

MINEA WG 1: “Resource potential of construction & demolition waste”

Topic: Towards a knowledge base for material reserves and resources in buildings & infrastructures

Towards a sustainable circular economy in the built environment:
policies improvements, strategic partnership and
life cycle assessment tools for supporting decision



POLITECNICO
MILANO 1863

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Agenda

01 Application of circular economy in the built environment

02 European building stock regeneration: demolition or renovation?

03 Toward a sustainable circular renovation of buildings

03.1 Waste management

03.2 Operators' relationship

03.3 Tools

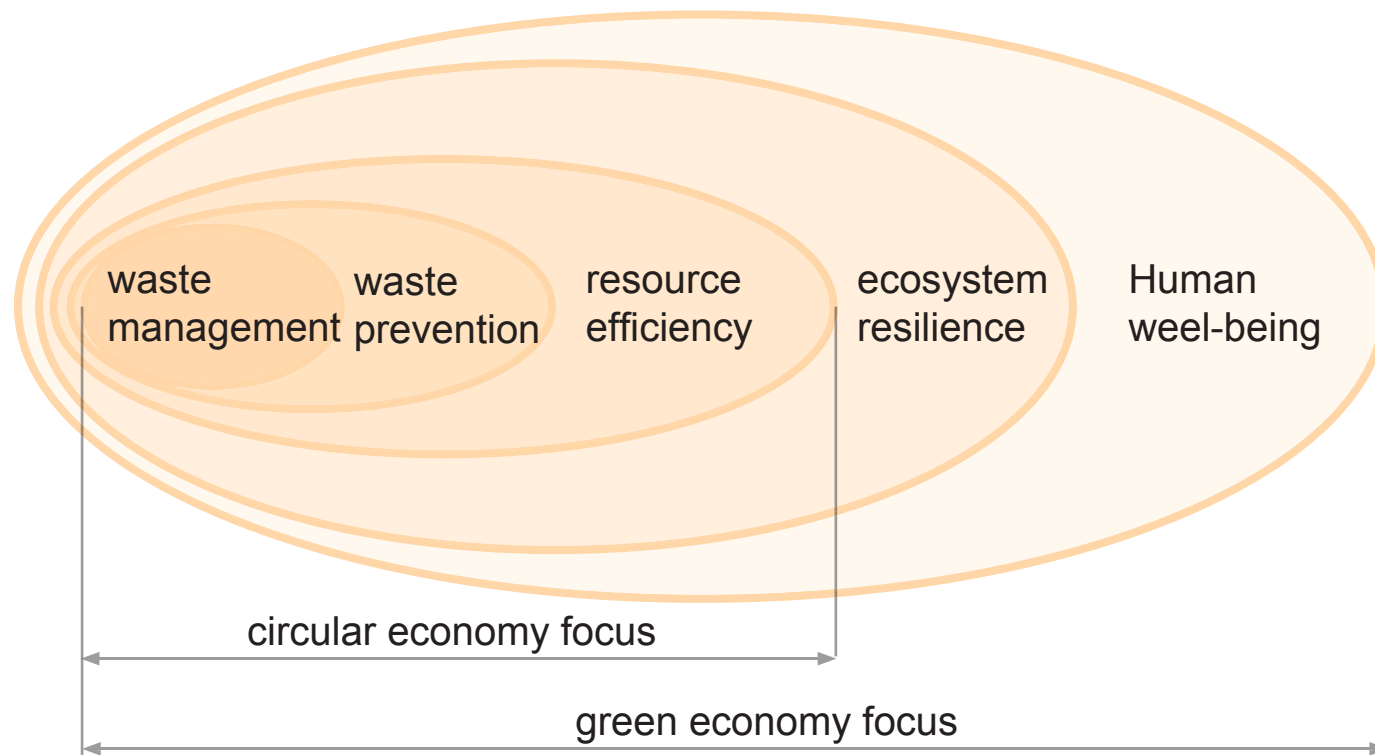
05 Challenges and opportunities



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01 Application of circular economy in the built environment

Objective: to apply circular economy in the built environment to achieve a resource conservation and waste reduction.



Circular economy,
within **Green economy**
aims at environmental,
economic and social
sustainability



Giorgi S., Lavagna M., Campioli A. (2017) *“Economia Circolare, Gestione dei rifiuti e Life Cycle Thinking. Fondamenti, interpretazioni e analisi dello stato dell’arte”*, *Ingegneria dell’Ambiente*, [dx.doi.org/10.14672/ida.v4i3.1141](https://doi.org/10.14672/ida.v4i3.1141)



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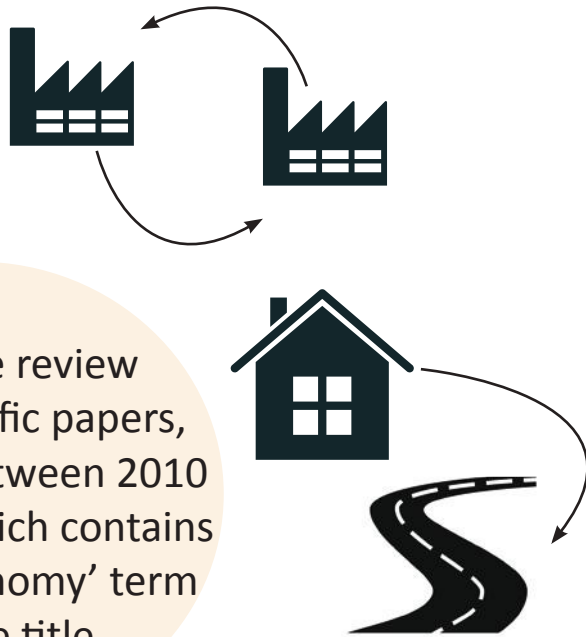
01 Application of circular economy in the built environment

MAIN LEVER:

- **cost reduction** derived by avoiding of landfill

MAIN PRACTICES:

- **recycling** is the main strategy among 4-R strategies.



- **intersectorial recycling** of industrial waste (e.g. fly ash for cement production)

- **downcycling** of CDW (e.g. recycled aggregate for road substrate)

- **no links** between **circular economy** and **environmental sustainability**



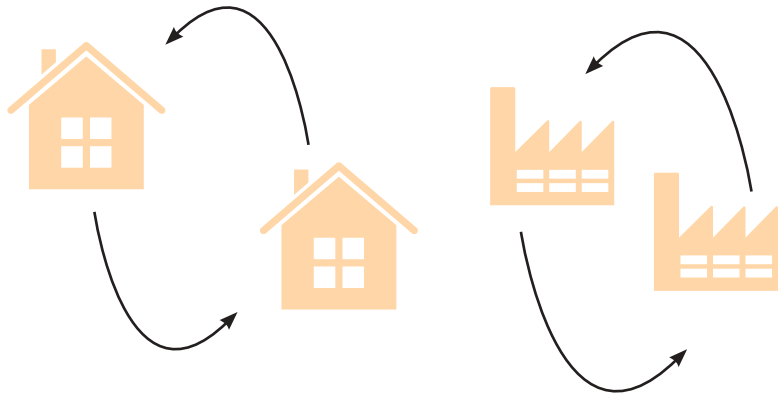
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01 Application of circular economy in the built environment

TO ACTIVE SUSTAINABLE PRACTICES:



- activation of strategies that **avoid the waste** (upstream/prevention strategies)
- improve the **reuse and up-cycling** (not only downcycling)
- **assess the sustainability** of circular strategies within a **life cycle** perspective.

✓ **LIFE CYCLE ASSESSMENT**

✓ **LIFE CYCLE COSTING**



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01 Application of circular economy in the built environment



MACRO LEVEL:

eco cities, urban metabolism, which consider energy-materials-water flows at district level



MESO LEVEL:

building as material banks, circular regeneration of building stock



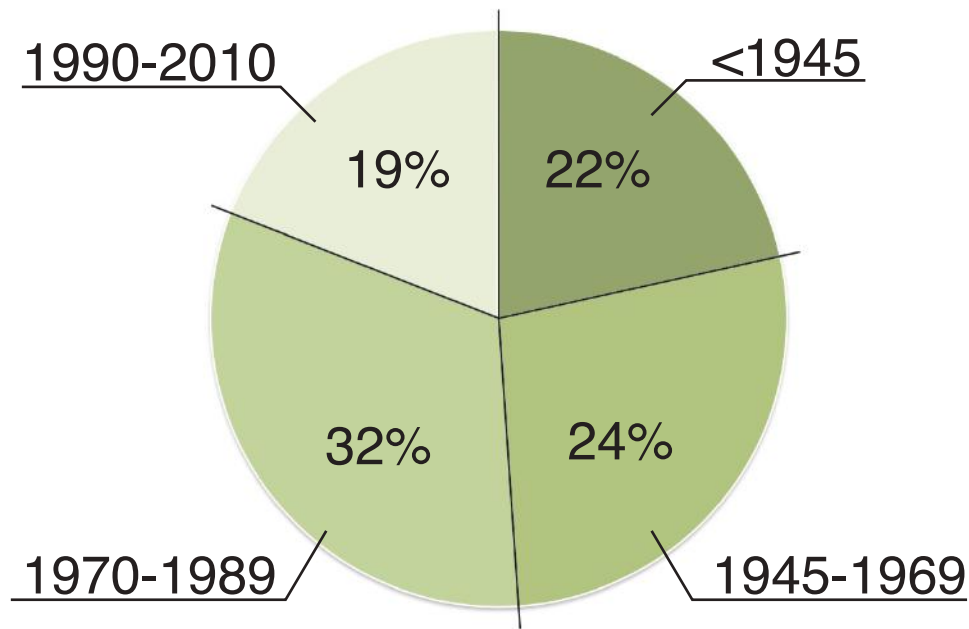
MICRO LEVEL:

innovation on the material dimension
new composition of materials



02 European building stock regeneration: demolition or renovation?

RESIDENTIAL BUILDING STOCK:



Almost the 50% of building stock has built before 1970 and it represents the main energy consumption in the use phase.

There is a need to regenerate these building stock in order to achieve the European objectives of 2050.

Residential building stock EU-27 (distribution by age)



Lavagna M, et al (2018). "Benchmarks for environmental impact of housing in Europe: Definition of archetypes and LCA of the residential building stock". *Building and Environmental Journal*. doi.org/10.1016/j.buildenv.2018.09.008



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01 Application of circular economy in the built environment

METHODOLOGY

To know consistency of building stock and the quantities of materials stored

To model and assess building archetypes and multiplied them to number of buildings for each Country (base-on statistical data).



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02 European building stock regeneration: demolition or renovation?



Production, construction, maintenance and end-of-life phases have an important role in the **life cycle impacts of building stock**, mainly for **resource depletion** impacts.

Life Cycle Assessment of EU residential building stock (Cradle to Grave)

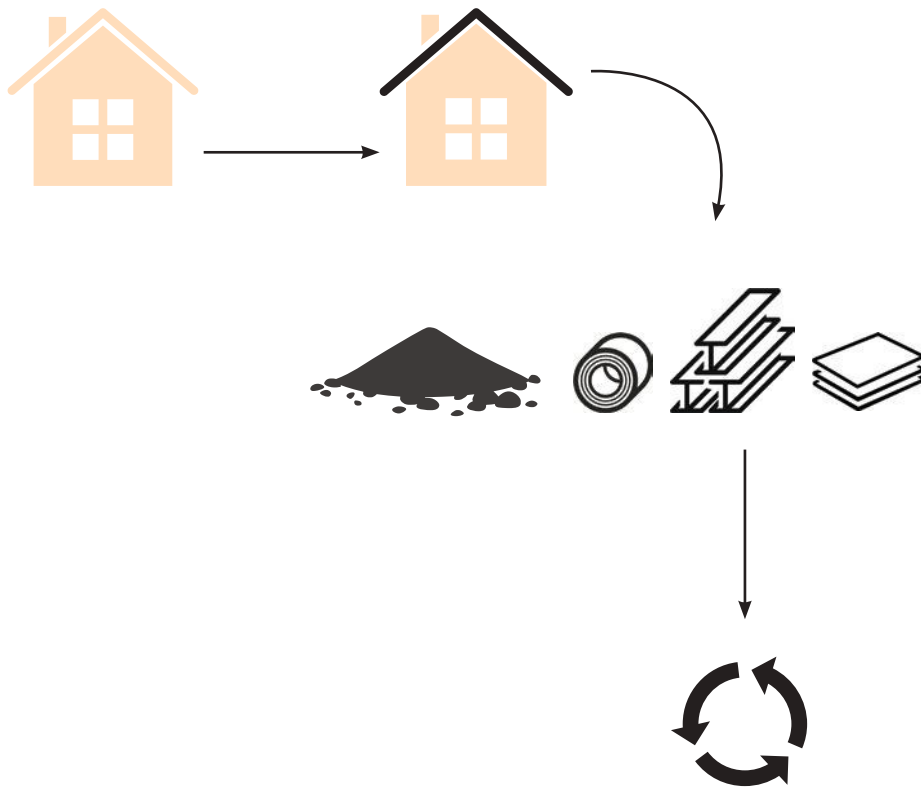
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02 European building stock regeneration: demolition or renovation?

RENOVATION OF BUILDING STOCK:



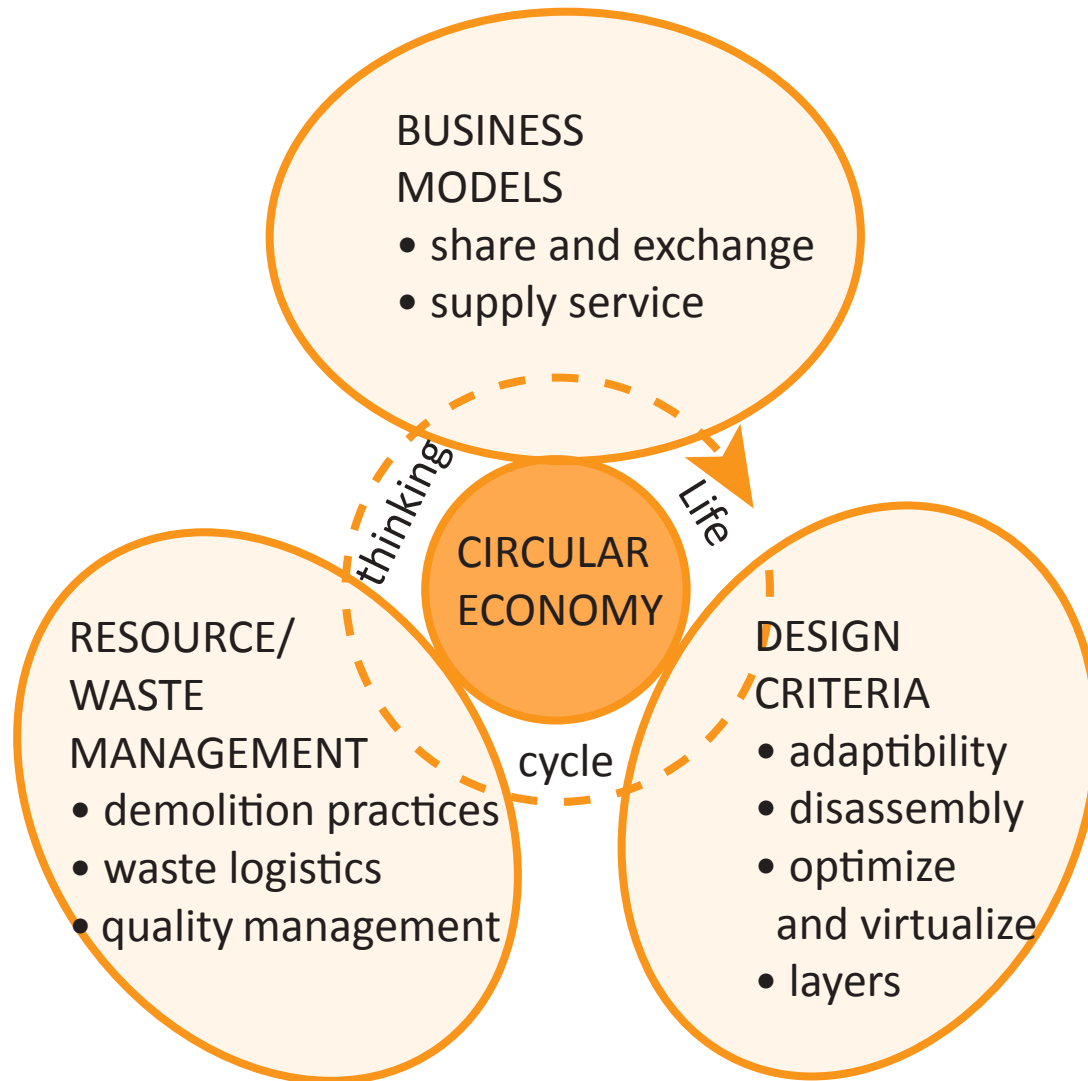
In order to contain environmental impacts, **it is better to renovate** buildings rather than demolish.

Renovate the building in order to **avoid waste and necessity of raw resources.**

The unavoidable **CDW** generated by requalification process have to have to be reused **as resources.**



03 Toward a sustainable circular renovation of buildings

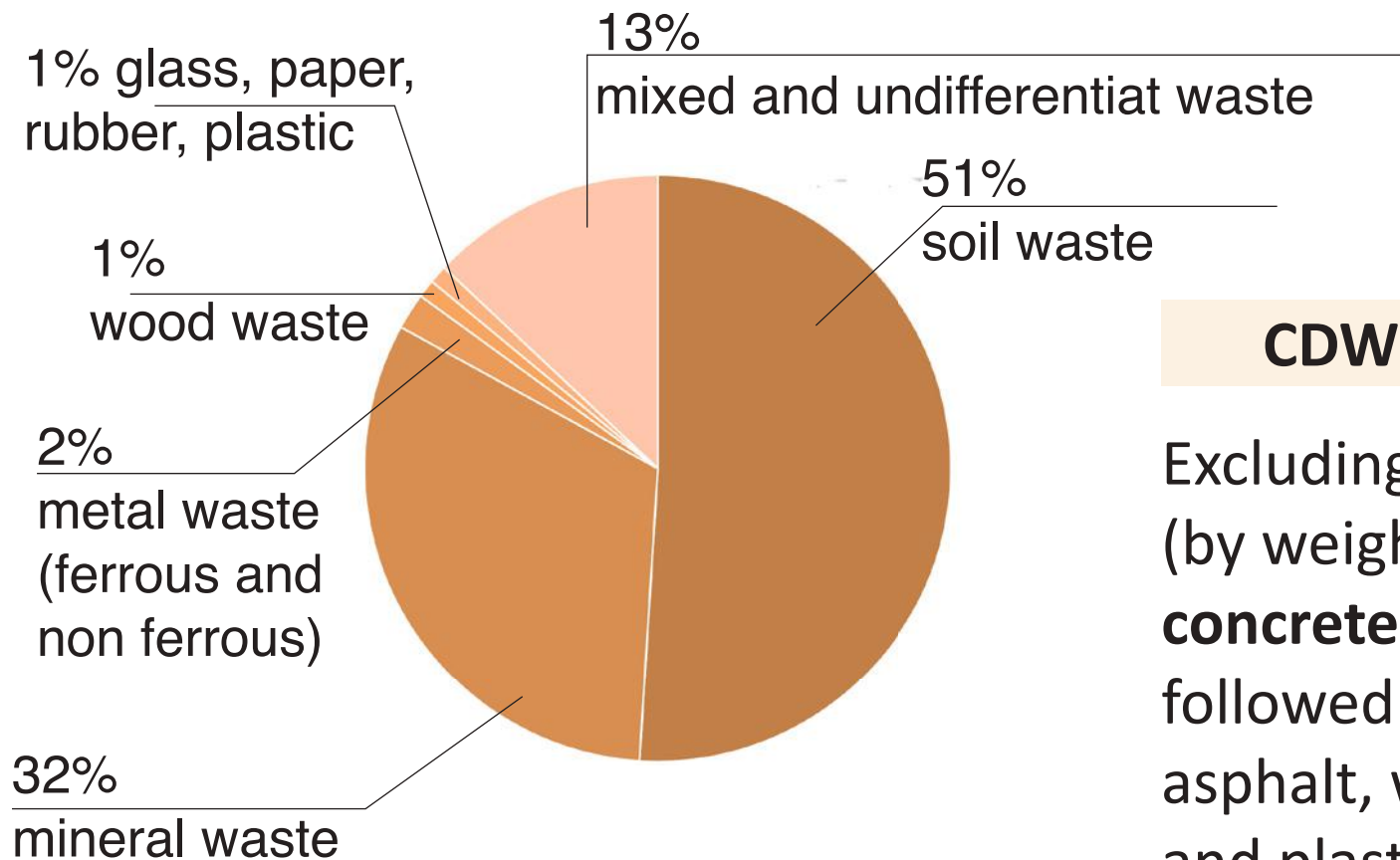


NECESSARY CHANGE:

- to improve policies
- to activate strategic partnership
- to use life cycle tools for supporting decision



03 Toward a sustainable circular renovation of buildings: waste management



Source: Eurostat, 2012

CDW COMPOSITION:

Excluding the soil portion, 60-70% (by weight) of CDW is composed by **concrete and masonry**, followed by minor percentages of asphalt, wood, metal, gypsum and plastic.

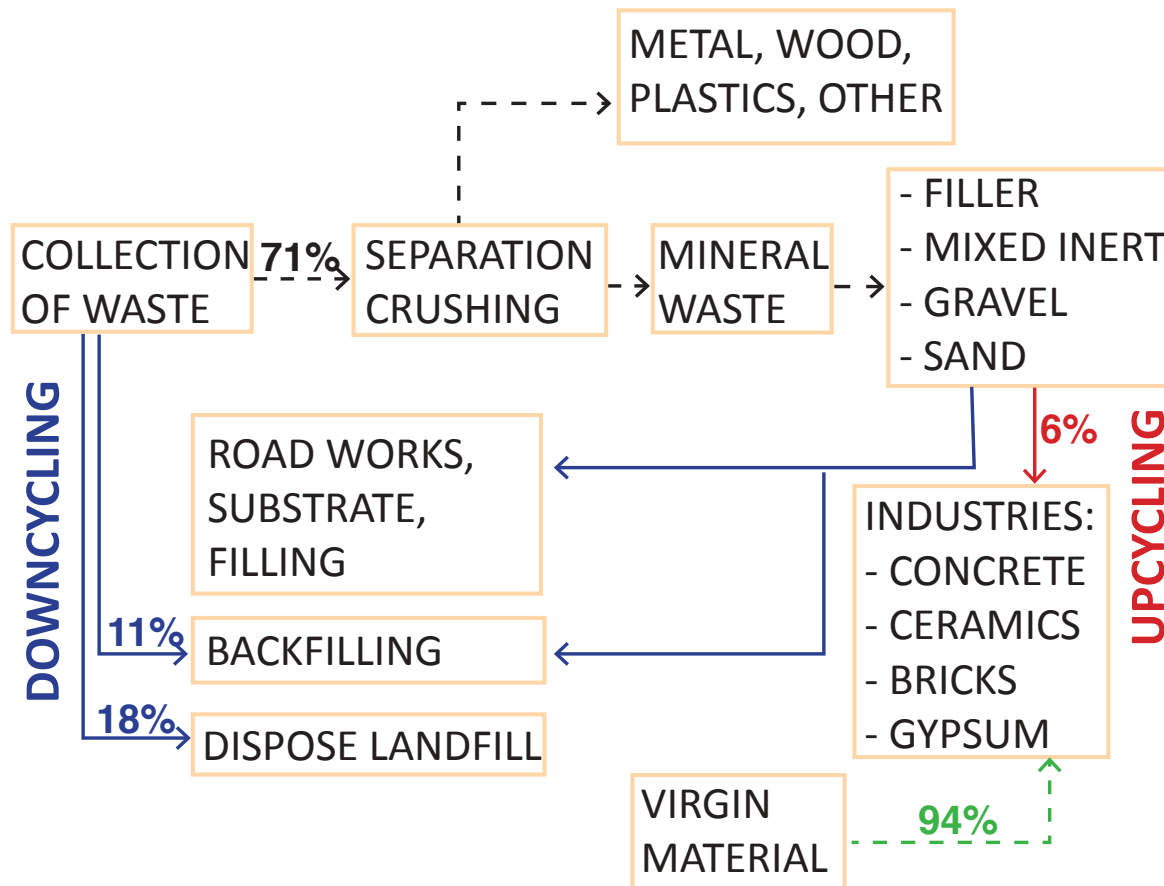


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Source: rielaboration of IDEA Consult data

CDW MANAGEMENT:

In practice, **there are no life cycle assessment** for evaluating the sustainability of recycling process.

WFD is not effective: (recycling percentage expressed by weigh; recycling in term of sustainability is not considered, etc.)



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03 Toward a sustainable circular renovation of buildings: waste management

TO IMPROVE POLICIE:



- recycling in terms of **quality** (rather than quantity) and **sustainability**.
- mandatory environmental criteria in GPP
- differentiate statistical data and improve the classification code of waste;

TO IMPROVE PRACTICES AND TOOLS:



- improve **selective demolition** and **tools** to forecast and possibly avoid waste such as predemolition audit;
- to use mandatory **building/materials passport** and pre-demolition audit.

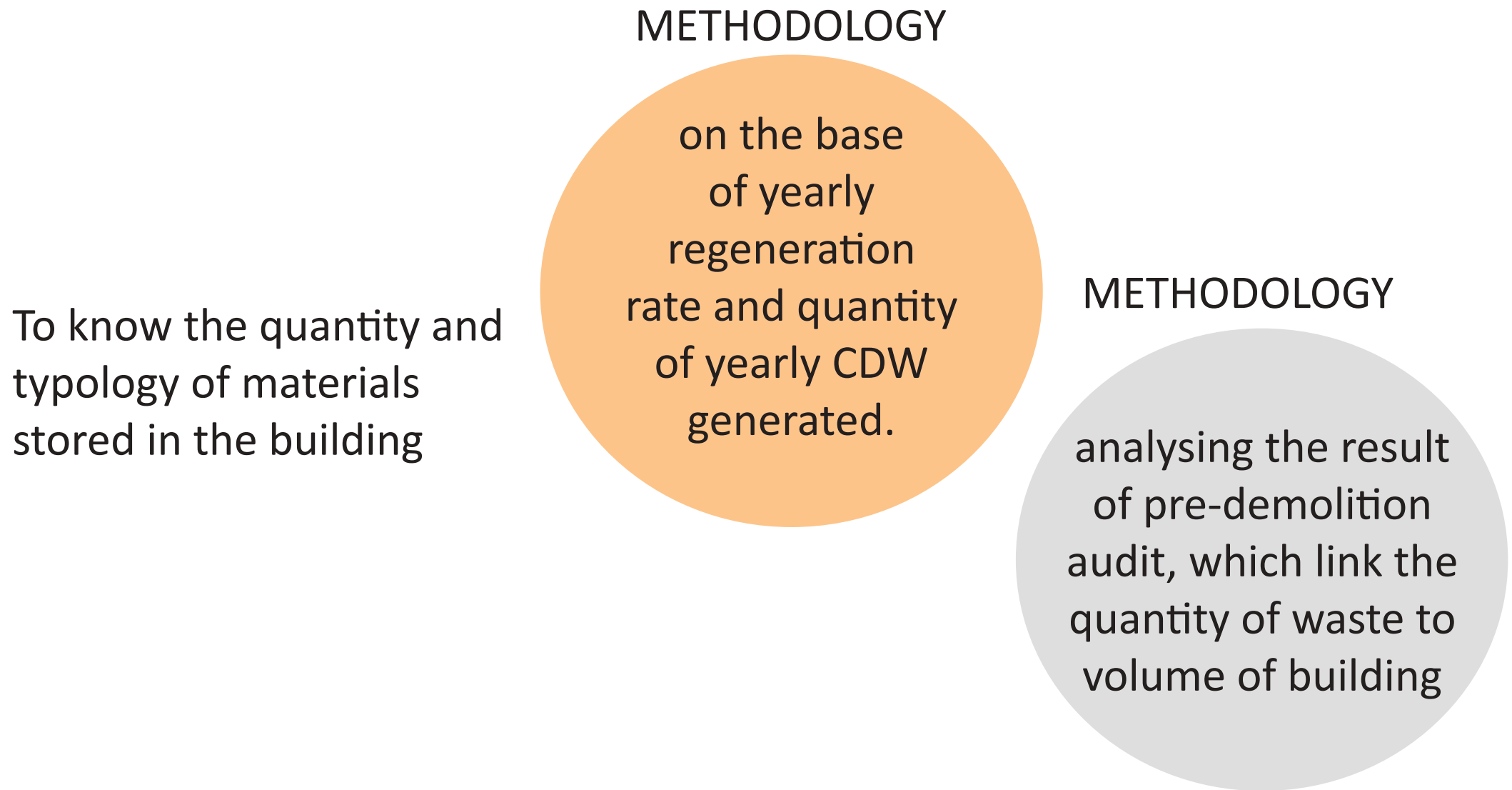


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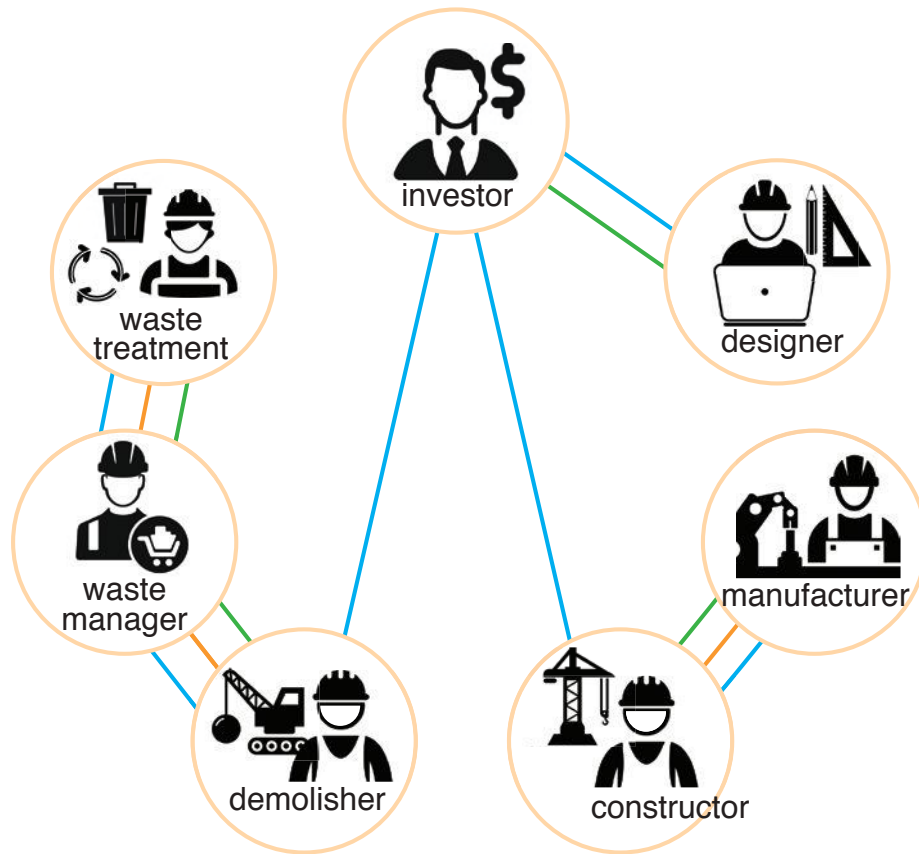


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03 Toward a sustainable circular renovation of buildings: operators' relationship



- there are **difficulties on cooperation**
there is not always a sharing of information among the operators

- the **decision-making is not based on the sustainability** assessment of different choices.

-the **difficult to activate new business models** (and lack of specific operators)

Materials flows (resources and waste management)

Information flows (value of materials, sustainable management)

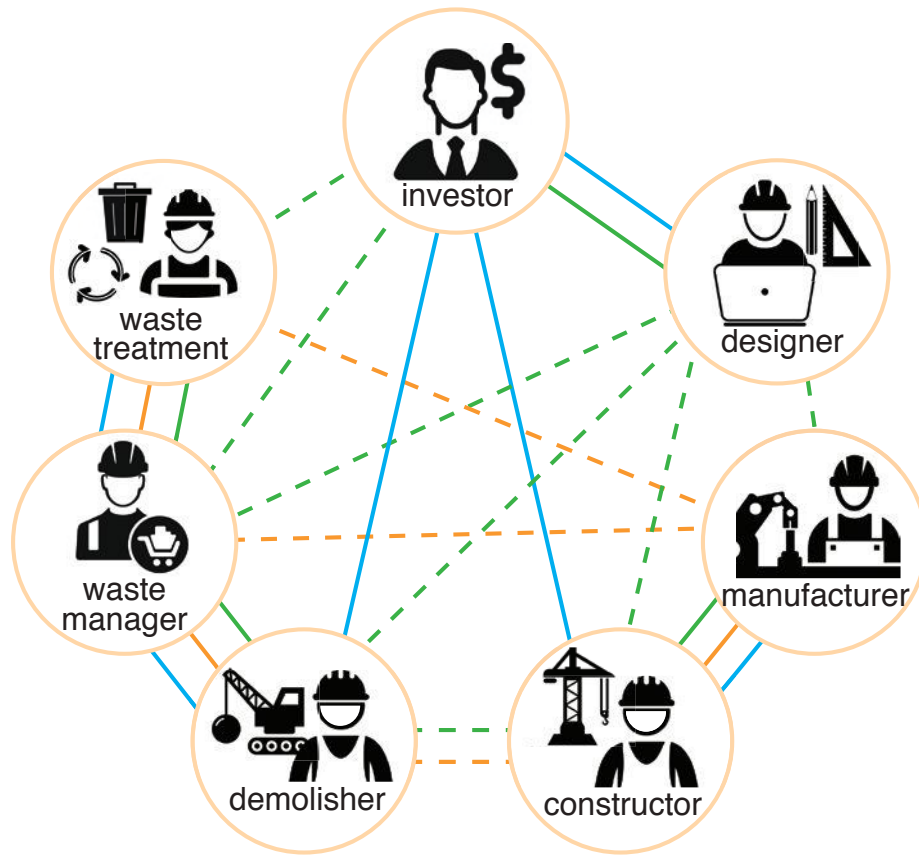
Financial flows (direct payments)

Giorgi S., Lavagna M., Campioli A. (2018) "Circular economy and regeneration of building stock in the Italian context: policies, partnership and tools" paper submitted to SBE19_BAMB final event



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03 Toward a sustainable circular renovation of buildings: operators' relationship



- to **create a link** between operators, also utilising tools, to have an **information sharing** (e.g. about the consistency and quality of materials) and **materials sharing**.
- to open up **new business models** to promotes a supply service chain and to define **new expert operators**

Materials flows (resources and waste management)

Information flows (value of materials, sustainable management)

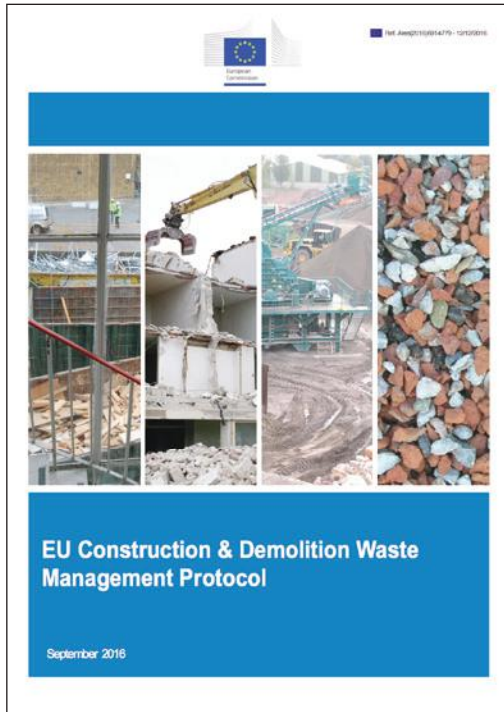
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03 Toward a sustainable circular renovation of buildings: tools



Pre-demolition
audit

Waste
management
plans

- they are **only quantitatively**
- have a **downstream approach**
- are **not used** by designers in design process as **decision-support**

IMPROVE EXISTING INSTRUMENTS:

- with a **life cycle approach** using LCA and LCC tools
- to define tools not only for CDW management but also as **decision support**, to be used during the decision (to demolish a building or not)



Giorgi S., Lavagna M., Campioli A. (2018) "Circular economy and regeneration of building stock. Assessment tools for sustainable end-of-life scenario", presented to the conference SUM 2018 conference.



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05 Challenges and opportunities

to improve
policies

Top-down approach:
e.g. law that forbidden
the use of raw materials

Bottom-up approach:
e.g. economic incetives
to building renovation
that avoid waste,
to utilise recycled /
recyclabe materials.
(policy maker)

to active
strategic partnership

To link different operators:
e.g. to share information
regarding materials value
(designer-waste manager)

New business models:
e.g. supply services rather
than sell a product
(manufacturer-investors)

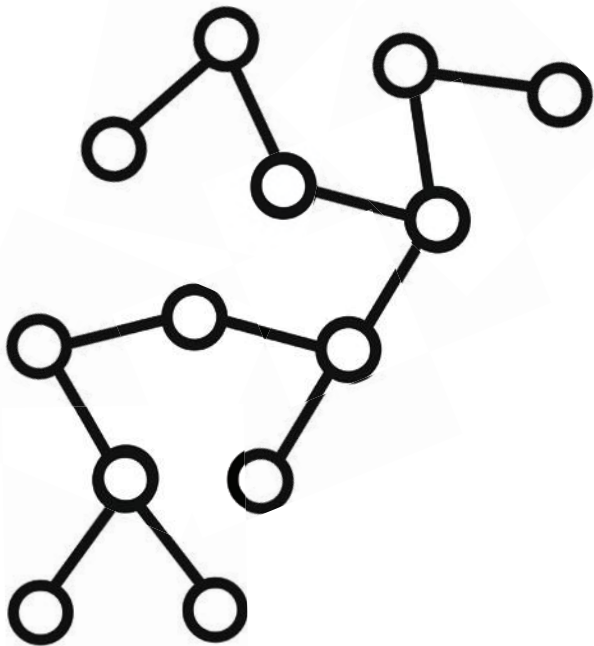
to use life cycle tools
for supporting decision

Using Tools:
e.g. LCA and LCC tools
in the decision-
making for sustainable
choices about
building technology
and materials and a
sustainable management
of CDW



05 Challenges and opportunities

CIRCULAR ECONOMY WORKING GROUP OF ITALIAN GBC, SUGGESTS:



- to investigate on **resouse/waste flows** at district level in order to activate controlled sharing;
- to form a **database** of 'circular' materials useful to designer and constructions;
- to set-up **digital platform** for sharing materials and information;
- to **define inefficiencies** in renovation process for avoiding them.
- to **evaluate** disassembly and durability of building and traciability of materials.



GBC "Position Paper Economia Circolare in edilizia" will be presented to ECOMONDO Conference



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