



D2.1 Definition of relevant activities and involved stakeholders in actual and efficient renovation processes



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EXECUTIVE SUMMARY

The report describes renovation processes, listing involved stakeholders, activities, and process stages (in compliance with the European standard EN 16310 [EN 16310, 2013] in both the case of private and public works. Hence, possible peculiarities and differences are outlined across EU Countries where the renovation process takes place (especially in relation to public works).

Main differences concern:

- profit-minded concept in private works is replaced by public concerns and social, economic and/or aesthetic benefits in public works;
- different sources of funding result in different binding and tendering processes;
- different criteria for selection of procurement strategies are adopted;
- regulation limitations need to be strictly fulfilled in public works.

Presenting the activities that are generally performed during renovation processes provides a scenario on which it is possible to point out when and how optimisation can be pursued, e.g. in relation to information management. As it is commonly agreed that information losses, data lacks or redundancies are one of the main causes of time delay and cost increase, a flowchart representing the building process in case of renovation is presented to be used as an input for WP3 and WP4. Its validation will be carried out checking the application of the developed tools on demo sites that have been chosen to demonstrate the renovation process optimisation. Hence, the BIM Management System will be customized, at least considering the peculiarities of the three countries used for validation (Italy, Poland, Finland).

PUBLISHING SUMMARY

The report describes the relevant activities and involved stakeholders in case of a residential renovation in two scenarios:

- when the owner is a private person, a group of people, a private company or a group of private companies;
- when the owner is a public administration.

As WP2 aims at analysing the workflow of renovation processes, focusing on how to optimise information workflows between different stages through the use of ICT and the implementation of BIM, a particular attention has been paid in individualising differences between the public and private sectors, in order to deliver methods and create tools that can be successfully applied to the renovation process in both the sectors. Figure 1 synthetizes WP2 objectives. Task 2.1 is mainly focused on the first two points:

- to define precisely every activity that is required in each stage of the building process in case of renovation interventions;
- to point out the involved stakeholders (as designers, architects, construction companies and service companies, but also owners and inhabitants) in each single stage and to focus on their needs (with a special attention on the evolution of these needs according to rising and innovative methods and tools that rely on ICT and BIM) for defining the most proper information exchange/share processes and workflows that will be considered within BIM4EEB.



Figure 1: WP2 objectives

The analysis of the requirements allows to ensure the best adaptation of the methodological and technological features of BIM4EEB toolkit to the specific needs. The outputs here described are the results of T 2.1 “Process analysis and definition of relevant activities and involved stakeholders (public vs private sectors)”.

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TERMS AND DEFINITIONS

Table 1: Terms and definition of the principal stakeholders involved in a renovation process

Term	Definition	Source
Client	The party commissioning the design and construction of a project. The client may be an individual or a company. In the latter case, an individual should act as a single point of responsibility for decision and communication even if numerous bodies, or individuals, within the client organisation will contribute to decisions. The client may use an RIBA Client Adviser, a specially accredited individual, able to provide strategic advice in the early stages of a project in relation to the strategic definition or briefing aspects as well as the best methods for setting up the project team	[RIBA, 2013] Project Roles Table
Owner	A person, a group of people, a company or a public administration who owns a built asset	Authors
Inhabitant	A person that lives in a built asset	Authors
End-user	A person that uses a built asset	Authors
Client Adviser	A consultant providing strategic or specialist advice particularly during the early project stages	[RIBA, 2013] Project Roles Table
Technical adviser	A consultant employed by the client to provide specific advice, particularly on design and build or contractor-led procurement routes	[RIBA, 2013] Project Roles Table
Project Leader	The party responsible for managing all aspects of the project and ensuring that the project is delivered in accordance with the Project Programme	[RIBA, 2013] Project Roles Table
Lead designer	The party responsible for managing all aspects of the design, including the co-ordination of the design and the integration of specialist subcontractors' design, where applicable, into the coordinated design	[RIBA, 2013] Project Roles Table
Architectural designer	The party responsible for carrying out the architectural design	Authors
Structural designer	The party responsible for carrying out the structural design	Authors
Building services designer	The party Responsible for carrying out the building services design	Authors
Site surveyor	In the first-line management who monitors and regulates employees in their performance of assigned or delegated tasks. Supervisors are usually authorized to recommend and/or effect hiring, disciplining, promoting, punishing, rewarding, and other associated activities regarding the employees in their departments	Authors
Cost consultant/ quantity surveyor	The party responsible for producing Cost Information as the design progresses. This information will vary depending on the project but may include the overall Project Budget, estimates of the construction cost and life cycle cost analysis	Authors, adapting [RIBA, 2013] Project Roles Table
Health and safety adviser	Responsible for health and safety aspects as defined by legislation and in line with other project objectives and health and safety best practice	[RIBA, 2013] Project Roles Table
Acoustic consultant	Provides specialist acoustic advice on particular projects in relation to sound quality in spaces or noise transfer between rooms or from the external environment	Authors
Facilities management	Reviews the design proposals and comments on facilities management and in-use maintenance matters	Authors

(FM) adviser		
Information manager	Manages the flow of information between parties – note that this is not a design role	Authors
Access consultant	Provides specialist advice in relation to disabled and other access issues	Authors
Cladding specialist	Undertakes specialist design and/or reviews of aspects of the external cladding of a building, particularly where bespoke solutions are proposed	Authors
Interior designer	Provides particular design services in relation to the interior design of a project	Authors
Lighting designer	Provides specialist lighting advice internally or in relation to the floodlighting and external lighting of a project	Authors
Construction leader	The party responsible for constructing the project and for providing construction advice in the early stages. The contractor would be the construction lead at Stage 5. This role has been introduced to provide flexibility regarding who performs this role prior to work commencing on site	[RIBA, 2013] Project Roles Table
Contract administrator	The party responsible for the administration of the Building Contract, including issuing of additional instructions and the various certificates required to allow the handover and occupation of a building, until all of the defects have been rectified and the defect period concluded	[RIBA, 2013] Project Roles Table
Operational leader	Responsible for the facilities management (FM) aspects of the building	Authors
Party wall surveyor	Provides specialist advice in relation to adjacent properties and issues such as right of light	Authors
Security adviser	Considers security issues in relation to the design of a building	Authors
Master planner	Provides specialist advice for larger sites in relation to planning, roads, social issues and other high-level strategies	Authors
Planning consultant	Provides specialist advice in relation to planning applications	Authors
Sustainability adviser	Provides strategic advice in relation to green issues	Authors
Contractor	Independent entity that agrees to furnish certain number or quantity of goods, material, equipment, personnel, and/or services that meet or exceed stated requirements or specifications, at a mutually agreed upon price and within a specified timeframe to another independent entity called contractee, principal, or project owner	Authors
Sub-contractor	A person or company that does part of a job that another person or company is responsible for	Authors
Supplier	A party that supplies goods or services. A supplier may be distinguished from a contractor or subcontractor, who commonly adds specialized input to deliverables	Authors
Maintenance planner	Person who creates maintenance schedules, maintain parts inventory and work closely with maintenance staff, contractors and outside vendors	Authors
Fire safety designer	Provides special set of practices intended to reduce the destruction caused by fire	Authors
Landscape architect	Responsible for carrying out the landscape design	Authors
Local authority	An organization that is officially responsible for all the public services and facilities in a particular area	Authors
Tenderer	A person or company that estimates the cost of a proposed project or someone who presents a payment to another	Authors

Table 2: Terms and definition of the stages in the life cycle of built assets

Term	Definition	Source
Initiative	Stage where the need for a construction or urban project emerges and is established	[EN 16310, 2013]
Initiation	Stage where the context of the facility or product to be developed is identified and the requirements are defined	[EN 16310, 2013]
Concept design	sub-stage where plans for the asset(s) are developed that offer options and solutions on a planning scale, to determine the general form and schematic layout of the asset(s) to be built within the allocated area	[EN 16310, 2013]
Preliminary design	sub-stage where a design of the asset is developed that offers a broad insight covering planning aspects, functional organisation, spatial structure and general appearance, enabling the client to make informed strategic choices between functional concepts and options envisaged	[EN 16310, 2013]
Developed design	sub-stage where the design of the asset is further developed, providing detailed representations of the layout, the structure, associated technologies and the appearance of the asset and where suitable methods of construction, the use of materials and typical technical details as necessary for a good understanding of the asset to be built are examined	[EN 16310, 2013]
Detailed design	sub-stage where the project is fully described, so that equipment manufacturing and asset construction and installation of equipment can take place	[EN 16310, 2013]
Procurement	stage where fabrication / construction / installation sites are provided with equipment and materials and fabrication / construction / installation contracts are awarded	[EN 16310, 2013]
Construction contracting	sub-stage where contracts for supply of construction services, installations and materials are awarded	[EN 16310, 2013]
Pre-construction	sub-stage where the actual construction of the asset is prepared and scheduled, and project specific prefab parts and components may be produced	[EN 16310, 2013]
Commissioning	sub-stage where is it verified that installed equipment is ready for use	[EN 16310, 2013]
Handover	sub-stage where final checks of compliance with the contract documents are performed. At this point the project is handed over to the client and where the starting points and conditions for maintenance and operations are established	[EN 16310, 2013]
Regulatory approval	sub-stage where is established and confirmed by the authorities that the built asset complies with the regulatory requirements and that the asset is released for use	[EN 16310, 2013]
Operation	sub-stage where the facility is being run and exploited and where the expected performance is monitored and managed	[EN 16310, 2013]
Maintenance	sub-stage where the asset is maintained according to predetermined objectives	[EN 16310, 2013]
Revamping	sub-stage where the built asset is updated for continued use	[EN 16310, 2013]
Dismantling	sub-stage where the built asset is taken down, removed and (partly) recycled after it's functional and/or economic life span	[EN 16310, 2013]

1 Introduction

T2.1 concerns “Process analysis and definition of relevant activities and involved stakeholders (public vs private sectors)”. This task carries out a deep analysis of the building process in case of renovation interventions, focusing on the different information workflows for each involved actor that takes part directly or indirectly to the renovation process itself. Hence, informative flows have been tracked, identifying how BIM can improve data exchange, both in private and public works. The main objective is to improve communication, making data sharing easy, reliable and fast for the involved stakeholders and avoiding data duplication and conflicting datasets.

The entire building process may be optimised, if every stakeholder along the life-cycle of a building (and built asset) is able to find required information and share existing or new datasets in a straightforward and conflict-free manner.

To overcome possible inefficiencies due to incorrect or redundant exchange of information among all the actors of the construction chain, it is necessary to rationalise the information flows. These achievements can be reached by adequately managing information during the different renovation process stages (initiative, initiation, design, procurement, construction, use and end of life) and by connecting the various actors involved (such as inhabitants/end-users, clients/owners, designers, site surveyors, and contractors). Hence, relevant activities and involved stakeholders have been defined for actual and efficient renovation processes, in order to be able to outline how ICT and BIM will support the rationalisation of information flows. A particular attention has been paid in individualising differences between the public and private sectors, in order to deliver methods and create tools that can be successfully applied to the renovation process in both the sectors.

2 Residential renovation processes

When a renovation process takes place, different stakeholders are responsible of several activities. For mapping a renovation process, first of all, a list of involved stakeholders has been produced, considering experience of Consortium partners and through a literature review [CCC 2006, GBPN 2013, RIBA 2013]. Furthermore, stages of building processes have been defined, according to EN 16310 [EN 16310, 2013].

Hence, a common background has been developed in order to associate activities for the different stakeholders in subsequent stages, outlining differences for public and private renovation processes in their own countries. Information presented in the form of a list in a shared excel file has been then converted in a flowchart, mapping actors, activities and decision gates for each stage of the building process.

2.1. Analysis of a renovation process

In an ideal case, the buildings are managed and renovated systematically throughout their whole life cycle. The basis is the execution of the maintenance strategy of the building owners - either private or public, which ensures that there are always up-to-date condition surveys made by professionals and long-term planning and budgeting based on them. Unfortunately, the ideal case rarely realises resulting to the renovation debt and the poor documentation of the buildings' present condition and the maintenance history. There are many reasons behind this kind of approach resulting in the overall slow implementation of the renovation in the residential building stock, for example:

- lack of understanding of the long-term planning and its importance;
- the disturbance of the renovation for living is not welcomed by the residents, if they have to live on the construction site or, if they have to move because of the renovation;
- the need to “save” in housing costs in the short run, especially in the privately-owned apartment buildings - long time span is somewhat blurred and not interested;
- the non- or semi-professional ownership of the residential buildings;
- various actors along the stages of the building life cycle (people move in and out, maintenance professionals change, various condition survey professionals, housing manager changes);
- the technical complexity related to the deterioration and aging of the building.

The BIM4EEB-project aims to tackle this challenge by presenting the fast mapping to ground the initial stage quickly - either it has been ideally maintained or not and produce an enriched BIM, which creates the basis for the cost-efficient renovation planning, implementation and seamless hand over for the post renovation phase.

The process of renovation needs a methodology that takes into consideration a number of parameters such as the cost of the renovation measures, the targeted performance (Key Performance Indicators like indoor thermal comfort levels, CO₂-emissions, energy, safety), national building regulations, building specific information and the end user needs. Also, the process has to be adjusted so that the process allows some iterations, because the planning and the implementation of the renovation measures and the conditions surveys during the process might bring up some hidden deterioration of the building components having an effect either positively or negatively on the targeted performance of the renovation actions. It can be concluded that in general, the new built design and implementation process (e.g. RIBA) in construction can be used in the renovation process with the additions that need more attention during

the process. The list of the renovation specific additions is presented in the Table 3.

Table 3: Items that need more attention during the renovation process compared to the new built process and the list of requirements derived from the items

Item	Description	Requirements for the development
Initiation of renovation projects may be vague or late	The non-professional ownership of the residential buildings and the lack of understanding of the long-term planning can be a burden	-The support of the easy communication of the benefits and value for housing brought by the systematic maintenance strategy is needed.
Available amount of investment money is limited	Willingness to minimize housing costs in the short run increase renovation	-Tools for optimizing maintenance and renovation planning are needed -Fast and cost efficient mapping in the condition survey needed.
Initial condition and as-is data of the building is miscellaneous	Missing or misleading documentation of the building and its maintenance history	-Fast mapping of the initial building condition, measurements and properties needed
Residents and end users are involved in the process	Residents and end users are a good source for initial quality and building condition information before the renovation. Also feedback during the renovation process can be collected from the end users. The end user does not like the delays and disturbances.	-Easy multi-user collaboration and supporting tools with the BIM-platform needed. -Transparency of the process stage and Key Performance Indicators (KPI's) is needed to minimize the end user complaints during the process and to support the situation awareness of the process.
Energy renovation may not be attractive	Renovation activities for improving energy efficiency are typically expected to be profitable in reasonable time.	- The tools for energy efficiency calculations have to consider always also the impacts on user conditions, health and safety and other added-values to client.
Surprises may arise after opening the structures during renovation.	The hidden deterioration of the building components can have significant effect on the targeted performance (KPI's) of the planned renovation actions. Cost risks of surprises are included in tender prices.	-Support for the agile process, which contain feedback loops and allow the correcting of the design, is needed -Easy evaluation and recalculation of the impact related to the surprise event on the Key Performance Indicators (KPI's) is needed. -Automated issue management for the process actors is needed. -Correct linking to the technical process details derived from the surprise event is needed
Renovation work at site differ from new construction	Renovation is more labour intensive at site than new construction and require more specialized skills of workers	- New lean construction methods are needed for production planning and management to improve productivity and remove waste of resource usage - Systematic information sharing improve transparency of processes, allow right timing of activities and implementation in time
Unawareness of the value of Digital twin data	Owners need updated as-built data and easy to use digital logbook for further maintenance actions of the renovated building.	-Easy "As built"-BIM handover to the post renovation phase is needed. -Open and non-complicated interfaces to the BIM in the post renovation phase to support the 3 rd party access and to avoid software vendor lock-in is needed. -The support for the long-term planning and budgeting of the BIM

		in the post renovation phase is needed.
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The detailed list of the renovation activities and stakeholders in the renovation process has been further elaborated in the following paragraphs.

2.2. Relevant activities and involved stakeholders in a renovation process

By listing all the possible actors involved along the process, information workflow will be defined in order to be taken into account when developing the BIM Management system (WP4) and during the ongoing definition of ontologies and interoperable exchange formats (WP3). To collect this list, a table has been exploited: two different spreadsheets has been used, one dedicated to private works (where the owner is a private person or company), the other one to public works (where the owner is a public entity).

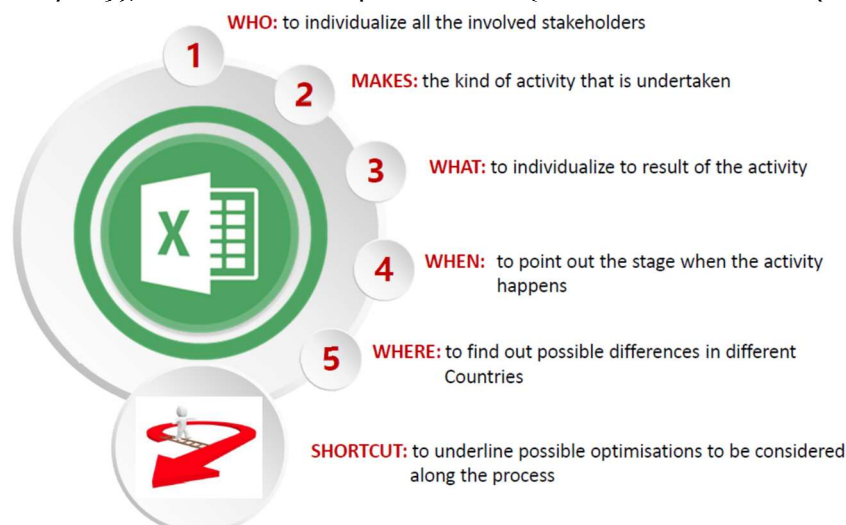


Figure 2: Structure of the spreadsheets for listing actors and activities for analysing the information workflow in renovation processes

For describing the workflow for renovation processes in both the scenario, the analysis presented in Figure 3 has been undertaken:

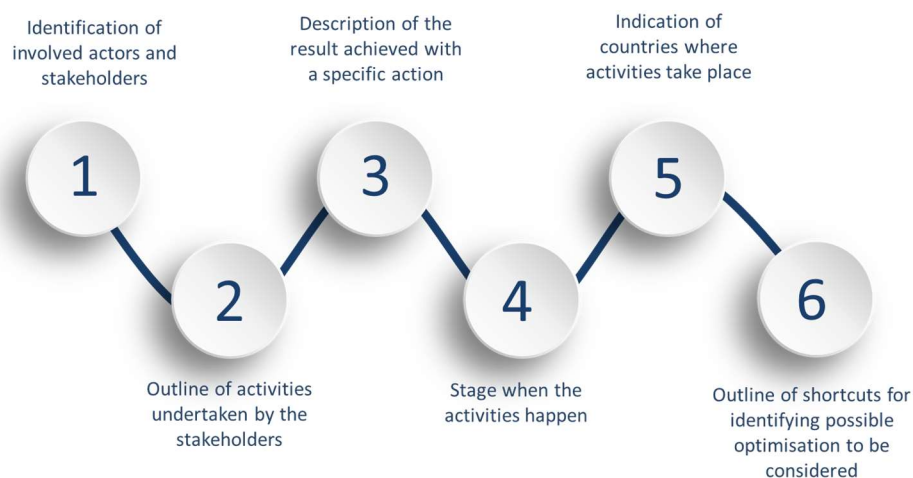


Figure 3: Main steps for analysing a renovation process

1. Identification of involved actors and stakeholders, mainly considering:
 - Inhabitant/End-user
 - Client/Owner
 - Client adviser
 - Technical adviser
 - Project leader
 - Surveyor (site, quantity)
 - Designer (lead, architectural, structural, building services, fire safety, landscape, interior, lighting)
 - Consultant (cost, access, acoustic, planning)
 - Adviser (health and safety, facility management (FM), security, sustainability)
 - Cladding specialist
 - Information manager
 - Landscape architect
 - Master planner
 - Contractor
 - Sub-contractor
 - Supplier
 - Maintenance planner
 - Construction lead
 - Contract administrator
 - Operational lead
 - Party wall surveyor
 - Local authority
 - Tenderer
2. Outline of activities undertaken by the stakeholders
3. Description of the result achieved with a specific action
4. Stage when the activities happen, referring to the structure defined within *EN 16310:2013 - Engineering services - Terminology to describe engineering services for buildings, infrastructure and industrial facilities* [EN 16310, 2013].

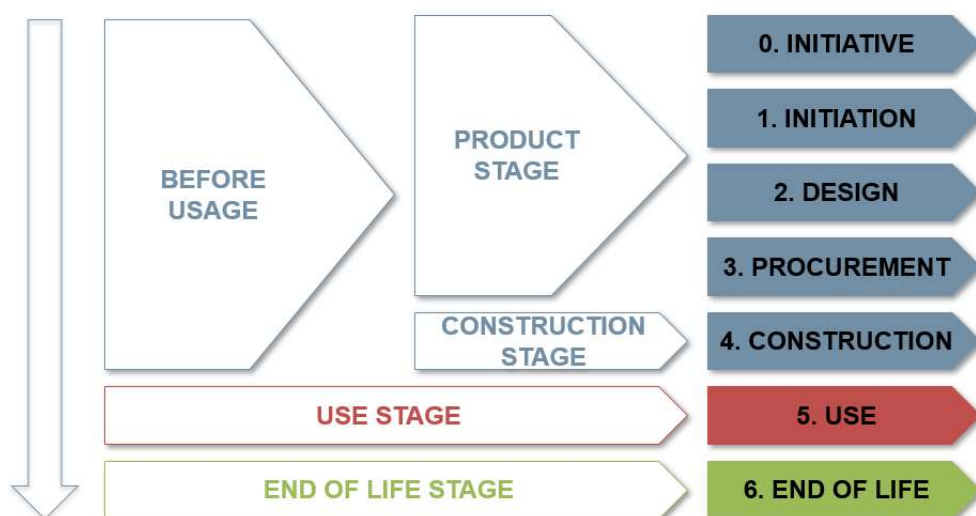


Figure 4: Stages in the lifecycle of a building asset (EN 16310)

5. Indication of countries where activities take place, with the possibility to outline national differences (e.g. in relation to public procurements)
6. Outline of shortcuts for identifying possible optimisation to be considered (e.g. for reducing time)

3 Process analysis and definition of relevant activities and involved stakeholders in private works

There are fundamental differences between the goals and procedures followed in renovation works in the case of private and public works. In this section, some key notes about the implementation of private works (and how these are differentiated from public works) are provided. The structure of this section is presented:

1. An overview of the private works specific processes, highlighting that way the main differentiation from public works;
2. A workflow analysis of the renovation process (following the definition of the methodological framework and the different phases as presented above) with focus on the private works specificities;
3. An overview of the national legislation about renovation in private properties at the different pilot sites, to complement the generic workflow for private works.

3.1. An overview of private works specificities

The scope of this section is to define/highlight the key points that characterize the implementation of renovation in private premises. By defining these key points, we will further adapt the generic renovation workflow to address private works specificities. A non-exhaustive list of private works specificities key points is presented:

1. In the case of private works, which are generally **profit-minded**, the Owner/Client is typically driving the work (along with any financial partners), with the ultimate objective to provide a **financial benefit on the investment** (i.e. return on investment). Once the need for a renovation intervention of a building is established, the Client/Owner makes the decision to undertake (or not) the works based on a cost-benefit appraisal and available funding. Interim goals, however, include enhancement of the building performance and in particular improvement of the inhabitants/end-users' comfort/living conditions. In contrast, public works are managed by governmental bodies/authorities and are mainly focused on addressing public concerns and providing social, economic and/or aesthetic benefits. The interim goals however are similar to the one of the private works.
2. In the case of private works, **financing of the intended renovation** works usually derives through the **Owner/Client himself** (private funds), or by **banks and/or a group of private investors** (third party financier). More specifically:
 - Typically, during the initiation phase, the Client Adviser prepares a detailed business case that could be used to source financing from third parties. The bank/third party financier assess the feasibility of the project and determines if savings guarantees are realistic.
 - If the financing of the project is agreed, negotiations take place to agree the financing terms (i.e. how money will be delivered over the course of the project, interest rates, time frame, payments schedule, etc.).
 - Lastly, the financing agreement is signed from both parties (Owner/Client- Bank/third party).
 - During the project, it is the financing entity's role to monitor the project's progress on regular intervals and especially during the phases of developed and detailed design in order to

observe any potential deviations.

- This however is not the case for public works, where the funds typically derive through public funding (i.e. tax revenue, duties, fees, etc.). Additionally, the Client/Owner (i.e. the Government) will have to approve the preliminary design and spending plan prior to proceeding in to the developed design phase. The different source of the funding between private and public projects, results in different bidding and tendering processes.
3. **Private bidding** can be seen as a **quality driven action**, where the Client/Owner can decide to appoint a contractor based on fulfilment of certain criteria, which can reassure him that the selected contractor can complete the project in time and within budget. On the other hand, public bidding projects are controlled by governmental regulations and require a more competitive process and greater transparency, which in turn will secure the lowest price for the project. Typically, the contract is awarded to the lowest bidder demonstrating that public funds are spend in a responsible manner. Due to this fact, typically public tenders are advertised for at least a month prior to deadline, in the public domain (e.g. newspapers, government /municipal websites, notice boards, etc.) and are open to the public, while private tenders aren't.
 4. Another critical difference between public and private works is identified in the **selection of the procurement strategy**. In the case of public funded works, the procurement process is constrained by some form of legislation, whether at the local, regional, national or international level, or a combination of these. Procurement practices need to be approved by several governmental bodies and suppliers/subcontractors often undergo background checks and scrutiny in order to qualify to bid (since taxpayers' money is spend), slowing down the overall procurement process. At this point it should be mentioned that throughout the European Union, the public procurement rules are defined and established through the "European Union Procurement Directives" which apply to any public purchases above defined thresholds. The purpose of the directives is to open up public procurement within the European Union ensuring the free movement of supplies, services and works. In contrast, private works can benefit from a **faster procurement process**. As there are no imposed regulations dictating supplier relationships/requirements, for private works (unless they are publicly subsidised), the Project Leader can source the suppliers/subcontractors (usually identified in the private entities' supply chain database) he 'prefers' to work with (typically evaluated by their previous work, experience/expertise, and reputation) and as long it is within the budget. As such, private projects can achieve better deals and procure materials/services when required, speeding up the overall process.
 5. Also related to the regulation specificities, though throughout the European Union the public procurement rules are defined and established through the "European Union Procurement Directives", there are differentiations among the different countries and these should be further addressed in the renovation workflow. This is not the case for **private works**, where the regulation limitations are not that strict and thus the **typical workflow process** is applicable in different geographical regions.
 6. Considering the **roles and responsibilities** it is evident that in **private projects** a subgroup of stakeholders is involved in the overall process. The **building owner/ project leader is the key role** that handles the main responsibilities during the renovation process. On the other hand, this is not the case for public works. Different organizational entities are involved in the different operations/processes and thus a more extended group of users is involved in the renovation task. Roles like Tester or Work Supervisor are distinguished in public projects while in private works the project leader is addressing multiple roles and responsibilities.

The above presented key points that differentiate the implementation of private works from public works are also highlighted in the following paragraphs through the description of detailed workflow steps for the implementation of private and public works.

3.2. Private works renovation workflow

As stated in the methodological section, the structure is defined following the EN 16310 [EN 16310, 2013]. The details at each stage of the overall renovation process are presented in the following, where we highlight the key aspects/points associated with private works implementation.

Table 4: Workflow in a renovation process in case of private works - Initiative

N.	WHO	MAKES	WHAT	SHORTCUT
1	Inhabitant/ End-user	needs	a renovation intervention	If the inhabitant/ end-user is the owner
2	Inhabitant/ End-user	communicates	the need of renovation to the owner	
3	Client/Owner	makes	a site inspection to evaluate the necessity and the urgency of intervention	
4	Client/Owner	agrees	on the necessity of a renovation	
5	Client/Owner	appoints	an adviser to provide a cost-benefits appraisal and a preliminary business case	If the owner is able to esteem cost-benefits
6	Client adviser	provides	a cost-benefits appraisal	
7	Client/Owner	evaluates	cost-benefits of a renovation	
8	Client adviser	prepares	preliminary business case which can be used for initial exploration of financing needs and options such as third party loans and Energy Performance Contracts (EPCs)	If the owner is able to establish his own business case.
9	Client/Owner	evaluates	preliminary business case	

Table 5: Workflow in a renovation process in case of private works - Initiation

N.	WHO	MAKES	WHAT	SHORTCUT
10	Client/Owner	decides	to undertake a renovation process	
11	Client/Owner	appoints	a project leader to manage the renovation project	
12	Project leader	identifies	clients/owner needs and user requirements	
13	Project leader	compiles	available information covering regulatory, infrastructure and geotechnical conditions	
14	Project leader	identifies	additional site investigations required including surveys of existing buildings and structures	
15	Client/Owner	appoints	a site surveyor	
16	Site surveyor	carries out	measured surveys and condition surveys of existing structures or buildings on site (site survey), measuring each room and building component in order to return a geometrical representation of the building to be renovated	if the project leader is a site surveyor

17	Site surveyor	documents	the present condition of the property, highlighting areas of failure or concern	
18	Site surveyor	identifies	causes of past, or ongoing, deterioration and issues that need attention to prevent serious damage	
19	Site surveyor	identifies	HVAC distribution and size of each building service component	
20	Site surveyor	identifies	materials and classify according to environmental issues	
21	Site surveyor	combines	the scanning data with installation schemes and existing drawings	if laser scanning has been undertaken for the site survey
22	Project leader	sets out	basic planning principles and possible construction strategies	
23	Project leader	examines	how the project can meet stated requirements and aspirations	
24	Project leader	informs	the client of technical and statutory constraints the project has to satisfy	
25	Project leader	prepares	feasibility studies and assessment of options to enable the client to decide whether to proceed	
26	Project leader	investigates	expected budget requirements	
27	Project leader	analyses	the kind of intervention and the tasks to be developed	
28	Project leader	defines	the project organisational structure and range of consultants and others to be engaged for the project, including definition of responsibilities	
29	Project leader	defines	possible procurement strategy	
30	Project leader	identifies	the procurement method	
31	Project leader	sets out	a project brief	
32	Project leader	produces	a room and function schedule	
33	Project leader	identifies	required statutory approval process and building permit	
34	Project leader	assembles	project team	
35	Lead designer	identifies	needs for specialist consultants	
36	Cost consultant/ quantity surveyor	esteems	costs and time	
37	Project leader	defines	an expected or desired time schedule, preparation of a project execution plan	
38	Health and safety adviser	considers	health and safety strategy	
39	Information manager	defines	information exchange objectives	
40	Inhabitant/ End-user	wants to	receive info on work planning/ schedules (pre/ during renovation)	& owner
41	Inhabitant/ End-user	wants to	negotiate with contractors about the work planning	

42	Inhabitant/ End-user	interested to	participate (jointly with contractors) for the optimal schedules of the renovation process	
43	Inhabitant/ End-user	is interested to	receive security and safety recommendations about construction programming	
44	Owner	is interested in	management and control of the renovation process	
45	Owner	agrees	to share information about building	
46	Owner	monitors	the results of building renovation simulation	
47	Owner	monitors	building energy performance (near real time)	
48	Owner	controls	working times and economic sustainability of the renovation process	
49	Client adviser	prepares	detailed business case that can be used for soliciting financing from third parties	
50	Bank or third party financier	assesses	detailed business case and feasibility of project through own cost assessments and potentially audits from external consultants to determine if savings guarantees are realistic	
51	Bank or third party financier	agrees	to finance the project	
52	Client/Owner	negotiates	financing terms with bank or third party. This includes percentage of project financed, how money is delivered over the course of the project, interest, time frame and payments schedule. This process will most likely involve contributions from the project lead	If the owner can front the cash for the whole operation/ owner can also be the one in charge of drafting business case with inputs from project lead
53	Client/Owner	signs	negotiated financing contract. The third party entity will generally monitor the progress of the project at different time intervals during the course of the following activities especially during the phases of developed and detailed design in order to observe any potential deviations	

Following the definition of the early activities at the renovation process, the design related activities are further specified. As the overall design process is a complex task, the following tables split this phase in different sub-phases (concept design, preliminary design, developed design and detailed design).

For the design phase, the different steps remain the same for both types of renovation (private vs. public works).

Table 6: Workflow in a renovation process in case of private works - Concept design

N.	WHO	MAKES	WHAT	SHORTCUT
54	Lead designer	examines	the principal elements of the brief, if already defined by the client, or the objectives and requirements the project has to satisfy	
55	Architectural designer	produces	concept sketches and undertake preliminary investigations	
56	Architectural designer	prepares	CONCEPT design proposals with design options, translating into drawings at an appropriate scale (typically 1:500-1:200) along with a preliminary design report and an initial cost estimate	
57	Architectural	holds	preliminary discussions with local authorities on the	

	designer		basis of the conceptual design agreed by the client	
58	Architectural designer	establishes	correct procedures to obtain statutory approvals	
59	Project leader	explains	to the client correct procedures to obtain statutory approvals	
60	Project leader	undertakes	tender action - convert the project design into a set of pre-contract documents setting out an unambiguous set of tender requirements - collate project documents necessary for contractors to appreciate the type, the quantity, the quality and the scope of their works so that contractors can calculate their best offer	It can be postpone to preliminary or developed or detailed design
61	Project leader	prepares	tender documentation in sufficient detail to enable a tender or tenders to be obtained for the project (i.e. a tender file to tenderers, including: the conditions of tender, the proposed form of contract, plans, specifications, possibly a bill of quantities and a list of contractual documents with their order of priority, etc.)	
62	Tenderer	submits	a tender to the client	
63	Project leader	analyses	tender returns, make recommendations to client and enable him to pass construction contracts with each respective trade	
64	Project leader	sets out	program dates	
65	Project leader	updates and reviews	the project execution plan	
66	Project leader	considers	options for construction strategy	
67	Lead designer	checks	design from specialist consultants for compliance with the general design	
68	Lead designer	integrates	as necessary into overall design documentation (including technical sub-disciplines of construction such as structural, mechanical, electrical, HVAC, geotechnical, fire security, acoustics, lighting, etc.)	
69	Health and safety adviser	prepares	an outline for health and safety strategy	
70	Information manager	manages	information exchange level 1 (brief and feasibility)	
71	Information manager	produces	end of stage report for client approval	
72	Information manager	considers	changes required to the brief	

Table 7: Workflow in a renovation process in case of private works - Preliminary design

N.	WHO	MAKES	WHAT	SHORTCUT
73	Project leader	develops	the concept design and chosen options as approved by the client and previewed with the authorities	
74	Local authority	gives	feedbacks on a preview of the concept design	
75	Architectural designer	prepares	graphic presentations of the project for discussions with the client and other interested parties	
76	Architectural	produces	a set of preliminary design drawings at an appropriate	

	designer		scale (typically 1:200-1:100) with floor plans, sections, elevations and 3d modelling	
77	Architectural designer	produces	technical reports to explain design options	
78	Architectural designer	produces	architectural plans and documentation describing the project to a level of detail as required for Planning or Building permit applications (based on the approved design)	It can be postponed to developed or detailed design
79	Architectural designer	collates	additional technical documentation from technical specialist consultants; such as acoustic, thermal, fire safety, environmental and other appraisals as required by applicable legislation	
80	Project leader	assembles	documents required for building permit applications, draft and submit applications	
81	Project leader	assists	during planning negotiations, monitor the approvals procedure (representing the client)	
82	Project leader	prepares	files for additional certificates as required by national legislation or by the specific nature of the asset	
83	Project leader	undertakes	tender action - convert the project design into a set of pre-contract documents setting out an unambiguous set of tender requirements - collate project documents necessary for contractors to appreciate the type, the quantity, the quality and the scope of their works so that contractors can calculate their best offer	
84	Project leader	prepares	tender documentation in sufficient detail to enable a tender or tenders to be obtained for the project (i.e. a tender file to tenderers, including: the conditions of tender, the proposed form of contract, plans, specifications, possibly a bill of quantities and a list of contractual documents with their order of priority, etc.)	
85	Tenderer	submits	a tender to the client	
86	Project leader	analyses	tender returns, make recommendations to client and enable him to pass construction contracts with each respective trade.	
87	Project leader	updates and reviews	the project execution plan	
88	Project leader	devises	fundamental schedule in phases	
89	Project leader	proposes	construction strategy	
90	Lead designer	checks	design from specialist consultants for compliance with the general design	
91	Lead designer	integrates	as necessary into overall design documentation (including technical sub-disciplines of construction such as structural, mechanical, electrical, HVAC, geotechnical, fire security, acoustics, lighting, etc.)	
92	Health and safety adviser	establishes	health and safety strategy	
93	Information manager	manages	information exchange level 2	
94	Information manager	produces	end of stage report for client approval	

Table 8: Workflow in a renovation process in case of private works - Developed design

N.	WHO	MAKES	WHAT	SHORTCUT
95	Project leader	develops	the approved preliminary design up to an appropriate level, providing the basic information required for issue of contract plans and specifications	
96	Project leader	prepares	a set of developed design drawings with floor plans, sections and elevations to determine the dimensions, appearance, principal technical solutions, materials and construction elements of the project at an appropriate scale (typically 1:100-1:50)	
97	Project leader	produces	specification and detailed description of the works in the form of a written document describing the nature of the works and defining the technical specifications for each separate trade	
98	Project leader	calculates	building costs based on customary prices and, if applicable, bills of quantities	
99	Architectural designer	produces	architectural plans and documentation describing the project to a level of detail as required for Planning or Building permit applications (based on the approved design)	It can be postponed to detailed design
100	Architectural designer	collates	additional technical documentation from technical specialist consultants; such as acoustic, thermal, fire safety, environmental and other appraisals as required by applicable legislation	
101	Project leader	assembles	documents required for building permit applications, draft and submit applications	
102	Project leader	assists	during planning negotiations, monitor the approvals procedure (representing the client)	
103	Project leader	prepares	files for additional certificates as required by national legislation or by the specific nature of the asset	
104	Project leader	undertakes	tender action - convert the project design into a set of pre-contract documents setting out an unambiguous set of tender requirements - collate project documents necessary for contractors to appreciate the type, the quantity, the quality and the scope of their works so that contractors can calculate their best offer	It can be postponed to detailed design
105	Project leader	prepares	tender documentation in sufficient detail to enable a tender or tenders to be obtained for the project (i.e. a tender file to tenderers, including: the conditions of tender, the proposed form of contract, plans, specifications, possibly a bill of quantities and a list of contractual documents with their order of priority, etc.)	
106	Tenderer	submits	a tender to the client	
107	Project leader	analyses	tender returns, make recommendations to client and enable him to pass construction contracts with each respective trade	
108	Project leader	proposes	a construction schedule	
109	Project leader	updates and reviews	the project execution plan	
110	Project leader	updates and	construction strategy	

		reviews		
111	Lead designer	checks	design from specialist consultants for compliance with the general design	
112	Lead designer	integrates	as necessary into overall design documentation (including technical sub-disciplines of construction such as structural, mechanical, electrical, HVAC, geotechnical, fire security, acoustics, lighting, etc.)	
113	Health and safety adviser	reviews and updates	health and safety strategy	
114	Information manager	manages	information exchange level 3	
115	Information manager	produces	end of stage report for client approval	
116	Project leader	submits	documents required for building permit applications to Local Authorities	
117	Local authority	issues	the building permit	

Table 9: Workflow in a renovation process in case of private works - Detailed design

N.	WHO	MAKES	WHAT	SHORTCUT
118	Architectural designer	develops	the developed design to provide execution and detail drawings at the required scale (typically 1:50, 1:20, 1:10, 1:5, 1:1)	
119	Architectural designer	provides	calculations and specifications intended for construction and enabling contractors to build the works	
120	Architectural designer	determines	all details including furniture and other elements that are specific to the project	
121	Project leader	recalculate	building costs based on customary prices and possibly, bills of quantities incorporating quotations from specialist subcontractors	
122	Project leader	establishes	a project execution plan	
123	Architectural designer	produces	architectural plans and documentation describing the project to a level of detail as required for Planning or Building permit applications (based on the approved design)	
124	Architectural designer	collates	additional technical documentation from technical specialist consultants; such as acoustic, thermal, fire safety, environmental and other appraisals as required by applicable legislation.	
125	Project leader	assembles	documents required for building permit applications, draft and submit applications	
126	Project leader	assists	during planning negotiations, monitor the approvals procedure (representing the client)	
127	Project leader	prepares	files for additional certificates as required by national legislation or by the specific nature of the asset	
128	Lead designer	checks	design from specialist consultants for compliance with the general design	

129	Lead designer	integrates	as necessary into overall design documentation (including technical sub-disciplines of construction such as structural, mechanical, electrical, HVAC, geotechnical, fire security, acoustics, lighting, etc.)	
130	Health and safety adviser	reviews and updates	health and safety strategy	
131	Project leader	undertakes	tender action - convert the project design into a set of pre-contract documents setting out an unambiguous set of tender requirements - collate project documents necessary for contractors to appreciate the type, the quantity, the quality and the scope of their works so that contractors can calculate their best offer	
132	Project leader	prepares	tender documentation in sufficient detail to enable a tender or tenders to be obtained for the project (i.e. a tender file to tenderers, including: the conditions of tender, the proposed form of contract, plans, specifications, possibly a bill of quantities and a list of contractual documents with their order of priority, etc.)	
133	Tenderer	submits	a tender to the client	
134	Project leader	analyses	tender returns, make recommendations to client and enable him to pass construction contracts with each respective trade.	
135	Project leader	details and agrees	proposed construction schedule	
136	Project leader	establishes	handover and Commissioning Strategy	
137	Information manager	manages	information exchange level 4	
138	Information manager	produces	end of stage report for client approval	

As stated in the introductory section, there is no need to explicitly set specific processes during the Procurement and Construction Contracting process in private works.

The building owner or Project Leader is the responsible for the selection of the suppliers/subcontractors he 'prefers' to work with (typically evaluated by their previous work, experience/expertise, and reputation) and as long it is within the budget.

As there are no specific requirements for this phase of the project, there are no specific steps in the workflow defined for private works.

The next phase is the **construction** and **commissioning** phase, and the detailed workflow is presented in the following table.

Table 10: Workflow in a renovation process in case of private works - Construction

N.	WHO	MAKES	WHAT	WHEN
139	Contract administrator	prepares	contract administration	Pre-construction
140	Contract	reviews	contracts and agreed project objectives	Pre-construction

	administrator			
141	Inhabitant/ End-user	uploads	information requested from contractors for the renovation process, if necessary	Pre-construction
142	Project leader	oversees	the execution of the building contract	Commissioning
143	Project leader	monitors	construction progress and compliance with plans	Commissioning
144	Project leader	inspects	contractors' activity and execution of the works	Commissioning
145	Project leader	considers	contractors' drawings	Commissioning
146	Project leader	undertakes	random inspection of materials and quality of workmanship	Commissioning
147	Project leader	undertakes	final clarification of design details prior to implementation	Commissioning
148	Project leader	undertakes	process changes required by the client and issue relevant instructions to contractors	Commissioning
149	Project leader	checks	requests for payment issued by contractors	Commissioning
150	Project leader	approves	requests for payment issued by contractors	Commissioning
151	Project leader	checks	that all works have been carried out in accordance to contract, and that the building is fit for use and compliant to regulations and permits obtained	Commissioning
152	Project leader	organizes	eventual statutory procedures required to open the building	Commissioning
153	Project leader	oversees	preparation of as-built documentation	Commissioning
154	Project leader	checks	workmanship and compliance with contract documents	Commissioning
155	Inhabitant/ End-user	updates	information about comfort conditions during renovation process	Commissioning
156	Inhabitant/ End-user	feels	comfort/ discomfort during the renovation process	Commissioning
157	Project leader	supervises	handover to the client and building users as start of guarantee periods	Handover
158	Project leader	oversees	issue of as-built documentation and final accounts	Handover
159	Project leader	applies for	for additional permits as required, enable possible monitoring by authorities during construction and produce documents to support registration of completion of the works with authorities if necessary	Regulatory approval
160	Structural, Electrical, HVAC, water and waste designer	produces	architectural plans and documentation describing the project to a level of detail as required for Planning or Building permit applications (based on the approved design)	Commissioning
161	Structural, Electrical, HVAC, water and waste designer	collates	additional technical documentation from technical specialist consultants; such as acoustic, thermal, fire safety, environmental and other appraisals as required by applicable legislation.	Commissioning
162	Project leader	monitors	revisions to construction contracts	Commissioning
163	Project leader	monitors	construction schedule as agreed by contract	Commissioning

Following the construction phase, the building use stage (operation & maintenance) is considered. Once again, the main peculiarity in private works is about the cost benefit analysis of the investment during the

operation phase from the building owner. The same applies for the maintenance process as the cost optimization is a key parameter for a private work.

Table 11: Workflow in a renovation process in case of private works - Use

N.	WHO	MAKES	WHAT	WHEN
164	Project leader	supports	the client to maximise the use of his investment	Operation
165	Project leader	reviews	project performance and additional project information as required	Operation
166	Facilities management (FM) adviser	provides	advice to program planned maintenance and periodical performance testing	Operation
167	Sustainability adviser	monitors	sustainability performance	Operation
168	Inhabitant/ End-user	updates	information about comfort conditions post renovation process	Operation
169	Inhabitant/ End-user	feels	comfort/ discomfort during post renovation process	Operation
170	Inhabitant/ Owner	uploads	ad hoc information related to operational processes that may be useful for the renovation process	Operation
171	Owner	monitors	The economic sustainability of the project	Operation
172	Facilities management (FM) adviser	advises	for maintenance of the building and external works for upkeep of the client's investment	Maintenance
173	Facilities management (FM) adviser	assists	with facility management, training, environmental monitoring, life-cycle strategy and energy-waste-water management procedures	Maintenance
174	Project leader	prepares	documentation to obtain permits for possible changes of use, renovation or redesign	Maintenance
175	Project leader	sets out	procurement documentation and tender procedures for facility management, maintenance, and possibly renovation	Maintenance
176	Technical adviser	undertakes	end of life audit	Maintenance
177	Technical adviser	recommends	demolition and/or rehabilitation strategy	Maintenance

Eventually, the decommissioning workflow is analysed for private buildings. The building owner in private projects has a key role as the responsible to trigger the dismantling process while it also monitors the financial parameters associated with this activity.

Table 12: Workflow in a renovation process in case of private works - End of life

N.	WHO	MAKES	WHAT	WHEN
178	Technical adviser	provides	services for a new cycle taking the built asset through stages from 0. Initiative to 4. New Use. Possibly partial dismantling under controlled conditions if required	Revamping
179	Project leader	schedules	works for revamping	Revamping

180	Health and safety adviser	considers	Health and Safety when revamping	Revamping
181	Project leader	sets out	procurement documentation and tender procedures for revamping	Revamping
182	Client/Owner	enables	facility shutdown and closing off of the site. Identify services (electricity, gas, fluids ...) in order to make the building safe for decommissioning	Dismantling
183	Project leader	applies for	any necessary closure permits, preparing documentation to obtain permits from authorities for dismantling or revamping as required	Dismantling
184	Project leader	identifies	Identify raw materials, waste and materials to be recycled	Dismantling
185	Project leader	arranges	removal and treatment of contaminated materials, removal of structures, treatment and/or removal of contaminated soil and groundwater	Dismantling
186	Project leader	selects	appropriate landfill (if necessary)	Dismantling
187	Project leader	proposes	measures to control noise, air and ground water pollution	Dismantling
188	Local authority	gives	permits for dismantling	Dismantling
189	Project leader	schedules	works for dismantling	Dismantling
190	Project leader	sets out	procurement documentation and tender procedures for dismantling	Dismantling
191	Project leader	inspects	dismantling of equipment and service disconnections	Dismantling
192	Project leader	coordinates	demolition under controlled conditions to ensure health and safety of site operatives and the general public	Dismantling
193	Sustainability adviser	considers	waste management, environmental impacts, contamination	Dismantling
194	Contractor	selects	appropriate landfill (if necessary)	Dismantling
195	Contractor	arranges	removal and treatment of contaminated materials, removal of structures, treatment and/or removal of contaminated soil and groundwater	Dismantling
196	Health and safety adviser	considers	Health and Safety when dismantling	Dismantling

The above detailed steps of the renovation process highlight the specificities of a private project. Considering that the scope of the BIM4EEB project is to address both types of buildings, the aforementioned usage flows will be thoroughly considered towards the design of the BIM4EEB platform and the development of the respective business applications in the project.

Complementary to this, a similar analysis is performed for the renovation activities performed in public buildings and the results of this workflow analysis are presented in the following section.

4 Process analysis and definition of relevant activities and involved stakeholders in public works

The case of “public works” differs from “private works” by the type of procedures: in the case of “public works” the whole procedure is governed by specific legislation, defined at European level (European framework law about public procurement) and then declared in each member state according to the local law.

By 18 April 2016, EU countries had to transpose the following three directives into national law:

- Directive 2014/24/EU on public procurement [Directive 2014/24/EU];
- Directive 2014/25/EU on procurement by entities operating in the water, energy, transport and postal services sectors [Directive 2014/25/EU];
- Directive 2014/23/EU on the award of concession contracts [Directive 2014/23/EU].

The aim of the European Commission’s public procurement strategy is to simplify public procurement procedures and make them more flexible, prevent “buy national” policies and promote the free movement of goods and services.

In Italy, “public works” regulations are included in a document called “Italian public contract code - Legislative decree No. 50, April 18, 2016, as modified by legislative decree n. 57/2017”: this document is a framework law that defines several aspect of the process by guidelines and other acts approved by the government (often by the Ministry of Infrastructures and Transport) and connects to other specific regulation as the Italian Code for the construction design (NTC2018) or Legislative Decree No. 42 of 22 January 2004, which contains the Code of Cultural Heritage and Landscape.

The A.L.E.R. (Lombardy Companies for Residential Construction), legally defined as public bodies of an economic nature, equipped with entrepreneurial and organizational autonomy, are the instrument used by Lombardy Region for the management of public housing services. Specifically, the ALERs are a total of 5, distributed throughout Lombardy, managing a real estate owned property that has about 106,000 homes, most of them built in the ‘60s and ‘70s.

Region Lombardy and A.L.E.R. are defined by the law ‘contracting authorities’ and it is mandatory for them to respect, in their activities, the rules established by the Code of Public Contracts.

The Italian public contract code defines regulations about all phases of the project starting from the planning, programming and design phase and going on the award, execution of works, purchasing of services and supplies and ending with the phase of testing and verification of compliance.

All the phases are leaded by the Official Responsible of the Procedure (ORP) with respect to the principles (set by the Code) of cost-effectiveness, efficacy, timeliness and correctness.

According to the Italian context, the stage of “Programming” is the phase of identifying the actions necessary to meet a need, identifying the financial resources and the most suitable operating methods to guarantee the implementation of the principles of good performance, cost-effectiveness and efficiency of the administrative action.

The planning of public works, which takes place on a three-year basis with annual updates, constitutes a mandatory fulfilment for all contracting authorities and must cover all the interventions with the amount of works estimated equal to or greater than 100.000 €.

In Poland public works need to be done according to “Public Procurement Law” [The Act of 29 January 2004- Public Procurement Law (Journal of Laws of 2018, item 1986 and 2215)]. This Act specifies the rules and procedures for awarding public contracts, legal protection measures, control of the award of public contracts and the competent authorities with respect to matters addressed in this Act.

Other two Acts that need to be taken under consideration - in both public and private works-are: Polish “Construction Law” and “The technical conditions which should be met by buildings and their location” [Regulation of the Minister of infrastructure and building from 14 of November 2017 item 2285].

Since most of the activities and involved actors respectively in public and private works are the same, in the following tables only the additional actions foreseen for the public works and not for the private ones are highlighted, showing the previous and following activity in order to understand where this variation takes place.

In public works, the client/owner doesn't evaluate preliminary business case as the last activity of the initiative stage, but he/she examines the available budget and existing opportunities to apply for public funding.

Table 13: Workflow in a renovation process in case of public works - Initiative

N.	WHO	MAKES	WHAT	SHORTCUT
9	Client/Owner	evaluates	preliminary business case	
10	Client/Owner	considers	available budget and opportunities to apply for public funding	

In the initiation phase, after the identification of client/owner's needs and user requirements foreseen for private works too, an identification of other public administrations' objectives by project leader is necessary.

Table 14: Workflow in a renovation process in case of public works – Initiation (extract of activities from 13 to 15)

N.	WHO	MAKES	WHAT	SHORTCUT
13	Project leader	identifies	clients/owner needs and user requirements	
14	Project leader	identifies	other public administrations' objectives	
15	Project leader	compiles	available information covering regulatory, infrastructure and geotechnical conditions	

Furthermore, while the project leader has the task to assess the need of appointing an external professional, the client/owner has to appoint designers to be employed within the project.

Table 15: Workflow in a renovation process in case of public works – Initiation (extract of activities from 25 to 28)

25	Project leader	defines	the project organisational structure and range of consultants and others to be engaged for the project, including definition of responsibilities	
26	Project leader	evaluates	if it is necessary to appoint an external professional	If the owner has an employee with the expertise to be appointed as site surveyor
27	Client/Owner	appoints	designers to be engaged for the project (such as structural, mechanical, electrical, HVAC, geotechnical, fire security, acoustics, lighting, etc.)	
28	Project leader	defines	possible procurement strategy	

Finally, the inhabitant end user not only wants to receive info about the work, but he is also available to

upload information requested by contractors as reported below.

Table 16: Workflow in a renovation process in case of public works – Initiation (extract of activities from 38 to 40)

38	Information manager	defines	information exchange objectives	
39	Inhabitant/End-user	is available to	upload information requested from contractors for the renovation process	
40	Inhabitant/End-user	wants to	receive info on work planning/ schedules (pre/ during renovation)	

In the Italian and Polish context, the stage of “Design” represents an essential element for the correct execution of the works as, for subsequent levels of study (technical and economic feasibility project, final design and executive project), it precisely defines the characteristics both in terms of size and in the precise identification of costs and construction times, in compliance with environmental, urban planning and landscape protection regulations. The design activities can be carried out within the contracting authorities, if there are adequate professional profiles, or entrusted to external professionals.

It represents an extremely delicate phase, especially in the case of interventions on buildings with a high historical-artistic interest, and it is the phase of finding the graphic documents representing the building object of the intervention. If these are not available, or are available with insufficient information, necessary for the BIM representation, it is necessary to proceed with a “ad hoc” survey campaign of the building. The design phase, as for the “private works”, often involves other public administrations for providing specific authorizations (the Superintendent for Architectural and Urban Landscaping) or (seismic) other than the committing one.

The first sub-stage of the design phase, known as concept design, includes the same activities for both public and private works realized by the same stakeholders as previously reported in the paragraph 3.2.

In the following sub-stages of design - the preliminary and developed design – the client/owner has the task to approve respectively preliminary design, developed design and spending plan differently from the renovation process in private works where these two actions are not expected.

Table 17: Workflow in a renovation process in case of public works - Preliminary design

N.	WHO	MAKES	WHAT	SHORTCUT
89	Information manager	produces	end of stage report for client approval	
90	Client/Owner	approves	Preliminary design and spending plan	

Table 18: Workflow in a renovation process in case of public works - Developed design

113	Local authority	issues	the building permit	
114	Client/Owner	approves	Developed design and spending plan	

Referring to the detailed design, while in the private works the project leader recalculates building costs based on customary prices and, bills of quantities incorporating quotations from specialist subcontractors, in this case the project leader has to review and update building costs provided by the architectural designer and based on customary prices.

Table 19: Workflow in a renovation process in case of public works - Detailed design (extract of activities from 117 to 119)

N.	WHO	MAKES	WHAT	SHORTCUT
117	Architectural designer	determines	all details including furniture and other elements that are specific to the project	

118	Project leader	reviews and updates	building costs provided by the architectural designer and based on customary prices and possibly, bills of quantities incorporating quotations from specialist subcontractors	
119	Project leader	establishes	a project execution plan	

Two further actions are expected in the detailed design: as in the previous two design sub-stages the client/owner approves and authorizes detailed design, tender documentation and tender procedure and spending plan; and the project leader has to check and approve tender action with the contract administrator.

Table 20: Workflow in a renovation process in case of public works - Detailed design (extract of activities from 129 to 132)

129	Project leader	prepares	tender documentation in sufficient detail to enable a tender or tenders to be obtained for the project (i.e. a tender file to tenderers, including: the conditions of tender, the proposed form of contract, plans, specifications, possibly a bill of quantities and a list of contractual documents with their order of priority, etc.)	
130	Client/Owner	approves and authorizes	Detailed design - tender documentation - tender procedure and spending plan	
131	Project leader	checks and manages	tender action with the appointed office (contract administrator)	
132	Tenderer	submits	a tender to the client	

During the procurement, the client has the task to approve and authorize the tender-spending plan.

Table 21: Workflow in a renovation process in case of public works - Detailed design (extract of activities from 137 to 138)

137	Information manager	produces	end of stage report for client approval	
138	Client/Owner	approves and authorizes	the tender - spending plan	

Concerning “Award”, in Italy and Poland the Code of Public Contracts emphasizes the principles of transparency, non-discrimination and equal treatment in procedures for awarding public works, which should mainly be based on the criterion of the most economically advantageous tender (best ratio quality-price), limiting to the residual cases, and adequately motivated, the assignment with the criterion of the lower price.

The current Italian legislation provides for assignment strategies according to the qualification of the contracting authorities in relation to the economic dimension of the intervention to be carried out.

The “Execution” of the contract is the responsibility of the company awarded during the contracting phase.

It is supervised by the Official Responsible of the Procedure (ORP) and is directed by technical figures employed by the contractor (Execution Director, Works Manager, Health and Safety Coordinator, etc.).

“Testing” represents the final phase of a works contract in which the Contracting Authority, having verified the conformity of the work to the project and the contractual provisions, through a formal act takes delivery of the work itself and defines the contractual amount to be liquidated executing company, at the end of the contract. The testing act is mandatory in all public works contracts, except in cases where, based on the amount of work, it can be replaced by the Certificate of regular execution.

While in private works, after the review of contract and agreed project objectives by contract administrator, the subsequent activity is the uploading of information made by the inhabitant/end user, in the public works

the client/owner has to submit the contract with the construction lead.

Table 22: Workflow in a renovation process in case of public works – Construction (extract of activities from 139 to 142)

N.	WHO	MAKES	WHAT	WHEN	SHORTCUT
139	Contract administrator	prepares	contract administration	Pre-construction	
140	Contract administrator	reviews	contracts and agreed project objectives	Pre-construction	
141	Client/Owner	submits	contract with the construction lead	Construction contracting	
142	Inhabitant/End-user	uploads	information requested from contractors for the renovation process, if necessary	Pre-construction	& owner

Considering private and public works, the same action can be made by different people as in this case. The work supervisor, and not the project leader as foreseen in the private has to inspect the contractor activity, consider the contractor drawings, undertake inspection and so on as reported below.

Table 23: Workflow in a renovation process in case of public works – Construction (extract of activities from 144 to 156)

144	Project leader	monitors	construction progress and compliance with plans	Commissioning	
145	Work supervisor	inspects	contractors' activity and execution of the works	Commissioning	
146	Work supervisor	considers	contractors' drawings	Commissioning	
147	Work supervisor	Undertakes	random inspection of materials and quality of workmanship	Commissioning	
148	Work supervisor	Undertakes	final clarification of design details prior to implementation.	Commissioning	
149	Project leader	Undertakes	process changes required by the client and issue relevant instructions to contractors	Commissioning	
150	Work supervisor	checks	requests for payment issued by contractors	Commissioning	
151	Project leader	approves	requests for payment issued by contractors	Commissioning	
152	Work supervisor	checks	that all works have been carried out in accordance to contract, and that the building is fit for use and compliant to regulations and permits obtained	Commissioning	
153	Project leader	organizes	eventual statutory procedures required to open the building	Commissioning	
154	Work supervisor	oversees	preparation of as-built documentation	Commissioning	
155	Work supervisor	checks	workmanship and compliance with contract documents	Commissioning	
156	Inhabitant/End-user	updates	information about comfort conditions during renovation process	Commissioning	

In addition, the tester produces final administrative and technical test of the renovation and the client approves them.

Table 24: Workflow in a renovation process in case of public works – Construction (extract of activities from 162 to 164)

162	Project leader	monitors	construction schedule as agreed by contract	Commissioning	
163	Tester	produces	Final administrative and technical test of renovation works	Commissioning	
164	Client/Owner	approves	Final administrative and technical test of renovation works	Procurement	

During the use stage of the renovation process in public works, it's not the owner to upload information

related to operational processes but it's the FM adviser to upload them. In addition, some activities made by the technical adviser in private works are provided by project leader in the public construction.

Table 25: Workflow in a renovation process in case of public works - Use

N.	WHO	MAKES	WHAT	WHEN	SHORTCUT
171	Inhabitant/End-user	uploads	ad hoc information related to operational processes that may be useful for the renovation process	Operation	
172	Facilities management (FM) adviser	uploads	ad hoc information related to operational processes that may be useful for the renovation process	Operation	
177	Project leader	sets out	procurement documentation and tender procedures for facility management, maintenance, and possibly renovation	Maintenance	
178	Project leader	undertakes	end of life audit	Maintenance	
179	Project leader	recommends	demolition and/or rehabilitation strategy	Maintenance	

Even in the last stage, there is a difference consisted in an action made by a different actor: the technical adviser is the one who provides services during the revamping in private works, while the project leader makes the same action in public works.

Table 26: Workflow in a renovation process in case of public works - End of life

N.	WHO	MAKES	WHAT	WHEN
180	Project leader	provides	services for a new cycle taking the built asset through stages from 0. Initiative to 4. New Use. Possibly partial dismantling under controlled conditions if required.	Revamping
181	Project leader	schedules	works for revamping	Revamping

5 Relations between activities and stakeholders

As information collected in the shared Excel file is represented in a linear way, it does not represent the iterations that are typical of building renovation processes. Hence, a synoptic flowchart has been produced, outlining main actions and decision gates characterising renovation processes.

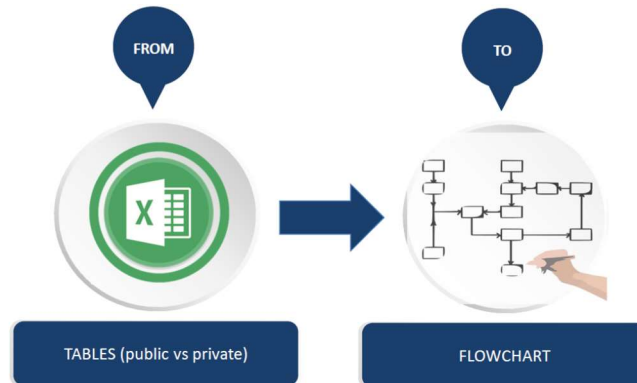
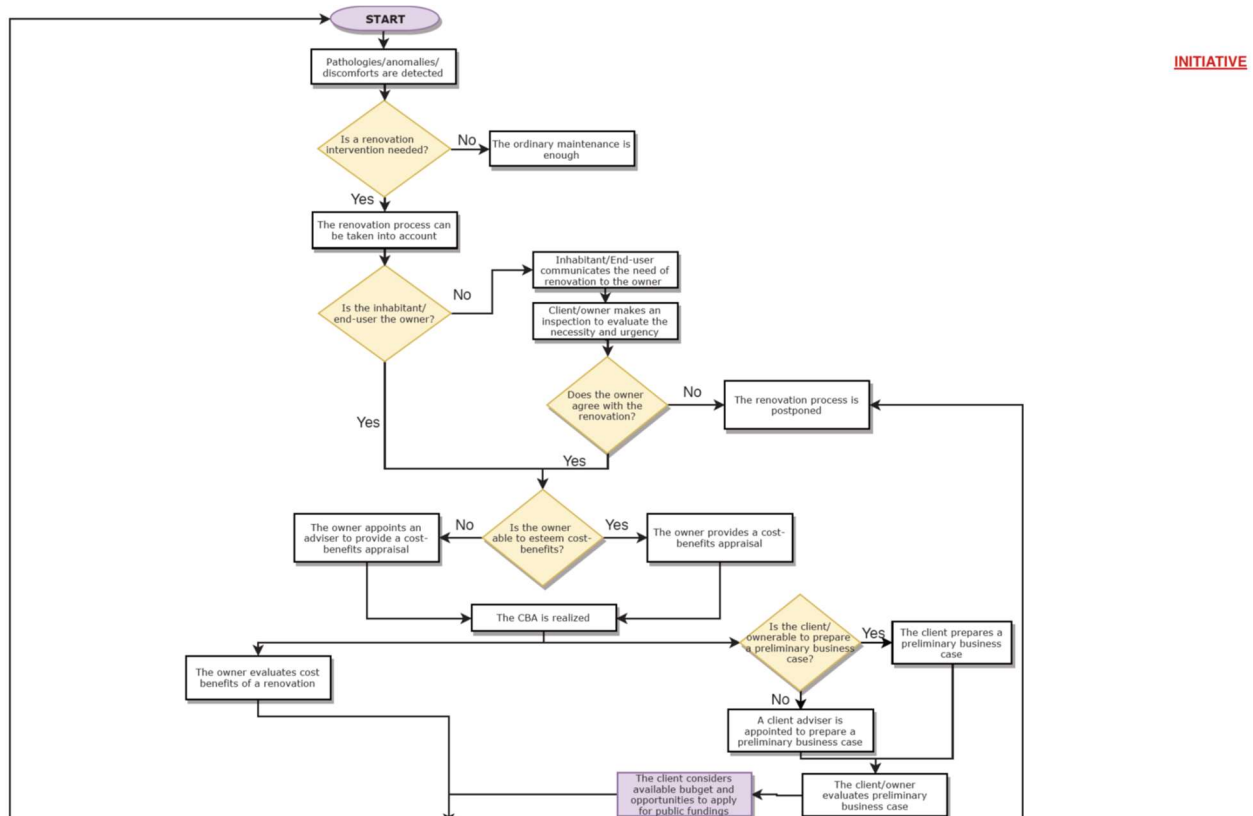
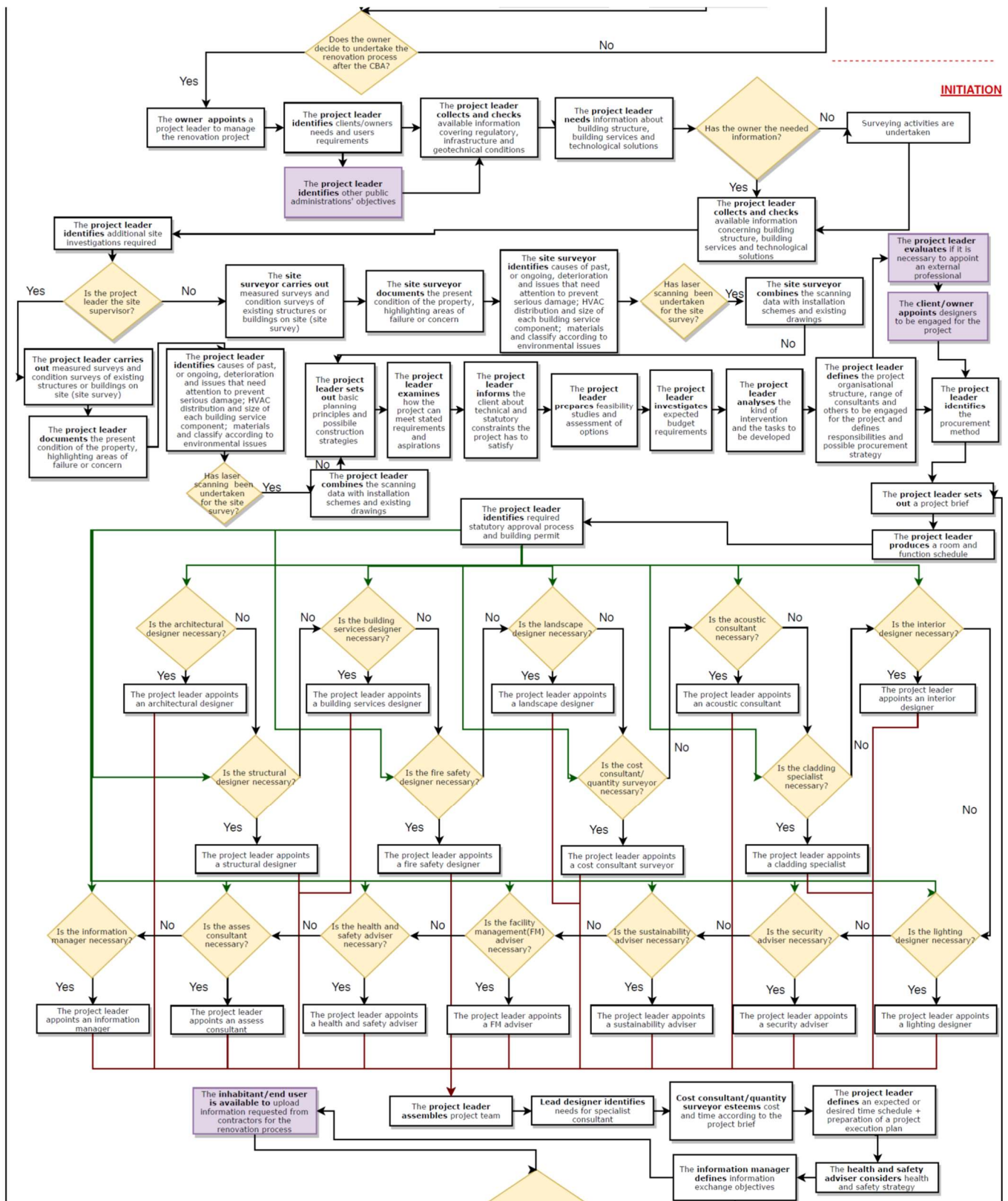


Figure 5: From the list of activities and involved stakeholders to renovation flowchart

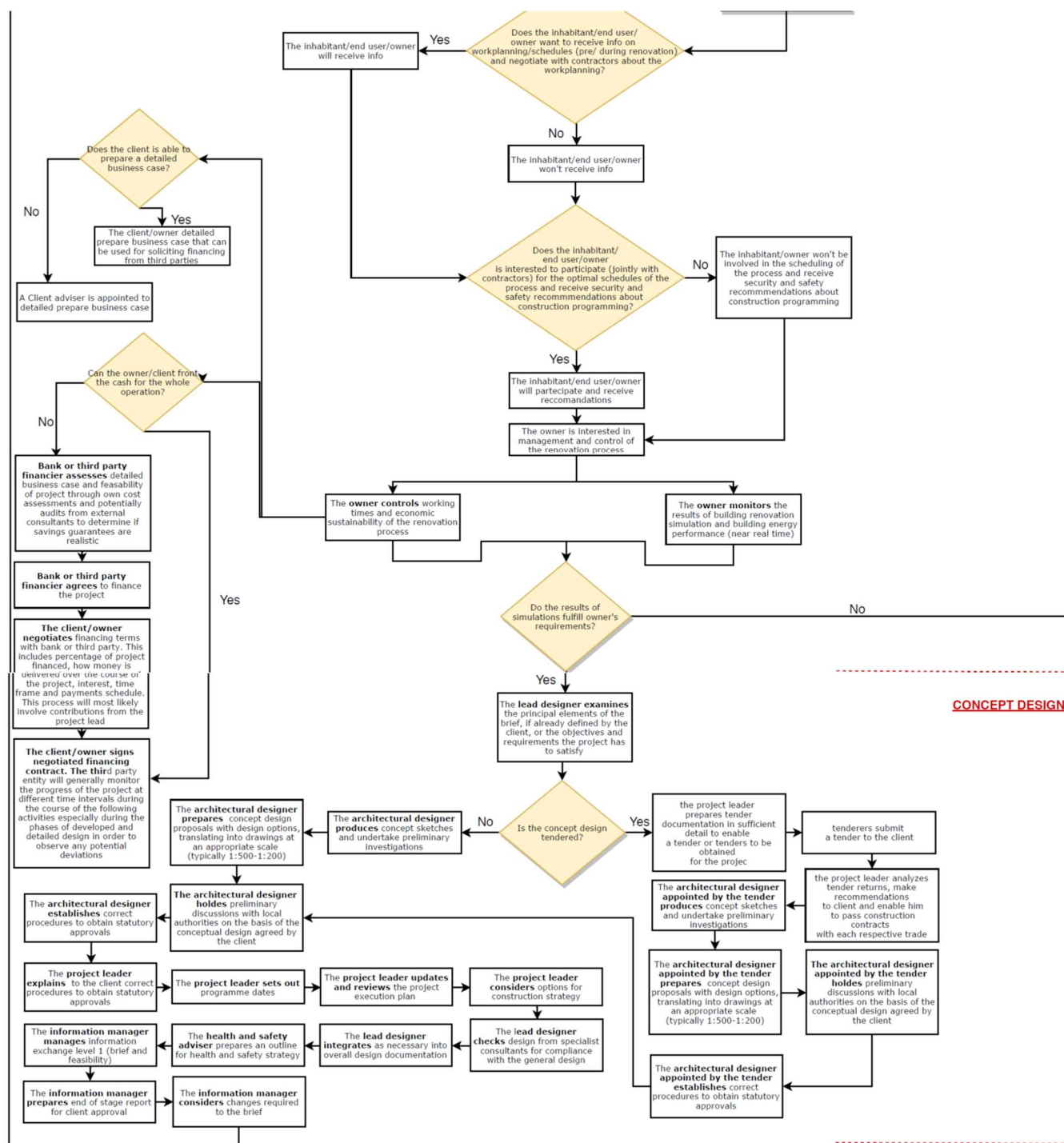
Actions are represented by rectangular shapes; dotted lines are used for actions that are used for actions that are not common to all analysed countries. The lilac rectangles represent the actions made only in public works. Decision gates are represented by diamond shapes. By representing actors and actions with flowcharts, redundant information exchanges or waste of times in reworking the same information can be outlined. Hence, starting from such wastes, next activities will analyse how to optimise information processes, by highlighting where to cut such wastes.



D2.1 Definition of relevant activities and involved stakeholders in actual and efficient renovation processes

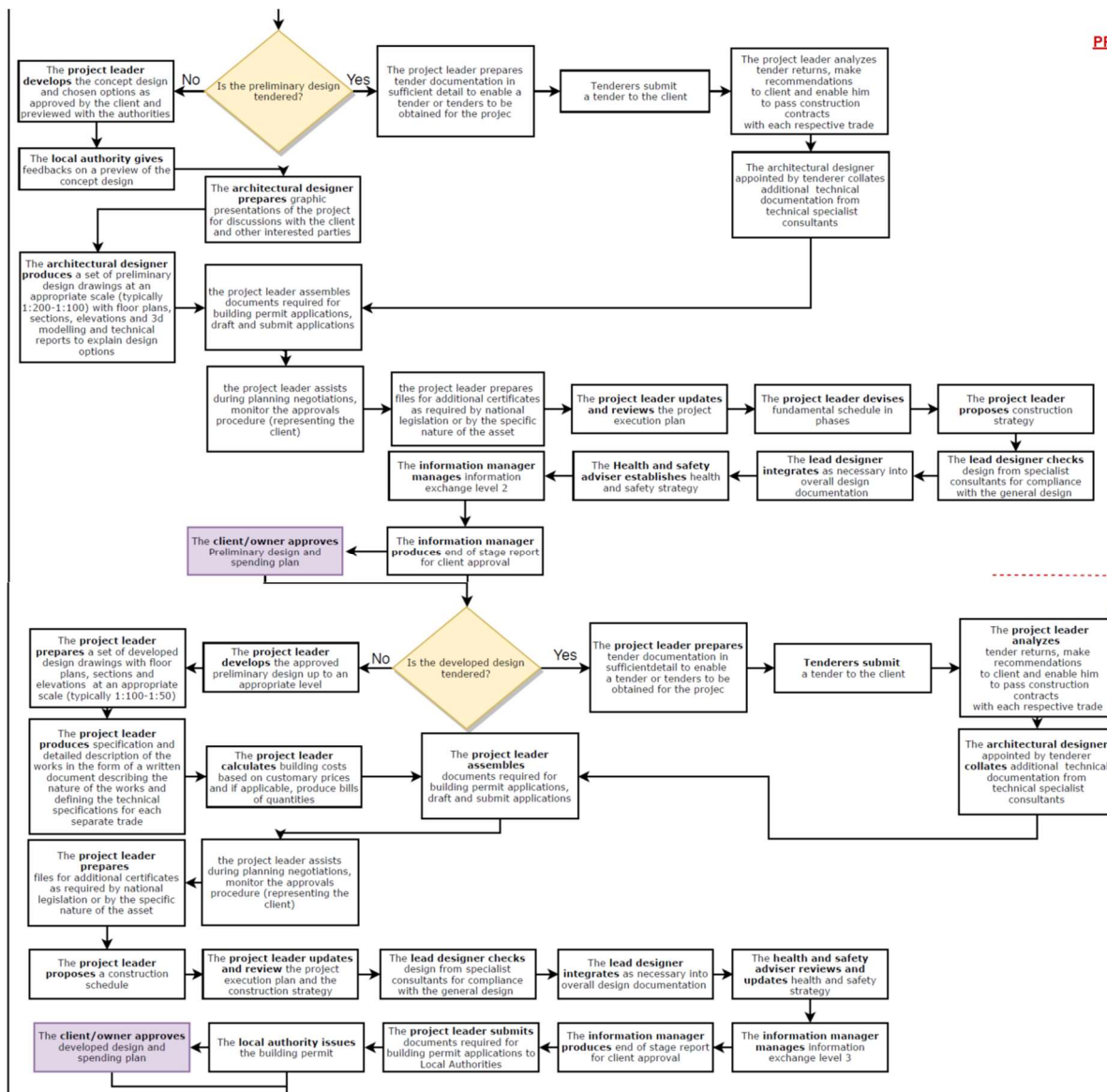


D2.1 Definition of relevant activities and involved stakeholders in actual and efficient renovation processes



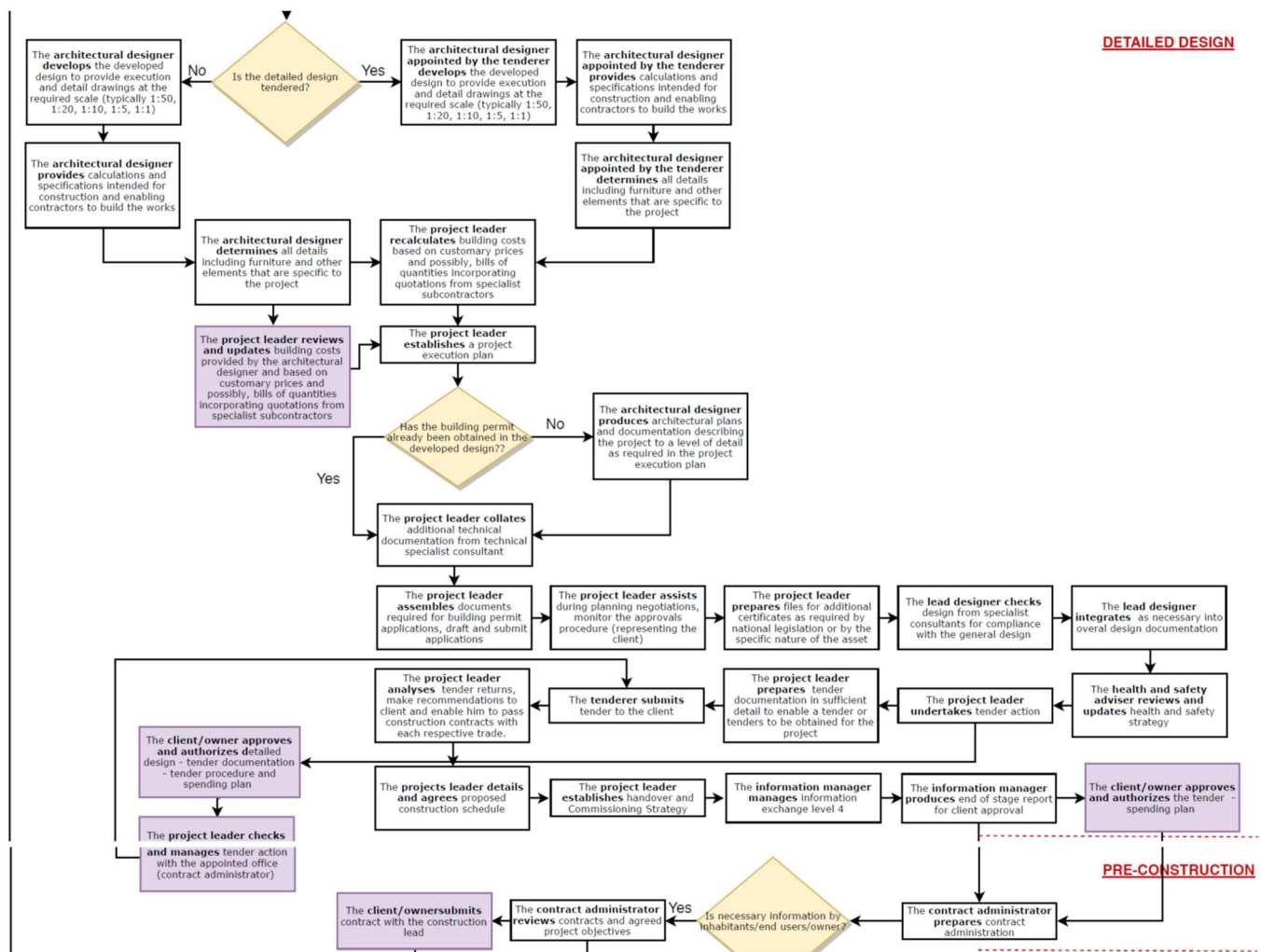
D2.1 Definition of relevant activities and involved stakeholders in actual and efficient renovation processes

PRELIMINARY DESIGN

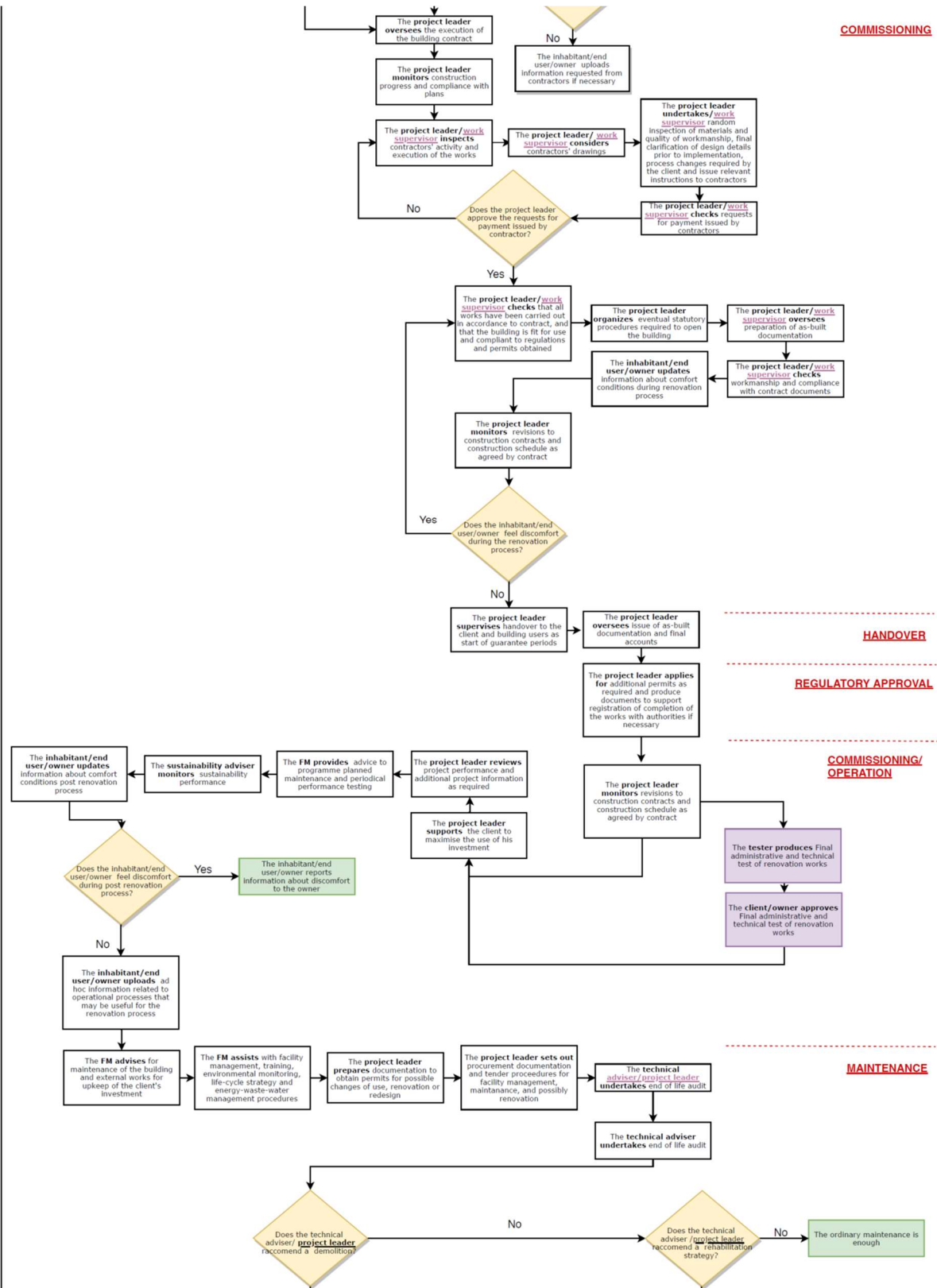


DEVELOPED DESIGN

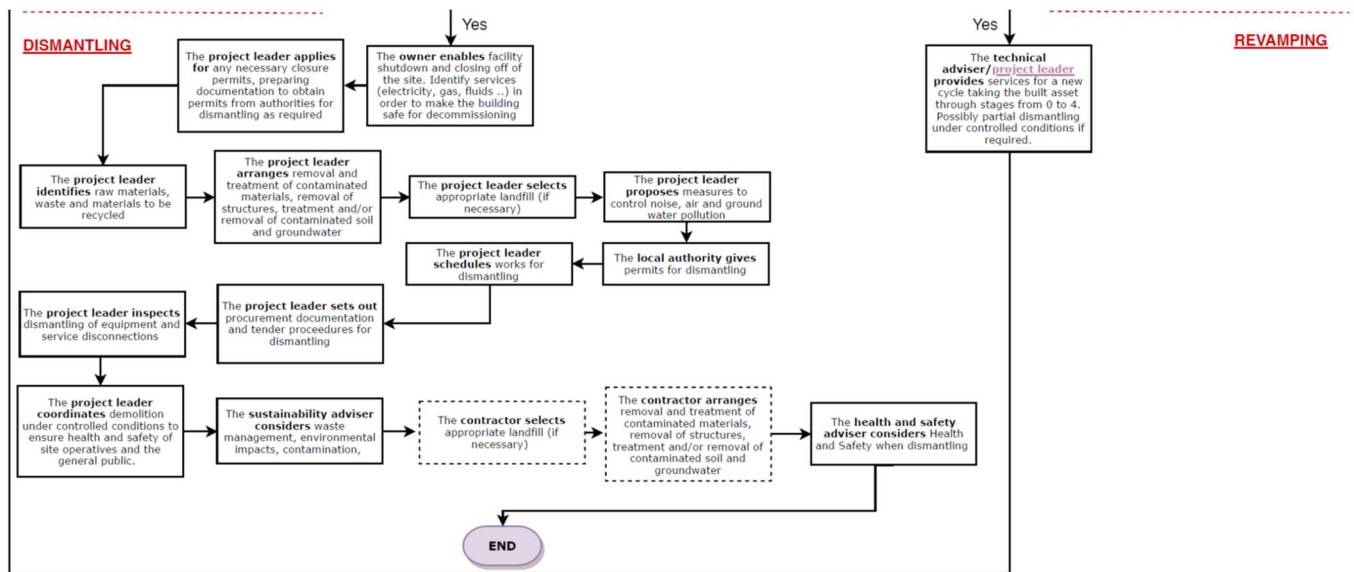
D2.1 Definition of relevant activities and involved stakeholders in actual and efficient renovation processes



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6 Conclusions

Presented activities aim to map stakeholders and actions characterising renovation processes.

Main differences between public and private works will be taken into account in the definition of the BIM Management System (WP4). Among these differences, it is worth to mention:

- profit-minded concept in private works is replaced by public concerns and social, economic and/or aesthetic benefits in public works;
- different sources of funding result in different binding and tendering processes;
- different criteria for selection of procurement strategies are adopted;
- regulation limitations need to be strictly fulfilled in public works.

These activities are the starting point for mapping outputs of such activities (that could be mapped in a traditional process and in BIM-based processes) and for estimating times spent for carrying activities and achieving defined outputs. The synoptic flowchart will be used in order to outline how ICT and BIM can support the rationalisation of information flows.

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