recycled and those that must be disposed of (recovery or, as a last resort, landfill).

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CHALLENGES AND BARRIERS

CDW management:

Challenge:

- Implementation of the EU CDW Management Protocol.

b) Waste logistics

- Adequate transparency and traceability of waste, providing the necessary documentation, improving logistics, optimising distances and transport systems (information technologies help in this task in addition to the use of transfer centres), guaranteeing the integrity of the materials (with adequate storage and safe transport).

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CHALLENGES AND BARRIERS

CDW management:

Challenge:

- Implementation of the EU CDW Management Protocol.

c) Waste processing

- Follow the application of the waste hierarchy, preparing for reuse and applying the different options for recycling, both on-site and off-site, recovery or recovery of both material and energy before landfilling.

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CHALLENGES AND BARRIERS

CDW management:

Challenge:

- Implementation of the EU CDW Management Protocol.

d) Quality management

- A key step in increasing confidence in the CDW management process and confidence in the quality of the recycled materials. It should be applied at all stages of identification, source separation, waste collection, storage, transport and waste treatment.

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CHALLENGES AND BARRIERS

CDW management:

Challenge:

- Implementation of the EU CDW Management Protocol.

e) Appropriate framework conditions and policies

- Reference is made to an adequate regulatory framework, building permits and licences, integrated waste management strategies, applications of restrictions, public procurement, etc.

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CHALLENGES AND BARRIERS

GENERAL CHALLENGES

- The need to provide an information system that collects and transparently transmits the sector's circularity data.
- Lack of data at many stages of the life cycle, such as: materials used, proportion, volume represented, industries or companies that generate by-products, data on waste production and management, use of reused or recycled material, etc.
- Loss of waste traceability due to the proliferation of illegal dumping will require improvements in waste management protocols, control and monitoring measures and exemplary measures for illegal practices.
- Improve harmonisation of data collection at state level, harmonising the autonomous systems.

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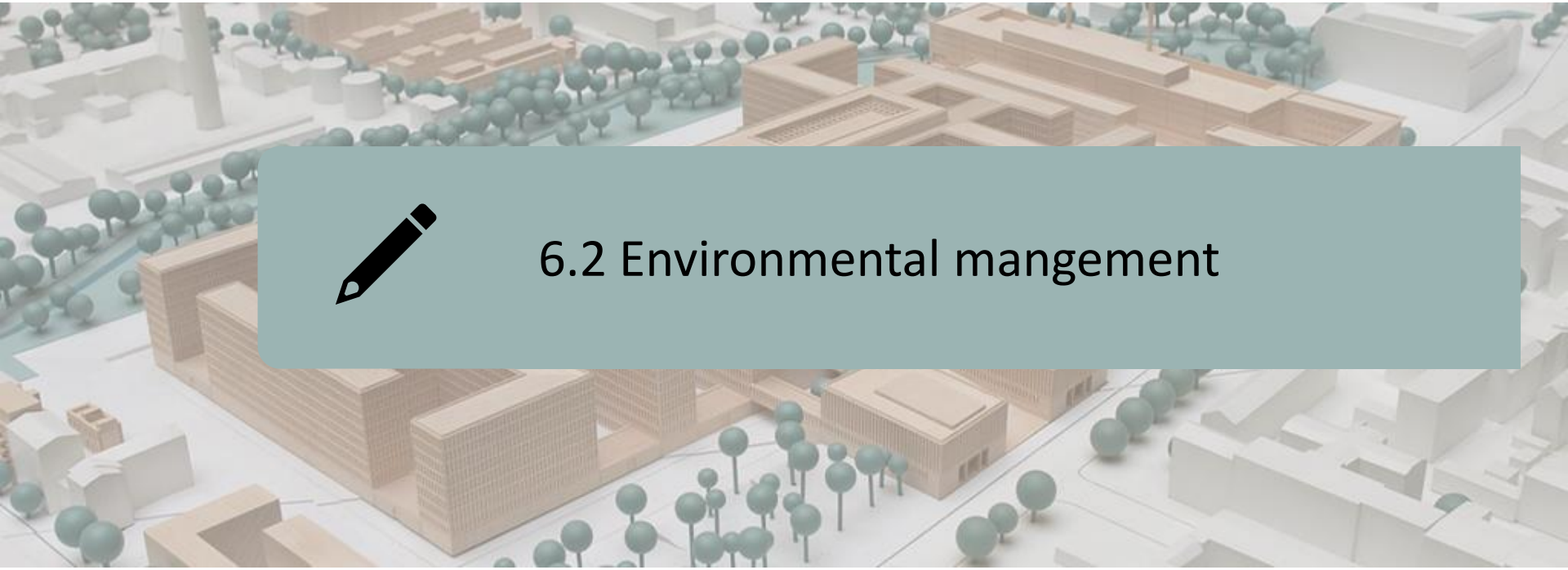

6.2 Environmental mangement

INTRODUCTION

STAGES OF IMPLEMENTATION

GOOD PRACTICES OF THE ACTORS IN THE PROCESS

WASTE MANAGEMENT PLAN

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INTRODUCTION

Waste produced in construction and demolition works (CDW) is seen by the Administrations as an environmental problem, due to the fact that its normal destination has been disposal, through its deposit in landfills that are not always controlled, sometimes appearing in areas of high environmental value, in watercourses, etc.

However, this type of waste can be reused and/or recovered in very high percentages, ceasing to be waste and becoming a resource, with the simple application of separation and classification operations in the works where it is produced, favouring its destination to treatment plants.

Proper environmental management contributes to a reduction in costs and, consequently, to an increase in the company's economic benefits.

Environmental management in construction ranges from the initial design, including the choice of the building site, through the choice of materials and the construction processes of the various trades involved, to the energy consumption of the finished building.

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INTRODUCTION

Of all the criteria that allow us to set the aforementioned objectives, we can focus on the following:

- Land and surroundings:
  - Where it is to be built and degree of construction.
  - Affections during the work and the useful life of the building.
- Materials:
  - Extraction of raw materials and elaboration process.
  - Waste generated.
  - Possibility of reuse and recycling.
- Water: use and discharges:
  - During the extraction and/or elaboration process of raw materials.
  - During the building construction process.
  - During the period of use and maintenance.

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INTRODUCTION

Of all the criteria that allow us to set the aforementioned objectives, we can focus on the following:

- Energy: sources and consumption:
  - During the extraction and/or processing of raw materials.
  - During the transport of materials to the construction site.
  - During the construction process.
  - During the transport of waste by the waste manager.
  - During the period of use and maintenance.
- Climate: how the implementation of the project may affect climate change (taking into account the above factors).

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STAGES OF IMPLEMENTATION

GENERAL CHALLENGES

Due to the large number of environmental aspects that may come into play in a construction project, it is necessary to set a series of prior objectives whose fulfilment can be verified throughout the entire process: from the drafting of the initial project to the foreseen use of the building, as well as the maintenance and conservation tasks of the projected work.

- PROJECT PHASE
- CONSTRUCTION PHASE
- USE, CONSERVATION AND MAINTENANCE PHASE
- DECONSTRUCTION PHASE

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GOOD PRACTICES OF THE ACTORS IN THE PROCESS

GOOD PRACTICES FOR THE DEVELOPER

From the very beginning of the development, it is necessary to consider the need to introduce the necessary elements and mechanisms so that the project starts with the premises of waste reduction and optimisation of efficiency in energy consumption, as well as the minimisation of emissions that the building will have.

The developer's fundamental task will be to transmit this vision to the designer and, subsequently, to involve the builder.

Nor should it be forgotten that, as the owner of the building that will be destined for clients, he will have to pass on to them all the information regarding waste, consumption and emissions.

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GOOD PRACTICES OF THE ACTORS IN THE PROCESS

GOOD PRACTICES FOR THE PROJECT DESIGNER

As a starting point, the guidelines established by the developer for the project should be transferred, the objective of which is to minimise the generation of waste, while also facilitating the reuse and/or recycling of waste.

On the other hand, there are specific issues that can be applied to practically all projects:

- Optimised calculation of structures and design in general.
- Limiting the use of certain chemical substances that are potentially hazardous to the environment.
- Encourage the use of large-format prefabricated elements.
- Opting for dry assembly whenever possible.
- Choosing sustainable and/or reused materials.

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GOOD PRACTICES OF THE ACTORS IN THE PROCESS

BEST PRACTICE IN SITE MANAGEMENT

Site management is probably the agent that can do the most during the construction process to minimise the harmful effects on the environment, while at the same time reducing the cost of the work (there is a direct cost associated with the management of the waste generated).

The Site Manager has to design/maintain the Waste Management Plan, which defines the means that will be needed to carry out an efficient management, and includes the way of recovering the waste from the site (reuse, recycling or delivery to a waste manager).

A Waste Management Plan will be necessary, where the type of waste that will be generated in each work execution item, as well as the estimated quantities that will be generated of each one, will be collected.

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GOOD PRACTICES OF THE ACTORS IN THE PROCESS

BEST PRACTICE IN SITE MANAGEMENT

He is also responsible for transmitting to the rest of the site personnel the guidelines to be followed for each phase of the work:

- optimise the use and application of materials;
- minimise the amount of waste on the site;
- determine the routes of the machines in the supply of materials and the collection of waste.

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GOOD PRACTICES OF THE ACTORS IN THE PROCESS

GOOD PRACTICES OF THE SITE FOREMAN

This is the person who ensures that all those involved on the site are aware of their obligations with regard to the management of the waste they generate, transmitting the orders of the Site Management.

In addition, he must ensure that subcontractors and site personnel comply with their obligations in this respect.

In order to achieve the necessary awareness and involvement of all those involved, he must make them aware of the advantages of optimising the resources used and reducing the waste generated.

It is a matter of using materials rationally, avoiding unnecessary breakages or cuttings, etc.

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GOOD PRACTICES OF THE ACTORS IN THE PROCESS

GOOD PRACTICES FOR CONTRACTORS, SUBCONTRACTORS AND SITE PERSONNEL

Contractors and subcontractors must be responsible for the waste they generate, for which it is necessary to coordinate work sequentially, with a trade not entering a site before the previous one has been completed. This avoids mixing the waste generated by different subcontractors and facilitates management.

All the companies involved are obliged to know and comply with the instructions received on environmental matters, with the same degree of commitment as with those relating to the construction process itself.

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WASTE MANAGEMENT PLAN

Due to the almost daily variation of the processes that take place on a construction site, given that each type of process will generate a type of waste and in variable quantities, only with an initial programming and planning of the management of such waste can we anticipate them and achieve an efficient reduction. This programming must be set out in the Waste Management Plan, which is mandatory.

It is necessary to establish a method that makes it possible to foresee, before starting the work, which processes will give rise to waste, and how to minimise and manage them, reducing the economic and environmental cost involved.

This Plan will have a clear structure and will describe the actions to be carried out at each stage of the process in order to achieve the objective set (waste minimisation and management), which will be dealt with in the following modules.

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6.3 BIM document management

BASIC CONCEPTS

BIM DOCUMENT MANAGEMENT STANDARDS

THE BIM PROCESS

DESCRIPTION OF THE BIM PROCESS

AGENTS INVOLVED IN THE BIM WORKFLOW

THE COLLABORATIVE ENVIRONMENT

BIM EXECUTION PLAN

INFORMATION MANAGEMENT DURING THE DEVELOPMENT PHASE

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BASIC CONCEPTS

Building models with BIM information enable the following:

- Support investment decisions, comparing functionality, scope and costs of solutions.
- Comparative analysis of energy and environmental requirements, to choose design solutions and targets for subsequent monitoring of the use of the building and its services.
- Design visualisation and construction feasibility studies.
- Improved quality processes and data exchange to make the design process more effective and efficient.
- Use of building project data during construction, operation and maintenance operations.

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BIM DOCUMENT MANAGEMENT STANDARDS

- **EN ISO 19650-1:2018.** **In force**

Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) - Information management using building information modelling - Part 1: Concepts and principles (ISO 19650-1:2018)

- **EN ISO 19650-2:2018.** **In force**

Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) - Information management using building information modelling - Part 2: Delivery phase of the assets (ISO 19650-2:2018)

- **EN ISO 19650-3:2021.** **In force**

Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) - Information management using building information modelling - Part 3: Operational phase of the assets (ISO 19650-3:2020)

- **ISO/CD 19650-4.** **Under development**

Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) — Information management using building information modelling — Part 4: Information exchange.

- **EN ISO 19650-5:2020.** **In force**

Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) - Information management using building information modelling - Part 5: Security-minded approach to information management (ISO 19650-5:2020)

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BIM DOCUMENT MANAGEMENT STANDARDS

EN-ISO 19650 SERIE

The EN-ISO 19650 series is a set of international standards that define the framework, principles, and requirements for the acquisition, use and management of information in projects and assets, both building and civil engineering, throughout their entire life cycle, and is primarily intended for:

- Agents involved in the design, construction and commissioning phases of built assets, which in this document and in accordance with ISO we refer to as the development phase.
- Actors involved in activities related to asset management, including operation and maintenance, which in this document and in accordance with ISO we refer to as the operation phase.

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BIM DOCUMENT MANAGEMENT STANDARDS

- **EN ISO 19650-1:2018. In force**

Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) - Information management using building information modelling - Part 1: Concepts and principles (ISO 19650-1:2018)

This document provides recommendations for defining an information management framework that includes sharing, recording, version control and organising all actors.

It applies to the entire lifecycle of any built asset, including strategic planning, initial design, engineering, development, documentation and construction, daily operations, maintenance, rehabilitation, repair and end-of-life.

It can be adapted to assets and projects of any scale and complexity, so as not to hinder the flexibility and versatility that characterise the wide range of potential markets and to cover the cost of implementing this standard.

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BIM DOCUMENT MANAGEMENT STANDARDS

- **EN ISO 19650-2:2018. In force**

Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) - Information management using building information modelling - Part 2: Delivery phase of the assets (ISO 19650-2:2018)

This document specifies the requirements for information management, in the form of a management process, in the context of the asset development phase and the information exchanges within that phase, using BIM.

This document can be applied to all types of assets and all types and sizes of organisations, irrespective of the chosen acquisition strategy.

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THE BIM PROCESS

Before starting any action in which the BIM methodology is used for its development, the BIM team of the contract will be constituted, which will include the interested parties of the life cycle of the equipment, object of the contract, or who have some responsibility with it. The initial team will have to include, as a minimum, the agents involved in all the phases of the construction process, from the initial conceptualisation to its commissioning, i.e. the contract manager and the person responsible for its subsequent operation and maintenance. The rest of the specific agents of each one that have to participate in the different phases will be incorporated as soon as possible, as long as the contractual conditions allow it.

The purpose of this team will be to define the information requirements necessary to achieve the objectives set for the entire construction process of the equipment and to ensure compliance with them, both in terms of content and formats. Likewise, the BIM team will have to develop and implement a collaborative process between all the agents involved that guarantees the transfer of accurate and consistent information in each of its phases and between them in order to achieve greater efficiency throughout the construction process.

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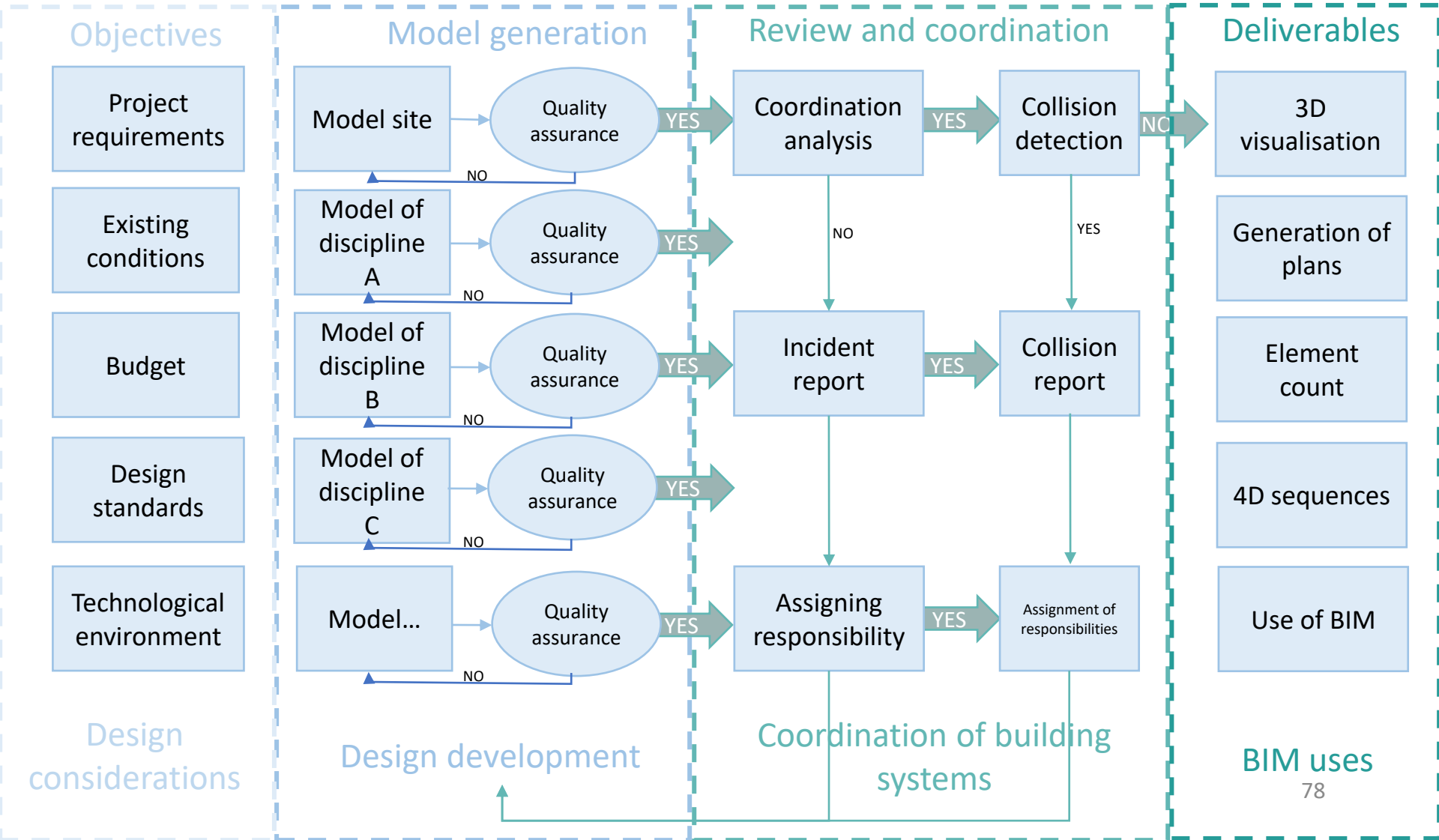
THE BIM PROCESS



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DESCRIPTION OF THE BIM PROCESS

The BIM process shall include at least the following activities:

1. The contracting party (e.g. the developer) and the contracted party (e.g. the project management) shall clearly define the level of development of the BIM objectives in the contract.

2. The contracted party will designate a BIM manager who will be responsible for drawing up the corresponding BIM Execution Plan, where the BIM standards to be followed in the development of each of the phases to achieve the objectives of the contract will be established.

3. The different agents involved in each of the phases will generate their corresponding discipline models (for example, in the project phase, the models of structures, installations, etc.). The review of these models will be the responsibility of the respective discipline BIM coordinators in order to ensure the quality of the information contained, both graphical and non-graphical, before sharing it with the rest of the contract agents.

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DESCRIPTION OF THE BIM PROCESS

The BIM process shall include at least the following activities:

4. The BIM manager will integrate the shared discipline models for coordination and collision detection. In the coordination meetings between all the agents, scheduled in the BEP, the BIM manager will assign the resolution of incidents to the corresponding BIM coordinators. These review activities are carried out using IFC open format models. As a summary of the coordination and collision management tasks, the BIM manager will prepare the final model report of each phase to give traceability to the decisions taken.

5. As a result of the previous process, and once the approval of those responsible for the contract has been obtained, the BIM team will have the BIM models of the contract, which may be for the Project, Construction, Work executed and/or operation and maintenance, depending on the phase in which the contract is being developed.

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DESCRIPTION OF THE BIM PROCESS

The BIM process shall include at least the following activities:

4. The BIM manager will integrate the shared discipline models for coordination and collision detection. In the coordination meetings between all the agents, scheduled in the PEB, the BIM manager will assign the resolution of incidents to the corresponding BIM coordinators. These review activities are carried out using IFC open format models. As a summary of the coordination and collision management tasks, the BIM manager will prepare the final model report of each phase to give traceability to the decisions taken.

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EXPLANATORY NOTE

- BEP: The BEP document (BIM EXECUTION PLAN) // BIM EXECUTION PLAN is a contractual document, from which the Company/Promoter requires its collaborators, subcontractors and internal team to plan, standardise and guarantee the development of each process and phase of a BIM Project.
- BIM Discipline Model: BIM documentation generated by each technical discipline.

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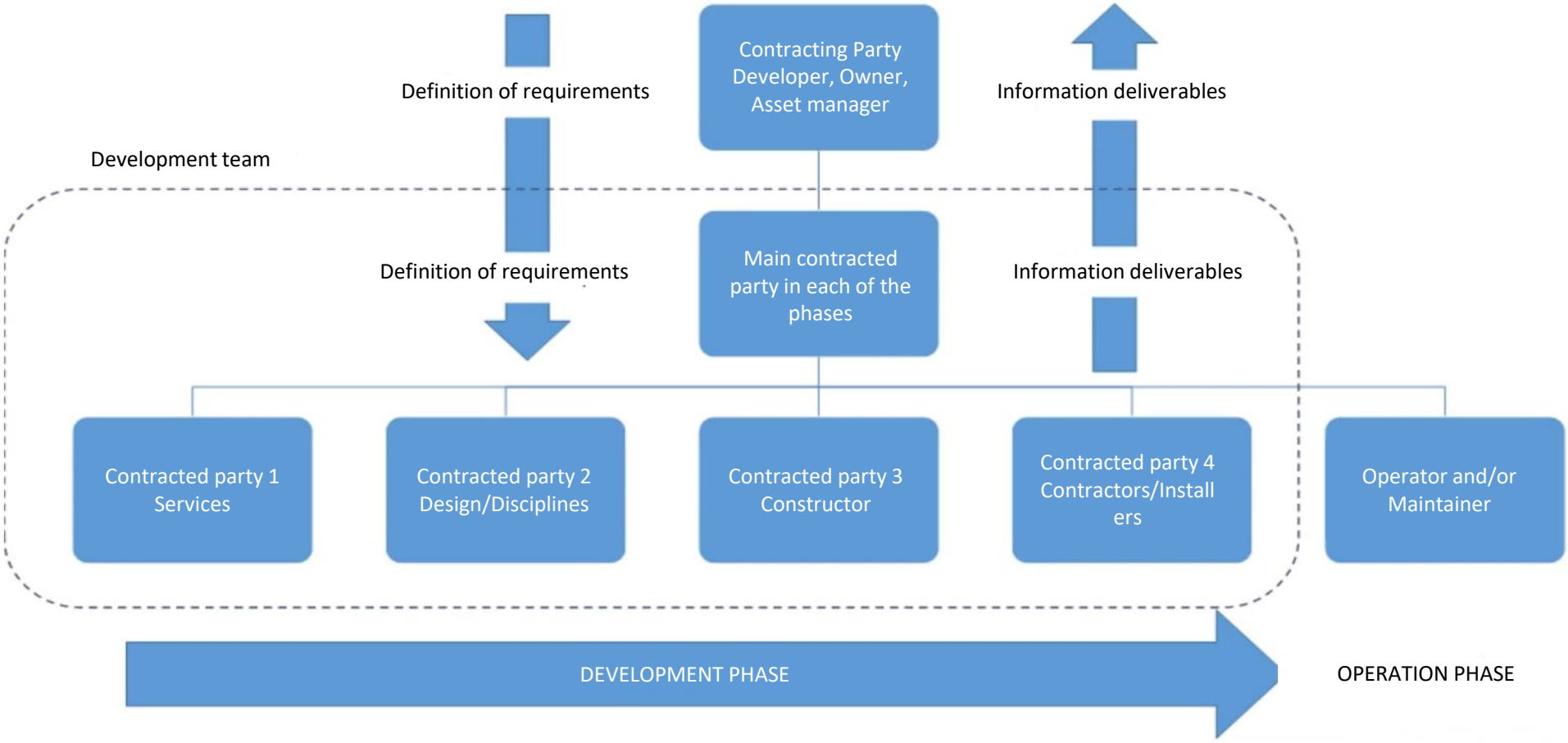
AGENTS INVOLVED IN THE BIM WORKFLOW



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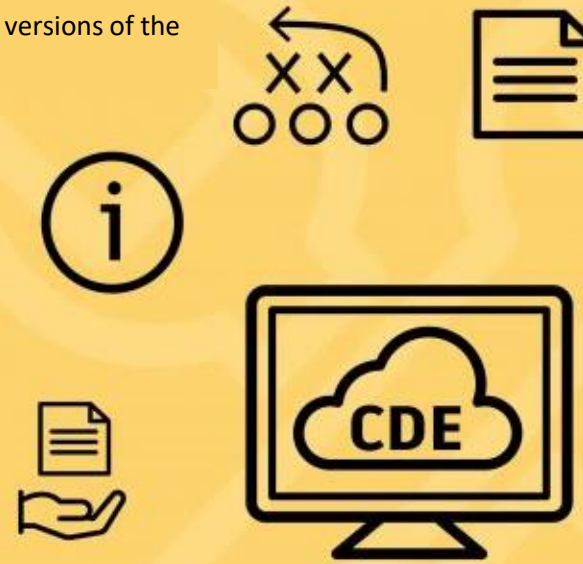
THE COLLABORATIVE ENVIRONMENT

The Collaborative Environment (CDE) allows for structured information management and the exchange of data and documents in a BIM project.



Control of the different versions of the project

Integrated workflows in document management

Share, consult and obtain project information through files, change orders, tasks, etc.

Combination of IFC files and structured export in COBie format

Management of access to project documentation

Ease of information search through filters and tags

Sharing information through links

Allows retouching of rendered images in a CAD environment

Viewing and annotating files and models

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THE COLLABORATIVE ENVIRONMENT

The Collaborative Environment or CDE allows for structured information management and the exchange of data and documents in a BIM project.

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Integrated workflows in document management

Share, consult and obtain project information through files, change orders, tasks, etc.

Combination of IFC files and structured export in COBie format

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EXPLANATORY NOTE

- CDE: Common Data Environment. It is a digital collaboration area, usually in the cloud, where all the project information is stored securely, and to which all members of the work team have access to make revisions or modifications according to their role, whose information must be provided and managed by the contracting party in a BEP.

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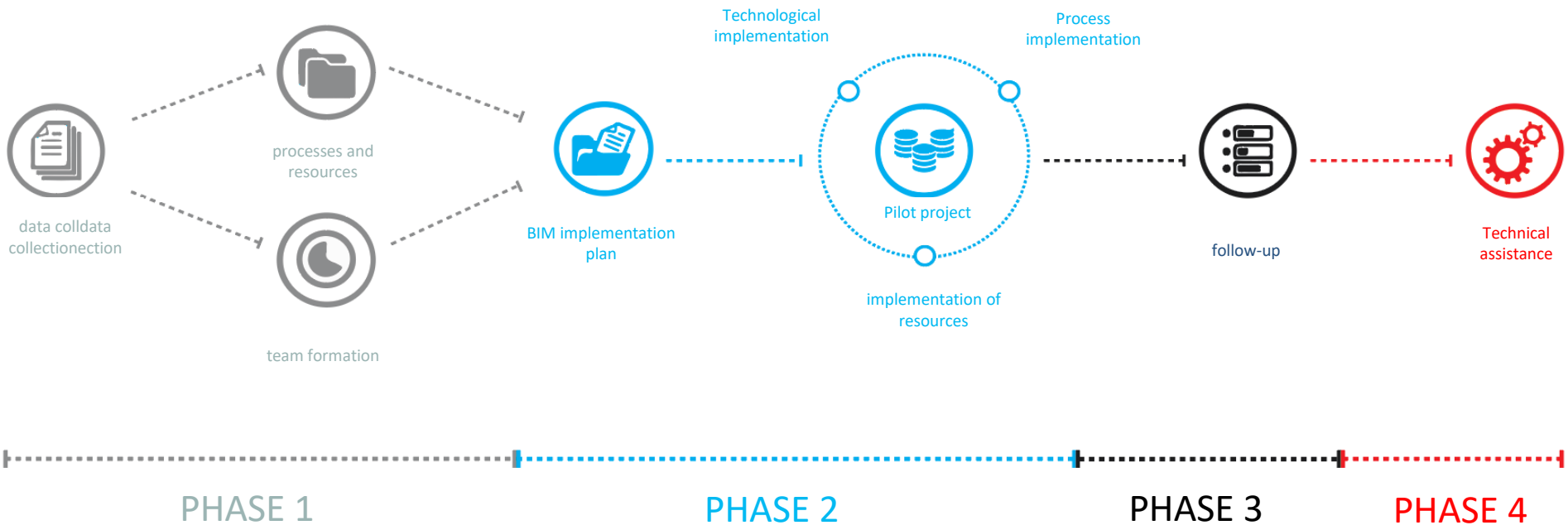
BIM EXECUTION PLAN

An example of BEP based on International Norms and Spanish standards, to build the internal processes applied to the requirements of each client, which allow to control the collaboration flows with other BIM Companies, with the aim of complying with all the regulations and standardisations required by the Public Administration and Private Project Management is the one proposed by 24Studio BIM.



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BIM EXECUTION PLAN

For the drafting of the BEP, various guidelines established in different international standards and conventions presented in public documents are taken as a reference, such as:

-Guide "**The BIM Project ExecutionPlanningGuide 2.1**" published by the ComputerIntegratedConstruction (CIC) of the University of Pennsylvania.

-Guide **PAS 1192-2:2013.**

-Document **LEVEL OF DEVELPMENT SPECIFICATION** - developed by **BIMFORUM.org**

-Standard ISO 19650 :1 :2 - Organisation and digitisation of information in building and civil engineering works for BIM projects.

- In this way, processes are generated that incorporate more definition regarding how the published information will be delivered, through the definition of, for example, level of detail and LOD data, type of information, BIM Uses, Model and Coordination requirements, Process Map, collaborative working conditions and model sub-projects, among others.
- This process refers to the development of a building or infrastructure project in which all actors involved focus on obtaining shared benefits from the tasks performed during the project life cycle and thus standardising the operation and maintenance of the building life cycle.

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BIM EXECUTION PLAN

GENERAL BEP DEFINITIONS

- Project Information.
- BIM roles and responsibilities of the site team for the collaborative development of management, modification and extraction of information from the models.
- Client requirements.
- Organisation and requirements of the models: BIM Objectives, BIM Uses and Levels of Development and BIM Information required (LOD, Lod).
- Definition of the project information modelling process.
- Development phases of BIM modelling.
- Collaborative working conditions and subdivision of BIM models.
- Nomenclature and classification standards.
- Process maps.
- Review and coordination process / Interference matrix.
- Audit of BIM models.
- Style Book.
- BIM deliverables in accordance with the project programme.
- Definition of information exchange and organisation procedures (Data Structure), through a CDE (Common Data environment).
- Licensing of the software used for the development of the project.

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BIM EXECUTION PLAN

APPLICATIONS: GENERAL SCOPE BEP

- Meet the needs of the site team configuration, structure and strategy selection.
- Apply workflows on site.
- Propose and coordinate the definition, implementation and compliance of the BEP.
- Responsible for the technology and processes that allow the correct integration of all the information of the model between specialities.
- Collaborate in the communication strategy between agents.
- Facilitate the use of standard exchange formats.
- Facilitate the correct classification of the elements.
- Coordinate the profiles and roles of access to information.
- Ensure the proper use of the information repository platform (CDE).
- Ensure that the technological environment (software, hardware and network) is in place and in correct use.
- Ensure compliance with the BIM Uses set out in the BEP.

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BIM EXECUTION PLAN

APPLICATIONS: GENERAL SCOPE OF BEP

- Coordinate the federated BIM model of the different disciplines.
- Manage the incorporation of information to the model from the documentation generated by each technical discipline (native files such as Csv, spreadsheets, dwg or similar).
- Solve problems related to the BIM aspects of the contract.
- Advise the team on the use of the necessary BIM tools.
- Create discipline specific BIM content.
- Export the discipline model according to the requirements established for its coordination or integration with those of the other disciplines.
- Perform quality control and resolution of discipline-specific collisions.
- Produce discipline-specific deliverables in accordance with the prescribed formats.
- BIM quality control: ensure that the standards set for the contract are met.
- Perform internal review of the contract documentation before making it available to FGV.

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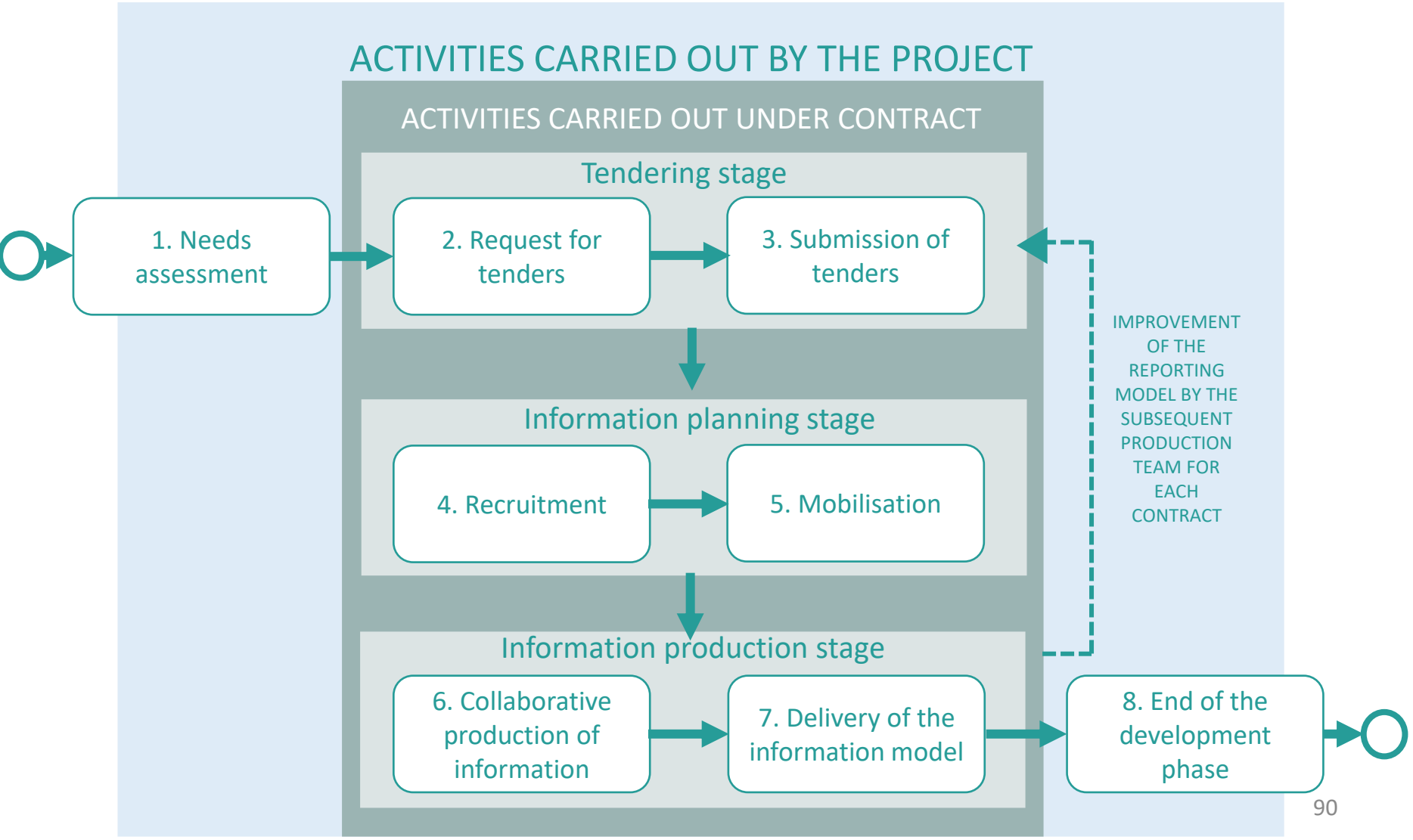
INFORMATION MANAGEMENT DURING THE DEVELOPMENT PHASE



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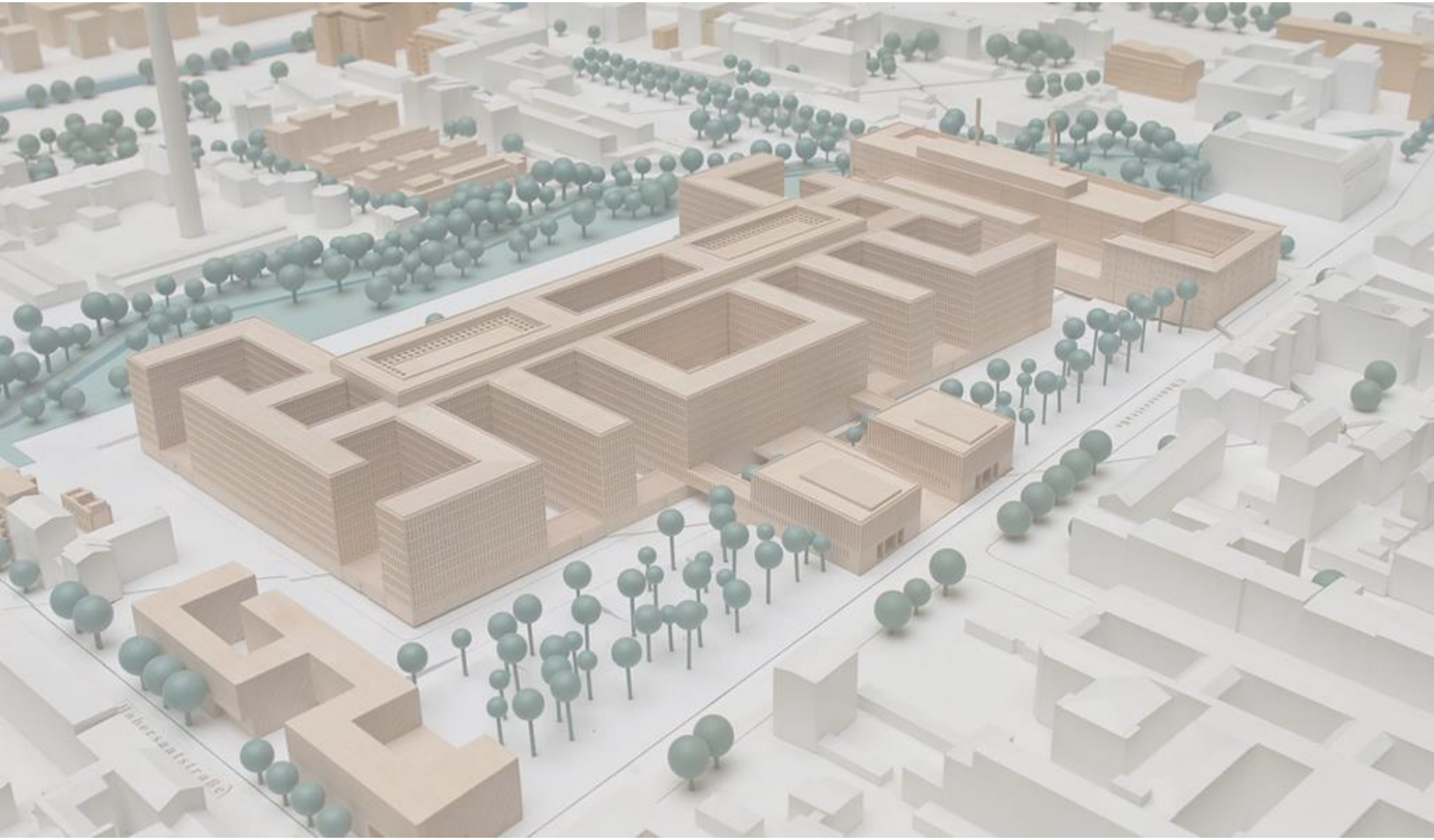

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