SUSTAINABLE PLACES 2021

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Renovation process challenges and barriers:

Developing an information exchange framework to address the communication and coordination bottlenecks in the zero-energy renovation process.

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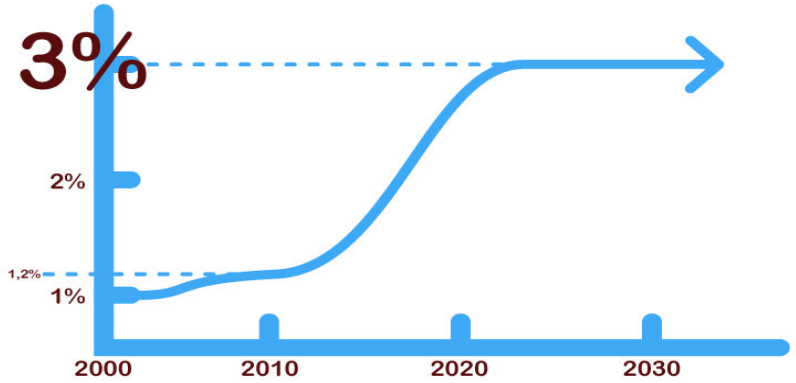
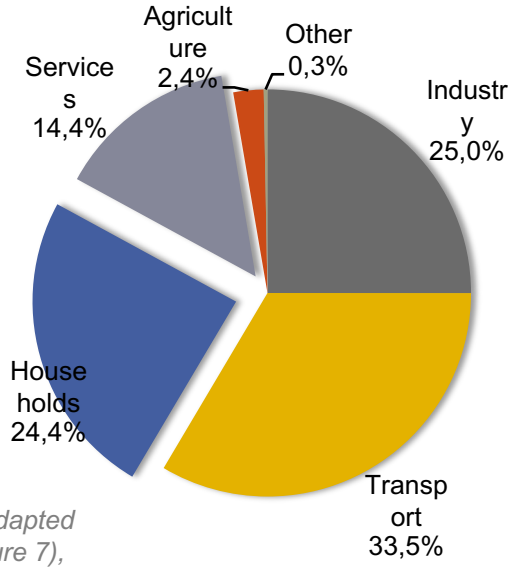
Refurbishment potential

- The building sector biggest energy user.
- Residential and service buildings 36% of energy consumption in EU
- Both rate and depth need to increase
- Deep Renovation to Zero-energy building



http://renovate-europe.eu/the-campaign/ambition-objectives/

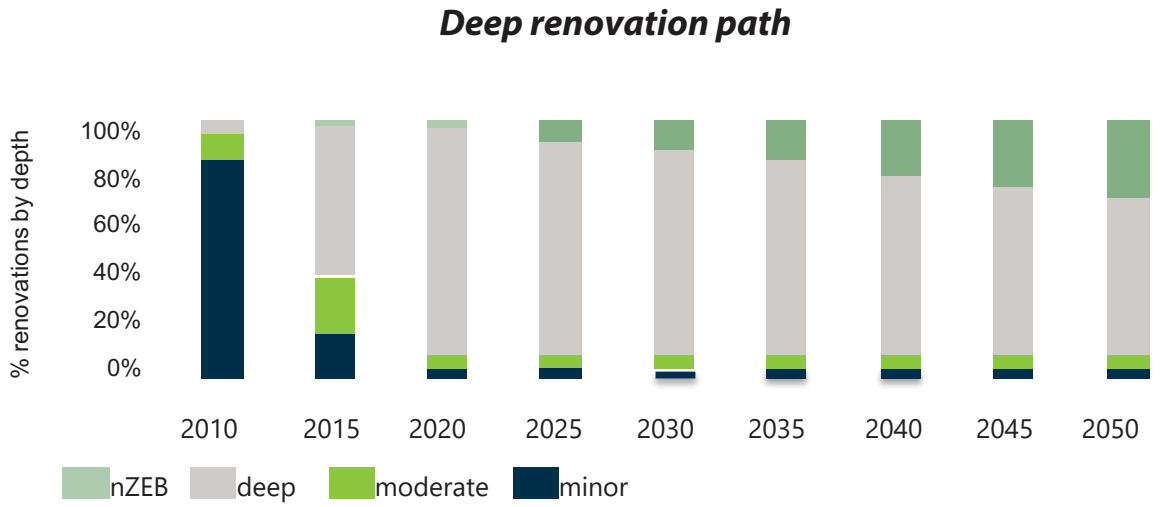


Final energy consumption, EU-28, 2018 (adapted from Tsemekidi Tzeiranaki et al., 2020, figure 7),

Deep renovation

Final energy saving (% reduction)

- Minor 0-30%
- Modarate 30-60%
- Deep 60-90%
- nZEB 90%



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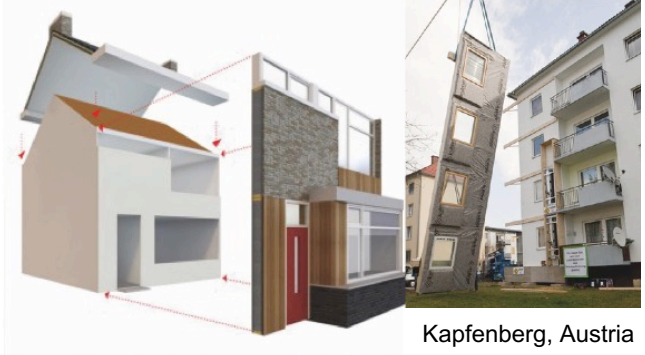
source: BPIE. (2011). Europe's buildings under the microscope.

Industrialised Retrofits

- Improving the productivity to make upscaling possible.
- Cost reduction through economy of scales.
- Reduced on-site construction time and disturbance for occupants
- Design and engineering efficiency
- Reduction of construction waste and material use.

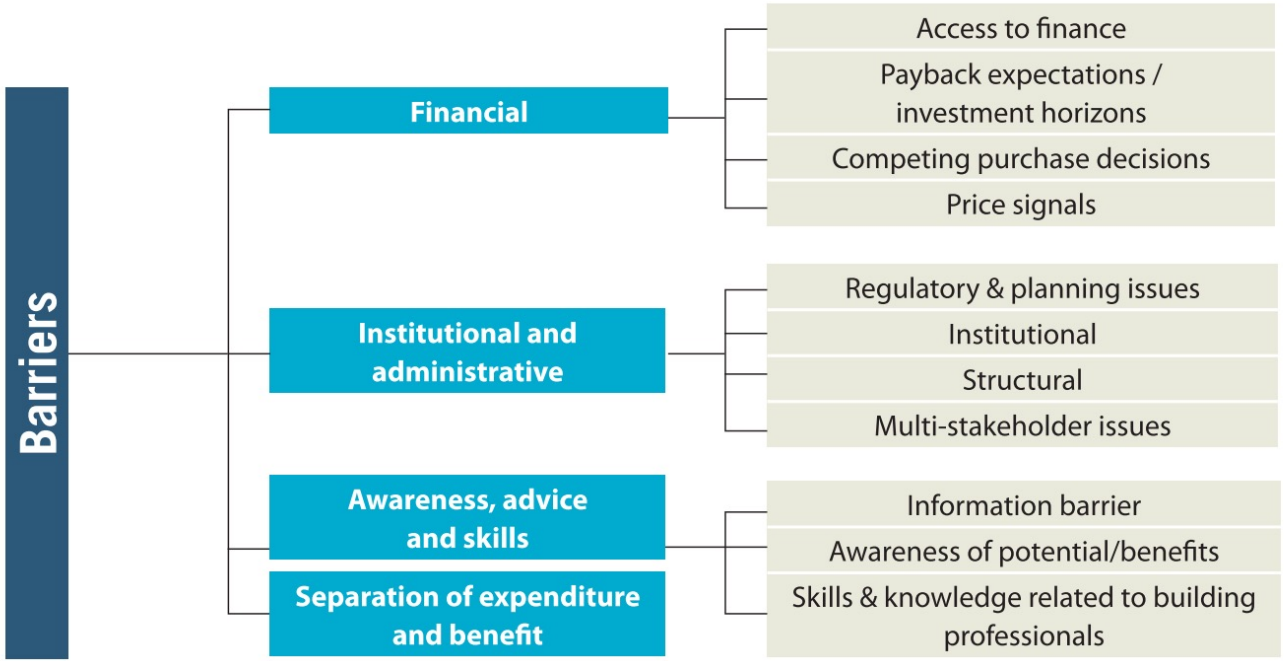


Kapfenberg, Austria

TES EnergyFacade

Stromversnelling, Soesterberg

Barriers to renovation



Barriers to renovation identified by the BPIE survey "European buildings under the microscope.

Figure from: BPIE, 2011

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Objective

- **Map** the renovation **process**
- Address the most important **bottlenecks**
- Make the renovation process more **efficient**
- Identify the type of **information** that the stakeholders require during the different renovation **phases**
- Structure the **workflow** between all the actors.

Methods

(1) Exploration of the current renovation workflow

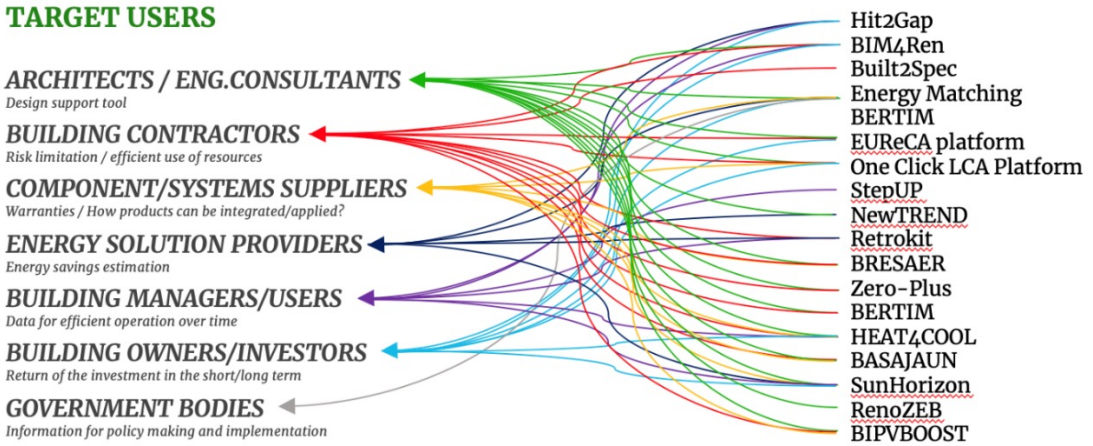
State of the art and existing projects analysis

17 R&I EU projects,
CORDIS (European Commission).

(2) Analysis of the Experts' interaction

Online questionnaire

Stakeholders' workshop



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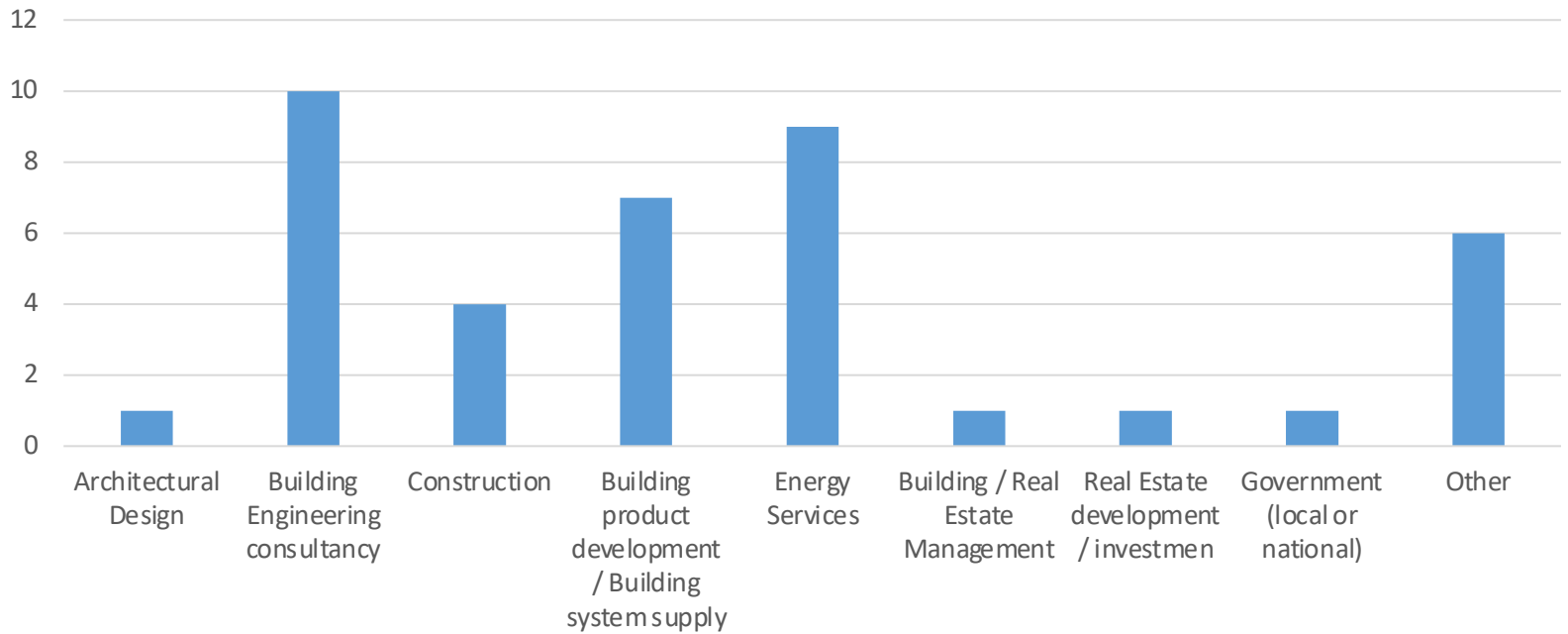
The sample: Core business of the organisations?



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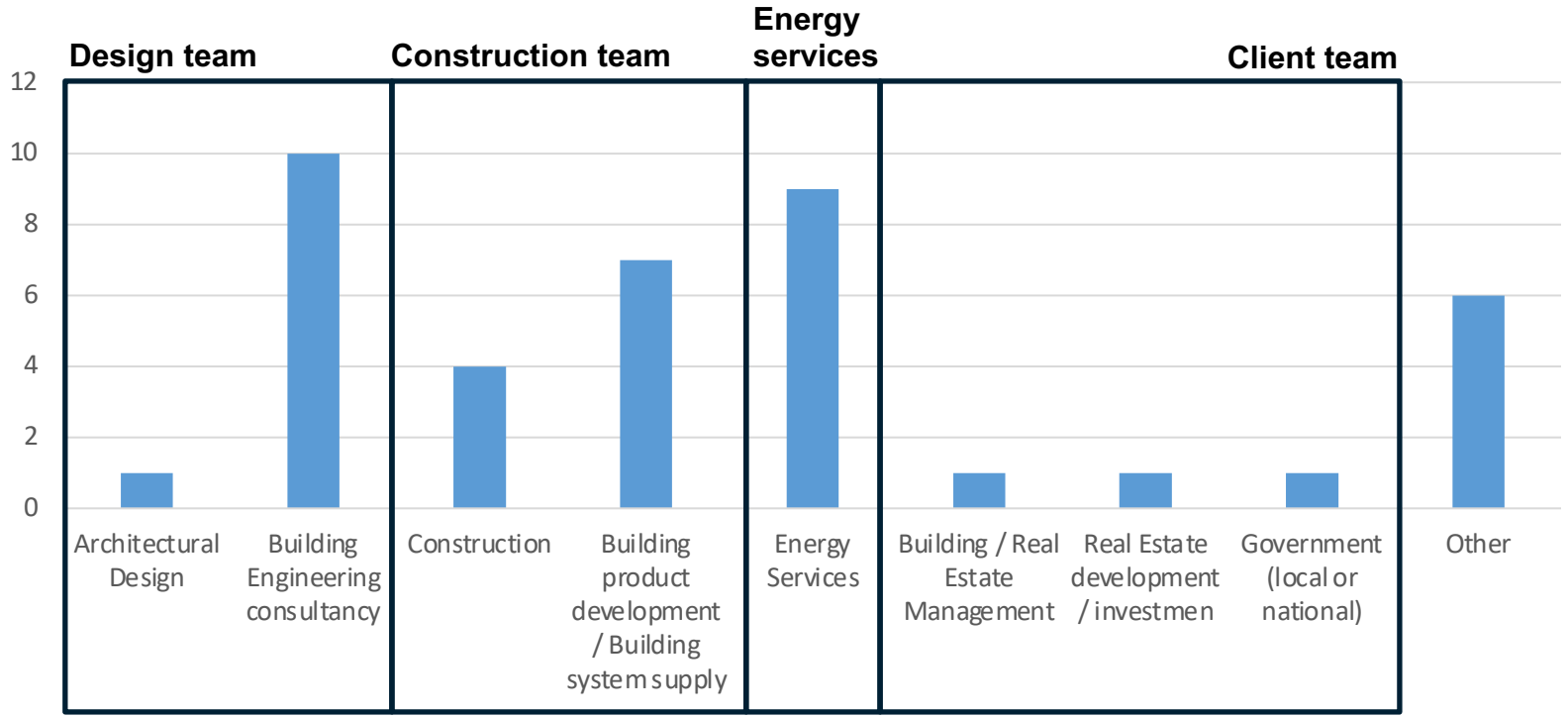
The sample: Core business of the organisations?



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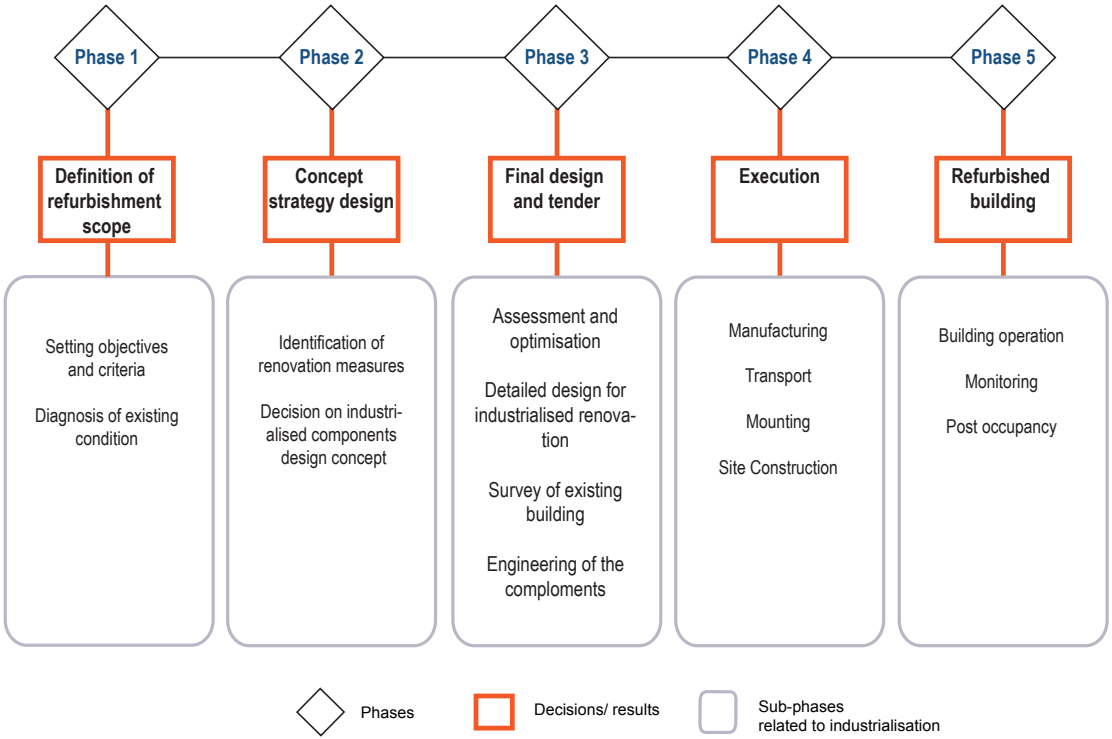
Results

The main questions of the study:

- Renovation process: phases, tasks
- Stakeholder per phase and their role
- Information flow
- Main perceived bottlenecks

1. Renovation process

- Pre-project: defines the need for the project, the problems, the ambition. Setup the design team
- Pre-construction: develops appropriate design solution
- Construction: Apply the solution. Manufacturing, assembly off-site and on site
- Post-construction: monitoring and maintenance of the project.



Stakeholders' involvement per phase

- Main stakeholders' involvement per phase ***(low / medium / high perceived involvement)***
  - Design team is heavily involved in phases 1-4.
  - Construction team present in phases 3-4.
  - Energy solution providers are seen involved throughout the process, but mostly in 3 & 4.
  - Client team involved throughout the process but mostly in phase 1 (users, managers & owners also heavily involved in phases 4 & 5).

Stakeholder	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5
Architects					
Engineering consultants					
Contractors					
System suppliers					
Energy solution providers					
Building users & managers					
Building owners					
Developers / investors					
Government bodies					

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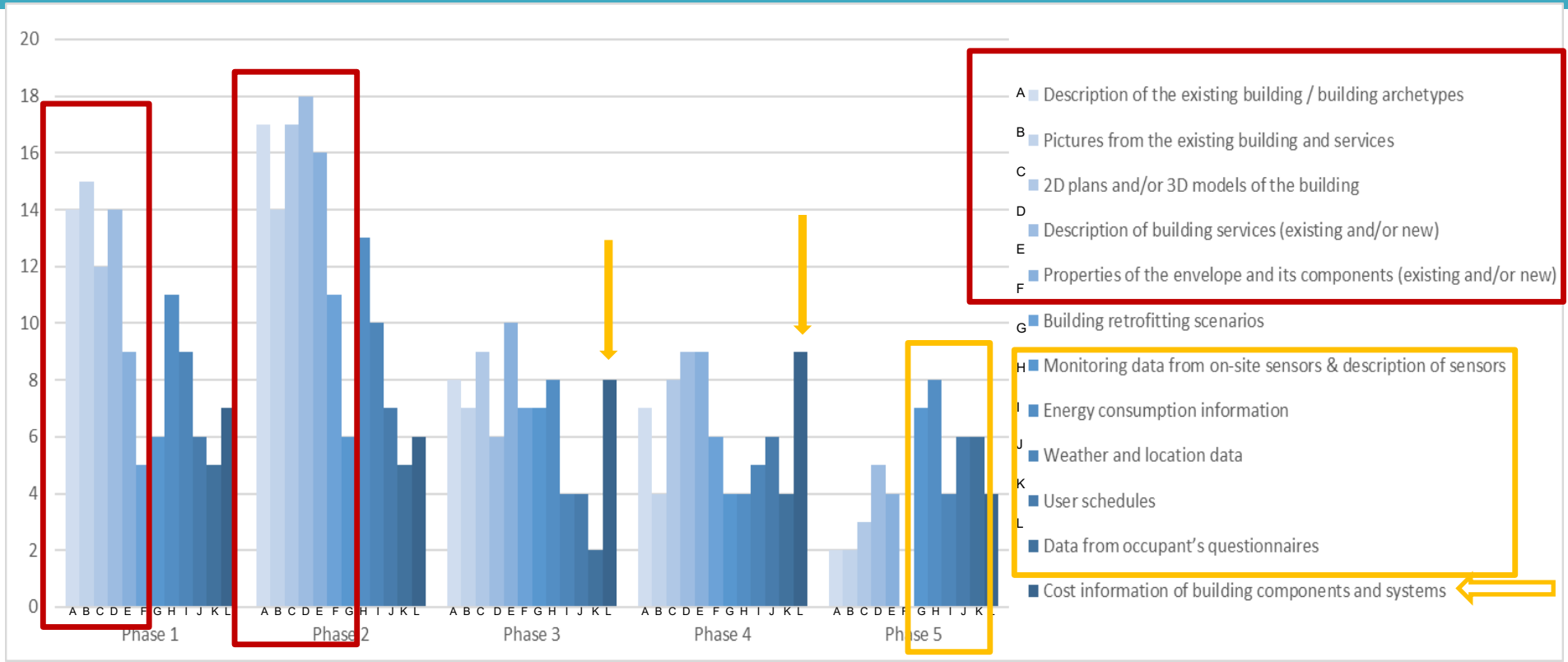
Specific info per phase: Required INPUTS



Specific info per phase: INPUTS overview

**Low/medium/high relative mentions per phase are shown with colours (the darker the colour, the highest the number of mentions per phase).*

Input	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5
Description of the existing building					
Pictures from the building and services					
2D plans and/or 3D models of the building					
Description of building services					
Properties of the envelope and its components					
Building retrofitting scenarios					
Monitoring data from on-site sensors					
Energy consumption information					
Weather and location data					
User schedules					
Data from occupant's questionnaires					
Cost information of components and systems					

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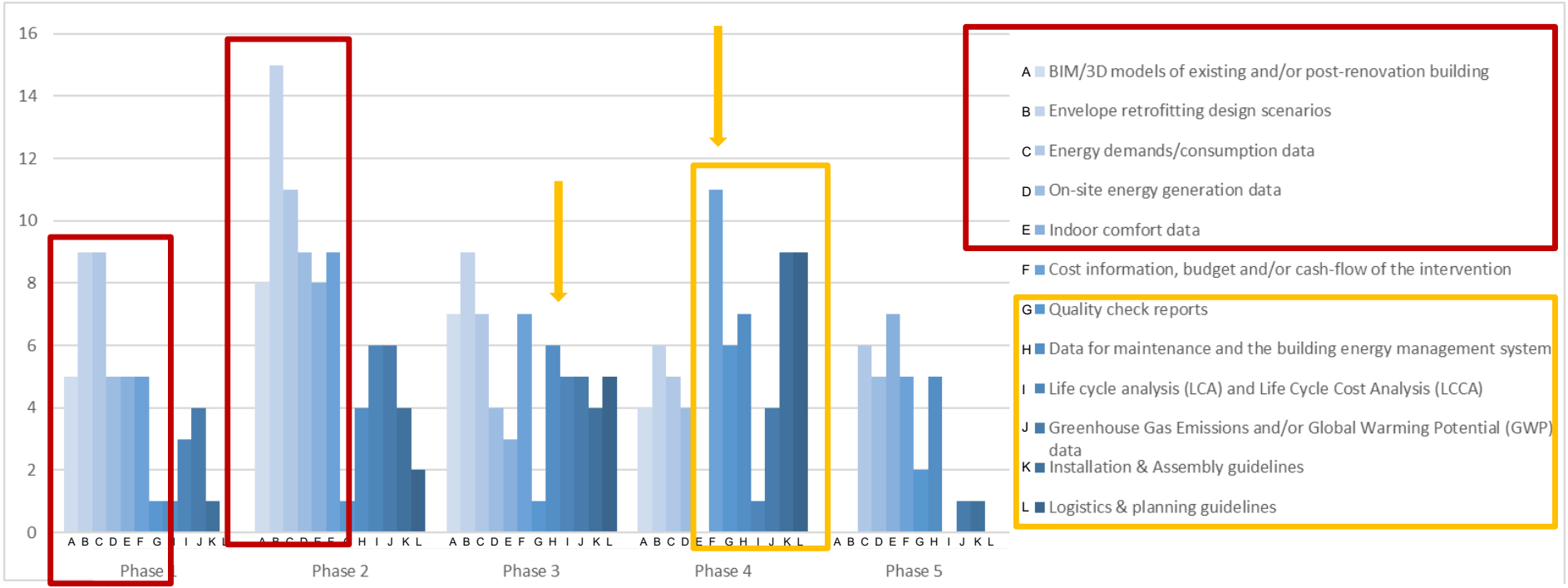
Specific info per phase: Main OUTPUTS



Specific info per phase: OUTPUTS overview

**Low/medium/high relative mentions per phase are shown with colours (the darker the colour, the highest the number of mentions per phase).*

Output	PHASE 1	PHASE 2	PHASE 3	PHASE 4	PHASE 5
BIM/3D models					
Envelope retrofitting design scenarios					
Energy demands / consumption data					
On-site energy generation data					
Indoor comfort data					
Cost, budget and/or cash-flow info					
Quality check reports					
Data for maintenance and BMS					
LCA and LCCA					
Greenhouse Gas Emissions and/or GWP data					
Installation & Assembly guidelines					
Logistics & planning guidelines					

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3.

Main perceived bottlenecks per renovation phase

Relevant bottlenecks: Renovation process

- Word cloud of all responses

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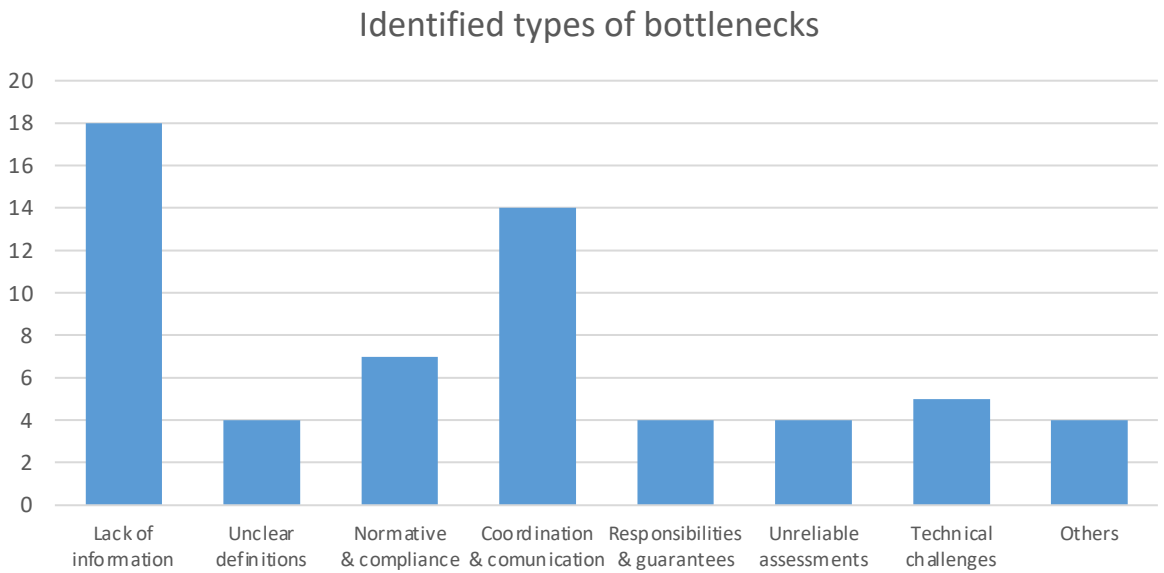
Relevant bottlenecks: Renovation process

- Main types of bottlenecks identified from the responses
  - LACK OF INFORMATION
  - UNCLEAR DEFINITIONS
  - NORMATIVE & COMPLIANCE
  - COORDINATION & COMMUNICATION
  - RESPONSIBILITES & GUARANTEES
  - UNRELIABLE ASSESSMENTS
  - TECHNICAL CHALLENGES
  - OTHERS



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Relevant bottlenecks: General overview

**Darker colours represent a higher amount of mentions per bottleneck type.*

	LACK OF INFORMATION	UNCLEAR DEFINITIONS	NORMATIVE & COMPLIANCE	COORDINATION & COMMUNICATION	RESPONSIBILITES & GUARANTEES	UNRELIABLE ASSESSMENTS	TECHNICAL CHALLENGES	OTHERS
PHASE 1	- Limited info about the existing building (construction, envelope, structure). - Limited energy consumption data	- Unclear definition of the renovation objective and KPIs. - Unclear design proposals at this stage hinder the clients' decision-making process.	- Bureaucracy	- Limited involvement and participation of specialists (mostly developer and owner).	-	- Not enough depth in the technical project to come up with reliable cost estimations.	-	- Lack of interested clients and governmental incentives.
PHASE 2	- Limited info about the existing building and its use. Not enough technical information about building products. - Limited availability of project information (drawings & specifications).	-	- Bureaucracy - Unclear overview of National or local normatives that need to be followed.	- Communication issues and limited information exchange between stakeholders. - Unclear client-designer communication. - Low involvement and response time from system suppliers.	- Unclear responsibilities of the local architects and other stakeholders.	- Unreliable assessment and optimisation of different design options. - Uncertain building energy performance predictions. - Unreliable cost predictions of energy services.	-	- Lack of skilled professionals to assemble a consortium.
PHASE 3	- Unclear design alternatives from suppliers. i.e. what colours, materials and shapes are possible. - Unclear detailed info on connections and installation materials.	- Unclear technical solutions and installation techniques for budget calculations and procurement.	- Approval of the project by local authorities.	- Coordination issues and clear involvement among consortium members. - Lack of a central access point of information - Collaboration between different suppliers.	- Unclear responsibilities and liabilities at the procurement stage for quality checks, delivery, defects and replacements during and after construction.	-	- Integration and fine tunning of all the elements and components.	- Lack of skilled professionals to assemble a consortium.
PHASE 4	- Not always enough technical information about the renovation components (façade panels)	-	- Permits and green light from the local authorities and the client.	- On and off-site logistics and work-flow. - Unclear communication channels between stakeholders and coordination issues between the supply-chain and contractors. - Unclear communication with owners and users.	- Unclear agreement of responsibilities between consortium partners.	-	- Design and maintenance of the envelope. - Errors in accuracy might jeopardize the installation on-site. - Lack of standardisation.	-
PHASE 5	- Post-occupancy evaluation is still rarely performed. - Limited access to monitoring data, which is usually fragmented. - Limited info on users' scheduled.	-	-	-	-	-	-	- Lack of incentives for landlords in tenant-based scenarios.

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Relevant bottlenecks: Main takeaways

- **Lack of information** seems to be the main perceived bottleneck during phase 1 (pre-project) and phase 2 (concept design).
- **Coordination and communication** between different stakeholders is the main perceived bottleneck type at phase 4 (execution and handover), along with **technical challenges**.
- **Unreliable assessments** were mentioned as a relevant bottleneck during Concept design (phase 2).

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Conclusion

- To increase rate of renovation we need to make the process more **efficient**
- Stakeholders' **communication** and **information** exchange need to improve
- Understand the **process**, which parties and what information is crucial

Recommendations

- **Archetypes**, to provide scenarios and indication of cost and energy at the early stage, with minimum effort
- Comprehensive **building data** checklist, considering the level of detail for said information at every step of the process
- Technical information on **products**, in form of catalogue.
- Construction and **suppliers** involve earlier in the process
- Clearly defined **responsibilities** of all stakeholders throughout the process
- **Communication** channels and **protocols** between the design team and the client team, for solutions approval and execution

THANK YOU

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