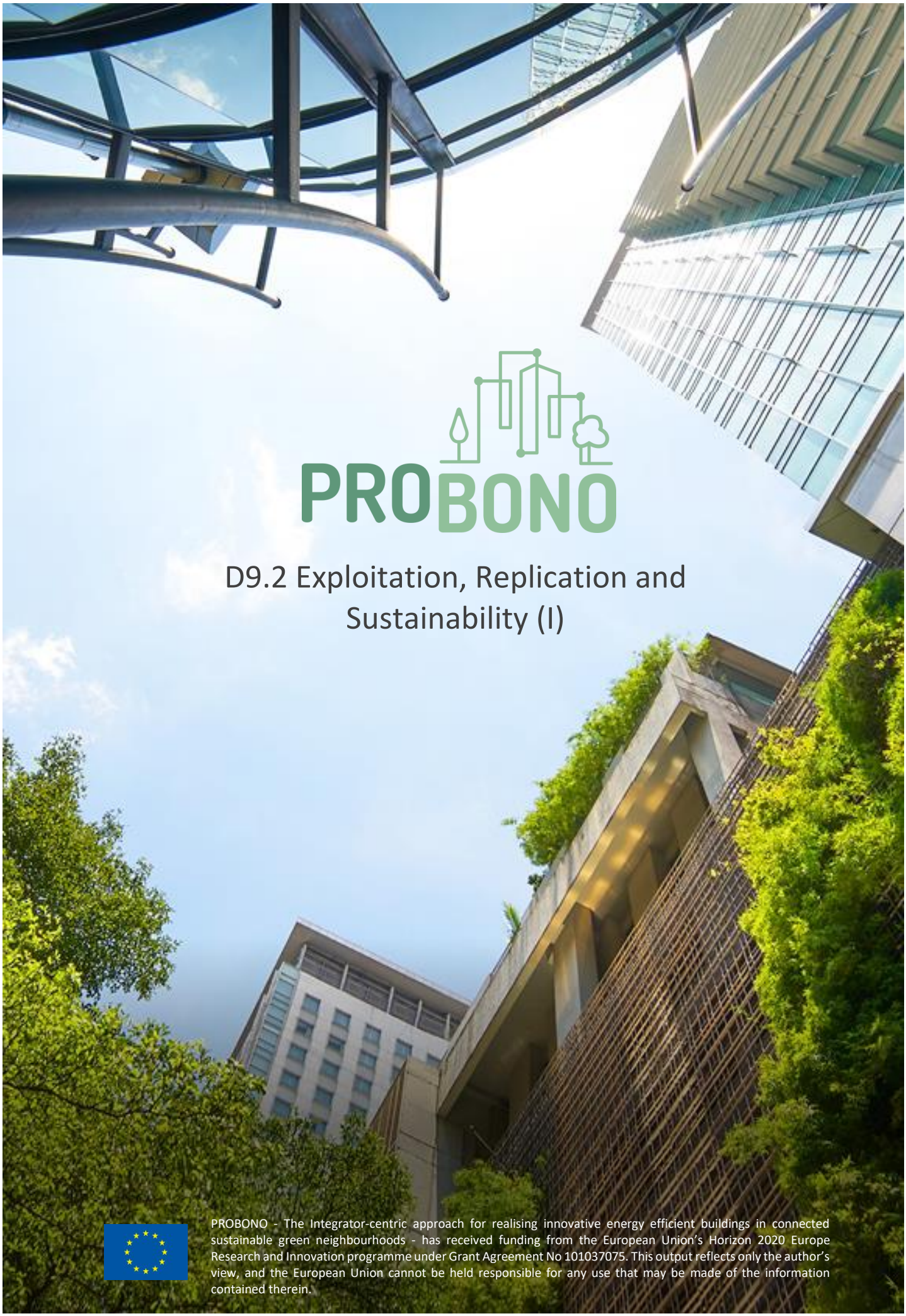

PROBONO

D9.2 Exploitation, Replication and Sustainability (I)

PROBONO - The Integrator-centric approach for realising innovative energy efficient buildings in connected sustainable green neighbourhoods - has received funding from the European Union's Horizon 2020 Europe Research and Innovation programme under Grant Agreement No 101037075. This output reflects only the author's view, and the European Union cannot be held responsible for any use that may be made of the information contained therein.

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DEFINITIONS[1]

A Green Building (GB) (new or retrofit) is a building that, in its design, construction and operation, reduces or eliminates negative impacts, and can create positive impacts, on the climate, social, and natural environment. GBs preserve precious natural resources and improve quality of life[2]. Specifically, this means that GBs should be very energy efficient, use extensively the potential of locally available renewable energy, use sustainable materials, and aim for a low environmental impact over the entire life cycle. GBs offer their users and residents a healthy climate and a high quality of stay, they are resilient e.g., to environmental change and contribute to social inclusion.

Green Neighbourhoods aligned with the European Green Deal[3], is a set of buildings over a delimited area, at a scale that is smaller than a district, with potential synergies, in particular in the area of energy. A green neighbourhood is a neighbourhood that allows for environmentally friendly, sustainable patterns and behaviours to flourish e.g., bioclimatic architecture, renewable energy, soft and zero-emission mobility etc. Green neighbourhoods are the building blocks of Positive Energy Districts (PEDs)[4] by implementing key elements of PED energy systems. For example, the exchange of energy between buildings increases the share of local self-supply with climate-neutral energy and system efficiency. They also provide the technical conditions to enable Citizen Energy Communities[5] and Renewable Energy Communities[6] to be implemented.

Green Buildings and Neighbourhoods (GBN) in PROBONO are GBs integrated at delimited area or district level with green energy and green mobility management and appropriate infrastructure supported by policies, investments and stakeholders' engagement and behaviours that ensures just transition that maximise the economic and social cobenefits considering a district profile (population size, socio-economic structure, and geographical and climate characteristics). Delivered in the right way, GBN infrastructure is a key enabler of inclusive growth, can improve the accessibility of housing and amenities, reduce poverty and inequality, widen access to jobs and education, make communities more resilient to climate change, and promote public health and wellbeing.

DGNB certification serves as a quality stamp ensuring the state of the building for buyers. The Green Building Council Denmark (2010) established the German certification DGNB meaning 'German Society for Sustainable Buildings'. The Danish version of DGNB was created to obtain a common definition of what sustainability is towards and making it measurable. A consortium of experts was established from all parts of the construction sector. DGNB had to be reshaped for the Danish standards, practice, traditions, and laws but is now available to certify any construction project. They chose DGNB as an innovation-forward and sustainable future guarantee. DGNB diversifies itself by focusing on sustainability and not just the environment. DGNB creates a standardised framework for the construction operations conditions and creates a common language which facilitates communication between professions and helps organize and prioritize the efforts in long and complicated development phases.

[1] Please refer to the last submitted reports for the latest status of the definitions

[2] https://www.worldgbc.org/what-green-building

[3] European_Green_Deal_EN_200710_fin

[4] SET-Plan Action 3.2: https://setis.ec.europa.eu/system/files/setplan_smartcities_implementationplan.pdf

[5] Internal Electricity Market Directive (EU) 2019/944 5 Renewable Energy Directive (EU)

[6] Renewable Energy Directive (EU) 2018/20012018/2001

Life cycle assessment (LCA)[7] is a tool used for the systematic quantitative assessment of each material used, energy flows and environmental impacts of products or processes. LCA assesses various aspects associated with development of a product and its potential impact throughout a product's life (i.e., cradle to grave) from raw material acquisition, processing, manufacturing, use and finally its disposal. In PROBONO, LCA represents the statement of a building's total energy, resource consumption and environmental impact in the manufacture, transport, and replacement of materials and for its operation over its expected life. Social life cycle assessment (S-LCA)[8] is a method to assess the social and sociological aspects of products, their actual and potential positive as well as negative impacts along the life cycle. Life-cycle costing (LCC)[9] considers all the costs incurred during the lifetime of the product, work, or service.

[7] https://op.europa.eu/en/publication-detail/-/publication/16cd2d1d-2216-11e8-ac73-01aa75ed71a1/language-en

[8] https://www.lifecycleinitiative.org/starting-life-cycle-thinking/life-cycle-approaches/social-lca/

[9] https://ec.europa.eu/environment/gpp/lcc.htm

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Abbreviations and Acronyms

Acronym	Description
DoA	Description of Action (annex I of the Grant Agreement)
EC	European Commission
ER	Exploitable Results
GA	Grant Agreement
GBN	Green Building Neighbourhood
IP	Intellectual Property
IPR	Intellectual Property Rights
JEA	Joint Exploitation Agreements
KER	Key Exploitable Result
R&I	Research and Innovation
RDI	Research, Development and Innovation
ToC	Table of Contents
TRL	Technology Readiness Level
VPC	Value Proposition Canvas
WP	Work Package

Executive summary

This report formulates the preliminary findings of PROBONO's exploitation plan. More specifically it focuses on three key concepts that have been developed within the project and that are mandatory for the sake of alignment and cohesion both within and beyond project activities. These work in progress concepts are:

- The Green Building Neighbourhood – establishing the vision for liveable sustainable places.
- The GBN Innovation Cluster – establishing the stakeholders and the motivations to set up GBNs in the near future.
- The International Ecosystem of GBN Innovation Clusters – establishing the network of best practices and alliances for GBNs across Europe and the globe.

This assessment has been performed taking into consideration the strategic work developed in other parts of the project (especially in WP1 - *Macro-Knowledge Base and GBN Framework*, WP2 - *Social and Behavioural Innovations*, WP6 - *Monitoring and evaluation of the project's Living Labs* and WP8 - *Communication & Dissemination, Capacity Building, & Recommendations*) and also interacting directly with the whole consortium (with particular attention to PROBONO's Living Labs). This has enabled this preliminary identification of results and the assessment on how these ambitious concepts can be: i) practically initiated and; ii) sustained in the future.

The methods used for this assessment combine business strategy and investment analysis tools like the Value Proposition Canvas or the Five Cases Business Case; in combination with general methods for assessing exploitation pathways of Horizon 2020 projects results.

Moreover, as part of the exploitation planning of PROBONO, by the end of the first year of the project, a first assessment on project exploitable results was executed and listed in this public deliverable. The full exploitation pathways will be iteratively assessed during the project and will allow the identification of opportunities for results usage, boost PROBONO's impact and ultimately, maximise environmental sustainability in the built environment.

1 Introduction

1.1 Mapping PROBONO Outputs

The purpose of this section is to map PROBONO's GA commitments, both within the formal Deliverable and Task description, against the project's respective outputs and work performed (**Error! Reference source not found.**).

GA Component Title	GA Component Outline	Respective Document Chapter(s)	Justification
TASKS			
Task 9.2: PROBONO GBN Exploitation, Replication and Sustainability Strategy (M1-M60)	**ST9.2.1. Key Exploitable Results (KERs).** Characterization of the main Key Exploitable Results (KERs) identified in the proposal using the PNO methodology to assess the exploitation potential of the results, based on the Innovation Radar of the EU, in order to make a ranking of KERs and identify the Most Valuable Product (MVP) and the exploitation champion. **ST9.2.3. Exploitation Plan Develop the Exploitation Plan for the main KERs, including a SWOT, a CANVAS, identification of barriers, exploitation route and financials obtained from previous subtasks.** The market uptake of the PROBONO outcomes will be further tested by organizing dissemination/exploitation workshops (one per cluster, in the last year), validating also the collaborative methodology defined in the proposal. **ST9.3.4. Innovation Clusters sustainability and PROBONO International GBN ecosystem.** Focus on the replication of PROBONO outcomes at the regional, national and EU level, as well as the continuation of the GBN ecosystem, and increased exploitation to achieve a wider reach and impact. The task will form an international GBN ecosystem that will combine the innovation clusters from EU who are focused on green energy, green buildings, and green neighbourhoods and enable interconnections, communications, and relationships to promote GBN. The task will look into understanding how one such ecosystem shall function, how the interactions take place, identify best tools for one such ecosystem, and then provide a medium where learnings from each innovation cluster is shared and mutual cooperation and knowledge sharing is promoted. The task will also involve interactions with T2.1 to identify the relevant innovation clusters, as well as involving the project Advisory board, and receives a Green Paper as input from T9.6 which shall form the discussion point of this international GBN ecosystem. The task will also interact with T8.4 for wider participation of innovation clusters, as well as T8.3 to have a capacity building program which can be taken up this GBN ecosystem.	1.3.3 WT3 Work package description	This report takes advantage of PROBONO's preliminary findings during the first project reporting period in order to develop a preliminary exploitation plan for the key concepts of the project defining the vision on what a GBN should be in the local and regional environment and how cooperation should be established at international level in order to promote cooperation and best practices for maximising the impacts of PROBONO and other related initiatives with similar main goals.
DELIVERABLE			
D9.2: Exploitation, Replication and Sustainability (I) This report formulates the findings of T9.2, and explores step/s A) GBN ecosystem initiation plan and sustainability roadmap.			

Table 1. Adherence to PROBONO's GA Deliverable & Tasks Descriptions.

1.2 Purpose and scope of the document

The scope of deliverable 9.2: Exploitation, Replication and Sustainability (I) part of task 9.2, is to pave the way for PROBONO's Exploitation Strategy and to ensure that results generated in PROBONO are taken up by relevant stakeholders during and after the project lifetime. Thus, by defining a preliminary exploitation plan to the key concepts establishing the long-term vision of the GBN and through the identification of the Exploitable Results (ER) it will be possible to facilitate consortium's alignment with relevant potential exploitation routes (which may include also commercial exploitation).

1.3 Structure of the document and its relation to other WPS/Deliverables

The deliverable is formulated as follows:

- Chapter 1: Introduction.
- Chapter 2: Presentation of the exploitation approach and the methods used in this deliverable.
- Chapter 3: Preliminary assessment of PROBONO's exploitable results.
- Chapter 4: Initiation and preliminary sustainability assessment for the GBN concept, the GBN Innovation Clusters and the International Ecosystem of GBN Innovation Cluster.
- Chapter 5: Conclusions and next actions.

Subsequent deliverables to D9.2 include D9.3 and D9.4- Exploitation, Replication and Sustainability II (M36) and FINAL (M60).

The present document paves the way for the development of the exploitation strategies of the project, which includes also the business modelling for the Key Exploitable Results. As mentioned before, the document already exploits the work executed so far throughout the project, but specially in WP1, WP2, WP6 and WP8. Deliverables D1.1, D1.3, D2.1, D6.1 and D8.1; have been the main sources of information used for this deliverable. Partner MM, that plays a horizontal role within the project, has also provided relevant inputs for this deliverable.

In any case, the preliminary assessment on exploitation and the future activities on exploitation will be relevant for all the partners in the consortium. Moreover, as presented in section 4, it is considered that the strategy developed in this document will be of particular interest for the liaison activities of PROBONO.

1.4 Contribution to creating GBN

This deliverable contributes to the sustainability of the proposed GBN vision and the different enablers of the project to design, deploy and spread GBNs.

Work developed in WP9 has a big importance in reducing the barriers that hinder the sustainable built environment market development. Those barriers are principally focused on the strategic, commercial, economic, financial and managerial viability (in this document assessed from the perspective of decision makers in local and regional environments, will be extent to other relevant profiles in further iterations of this assessment) that explains the slow penetration of the concept of GBN in most economies and that remain unclear especially from the perspectives of GBNs developers, decision makers and occupants. Different incentive models have been introduced by local governments, but it is not enough for enhancing the creation of GBN, that requires an exhaustive analysis of the context, the products, services and tools that can impulse its exploitation (within and beyond PROBONO).

Besides, the identification of the opportunities through the evaluation of market conditions and business motivations, will contribute to formulating a Strategic GBN Plan towards achieving zero-emission targets and sustainability.

2 Exploitation

2.1 Introduction to exploitation

2.1.1 General concepts

Exploitation is one of the key activities within WP9 Replicability, Exploitation & Commercialisation, being addressed from the very beginning of the project. Exploitation is described by the European Commission as "*the use of results in developing, creating and marketing a product or process, or in creating and providing a service, or in standardisation activities*"[10].

During the project, exploitation activities will allow to characterise the main outputs of the project, the Exploitable Results (ERs) using PNO's methodology (presented in section 2.2.1) to assess in upcoming stages of the project the exploitation potential of the results, based on the Innovation Radar of the EU, in order to make a ranking of the Key Exploitable Results (KERs) and identify the Most Valuable Product (MVP) and the exploitation champion.

A KER is defined by the European IP Helpdesk as "*an identified main interesting result, which has been selected and prioritized due to its high potential to be "exploited" – meaning to make use and derive benefits- downstream the value chain of a product, process or solution, or act as an important input to policy, further research or education.*"[11] .

The objective is to effectively use the project results through scientific, economic, political, or societal exploitation routes aiming to turn R&I actions into concrete value and impact for society, thus, to make concrete use of research results (not restricted to commercial use). The target audience is represented by people/organisations like project partners themselves that make concrete use of the project results, including stakeholders outside the project. Exploitation also means the capacity to innovate with a focus on new consumer needs and social challenges.

[10] European Commission. Dissemination and exploitation of research results (checked on April 2023), https://research-and-innovation.ec.europa.eu/strategy/dissemination-and-exploitation-research-results_en

[11] European IP Helpdesk. Introducing the Horizon Results Platform and Horizon Results Platform TV (checked on April 2023), https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/horizon-results-platform

As a key outcome of this methodology, KERs are divided into three different categories:

- **Knowledge**. This type of KERs refers mainly to scientific findings that will be exploited in the form of transfer of knowledge, further scientific activities, scientific publications, research collaboration, further research partnerships. These results are typically exploited by the research and academic partners.
- **Service / Method**. This type of KERs refers to project outcomes that can be exploited commercially, in the form of services or methods, delivered under different exploitation and commercialisation routes. These results could be exploited either by research and academic partners as well as by industrial partners.
- **Product**. This type of KERs refers to those project outcomes that are commercially exploitable in the form of a product that can be commercialised by different means.

In the PROBONO project, potential KERs need to be developed at a mid-high Technology Readiness Level (TRL). These elements not only result in high technical challenges, but also in potential internal barriers if the project's IP is not well managed. In order to better address such challenges, IP management and IP protection or standardisation will be conveniently covered in other tasks of WP9. Additionally, PNO with the support of the consortium, has matured and developed in time different and flexible methodologies and tools that apply to PROBONO.

The main methodological pillars of the PROBONO exploitation approach are a mix of live-interactions, desktop/intelligence studies and business research, realised through the following activities:

- A **collaborative approach**: implemented based on internal workshops, industrial workshops and exploitation meetings/seminars. The main idea is to actively involve all partners, key actors, sister projects and stakeholders in the exploitation process.
- **KER - Innovation assessment**: As results are delivered and made available, assessments of their exploitation potential will be conducted by the consortium guided by PNO, resulting in a clear picture of their represented value/benefits, potential user groups, etc.
- **Exploitation and Business planning**: some of the results generated will be acknowledged as key by the consortium and following the definition of ownership of KERs and related IPR agreements, Joint Exploitation Agreements (JEA) may be stipulated among two or more project partners. Negotiating additional (pre)commercial

agreements with selected external stakeholders will be sought. Business plans and exploitation strategies of PROBONO project will be built up based on the outcome of task 9.1 together with the result of the development and implementation of targeted commercialisation strategies and plans.

2.1.2 Exploitation in the case of PROBONO

PROBONO is not only an EU funded project, but one of the flagship initiatives for decarbonising the built environment. Thus, the approach for exploitation will go beyond the methods that have been introduced in section 2.1.1 which concern the future exploitation and replicability of the GBN concepts, the GBN Innovation Clusters and the International Ecosystem. For this category of results, the methods will belong more to strategic planning and business analysis, as will be presented in section 2.2. It is considered that this hybrid approach will maximise the capacity of the project to have a broad and solid impact in the built environment ecosystem.

2.2 PROBONO pathway to exploitation

2.2.1 Methodology

The methodology for this assessment is completely aligned with PROBONO's overall pathway to exploitation that will be further presented in section 2.2.2. On one hand, a conventional assessment of PROBONO's exploitable results (see section 2.2.1.1). On the other hand, a tailored assessment to the GBNs and the LLs within PROBONO (see section 2.2.1.2) that starts in this occasion for the basic concepts of the projects and will be refined and iterated in parallel to PROBONO execution.

2.2.1.1 Identification of PROBONO's exploitable results

For each of the detailed KERs, a list of preliminary elements will be asked to each partner so that the exploitation plan will be described and developed properly. It is expected to organise iterative sessions with the partners in upcoming meetings, (see section 2.2.2) to collect the information needed. Detailed information about ER is expected to be updated once the project results are generated. Below are listed the elements that will be described for all KERs, templates distributed to partners also provide explicit guidance of what is expected in each section.

1. *Description.*

2. *Problems you are addressing and how your customers solve them so far.*
3. *Alternative solution.*
4. *Unique Selling Point USP - Unique Value Proposition UVP.*
5. *Competitive advantage.*
6. *Target segments.*
7. *Early adopters.*
8. *Market size.*
9. *Trends*
10. *Settings – Acceptance*
11. *Settings – Legal or normative or ethical requirements (need for authorisations, compliance to standards, etc*
12. *Patent-oriented innovation management.*
13. *Use model (including potential commercial strategy).*
14. *Competitors/Incumbents.*
15. *Exploitation Timing (from the end of the project).*
16. *Positioning.*
17. *Channels.*
18. *Cost of implementation (before Exploitation).*
19. *Pricing.*
20. *The Team.*
21. *The Team. External providers.*
22. *Sources of financing foreseen after the end of the project.*

2.2.1.2 PROBONO's GBNs and LLs exploitation

To assess the sustainability of the GBN concept and the associated concepts, this initiation and preliminary sustainability assessment focuses on understanding the main needs and the value proposition of the GBN for the decision makers (i.e. the urban planners in the local environments) or the appropriate profiles for each dimension analysed in section 3. This assessment will be iterated for the most relevant profiles that are involved in the process of designing and implementing GBNs, in parallel to PROBONO's execution.

The methodology used for the preliminary assessment is the 'Value Proposition Canvas' (VPC)[12]. The VPC (*Figure **1***) allows to have a clear understanding of the particular situation of a certain targeted segment (the customer profile) and what is the created value (the value map). More specifically this represents the following:

1. **The customer profile**:
    a. *Customer jobs*: the functional, social and emotional tasks customers are trying to perform, problems they are trying to solve and needs they wish to satisfy.
    b. *Pains*: the negative experiences, emotions and risks that the customer experiences in the process of getting the job done.
    c. *Gains*: the benefits which the customer expects and needs, what would delight customers and the things which may increase likelihood of adopting a value proposition.
2. **The value map**:
    a. *Components offering (products and services)*: the elements, products and services which create gain and relieve pain, and which underpin the creation of value for the customer.
    b. *Pain relievers*: how the offer alleviates customer pains.
    c. *Gain creators*: how the offer creates customer gains and how it offers added value to the customer.

[12] Ostwalder. Original model from 'strategyzer' (checked on April 2023), https://www.strategyzer.com/canvas/value-proposition-canvas

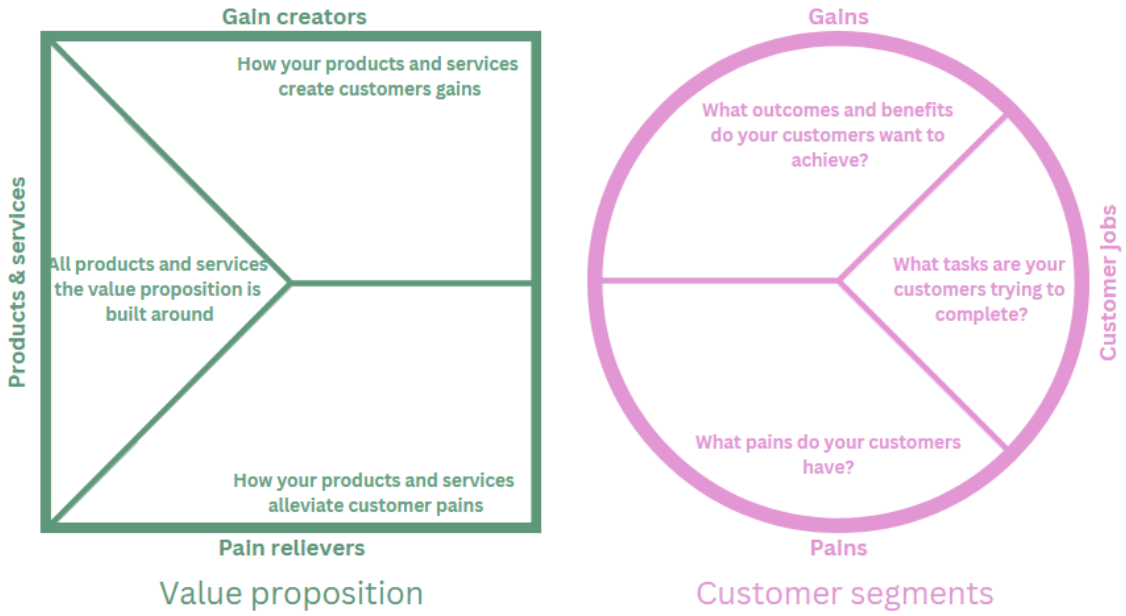


Figure 1. Value Proposition Canvas template.

This assessment is concluded with a presentation of the 'competitive advantage' (as presented in *Figure* ***2***, justifying the most valuable elements of the value proposition decision makers and other stakeholders will perceive and will make them prioritise the GBN methods rather than alternative planning options), enabling the definition of core messages and the identification of potential areas of improvement.

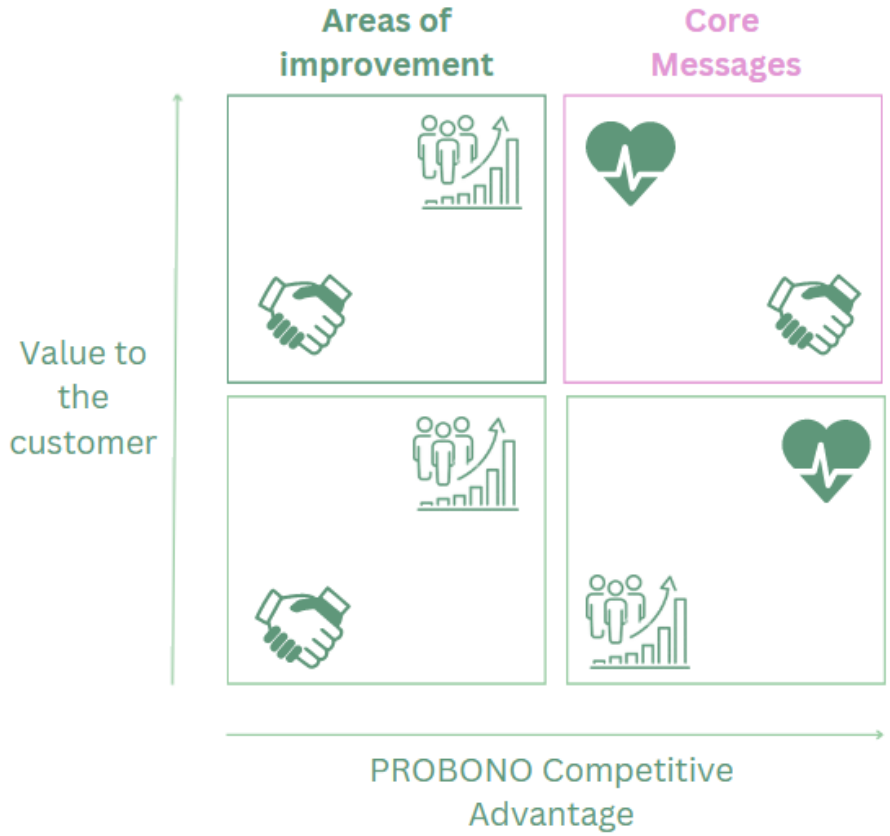


Figure 2. Competitive advantage canvas.

The competitive advantage and the core messages combine at the same time: i) the key findings of the Value Proposition analysis of section 4.2.3; and ii) PROBONO's Communication and Dissemination strategy[13]. These messages will be integrated in upcoming promotion activities in order to maximise the potential exploitation and replication of results.

The VPC for the GBN concept was analysed in an internal workshop with the whole PROBONO consortium from the perspective of the main adopter of the GBN concept, with particular attention to the LLs involved in the project. The main adopter of the GBN concept for the sake of the exercise was the decision maker in the local or regional environment for the built environment (i.e. the local urban planner).

From this basic assessment, the exploration of the sustainability pathways will be tailored depending on the typology of concepts and results that are presented in section 4.

[13] PROBONO Deliverable D8.1, Dissemination and communication strategy & reporting (I). Publicly available.

2.2.2 Current situation and next steps

As introduced in section 2.2.1, two main activities have been executed so far to prepare this preliminary exploitation assessment of PROBONO:

- A hybrid preliminary assessment of PROBONO's exploitable results, built upon the assessment developed at proposal stage and that will be iteratively updated during the project.
- A physical session as part of the workshop that took place in Chania (Greece) during the consortium meeting in February 2023.

Thus, the current situation of exploitation activities is:

- A long list of exploitable results has been collected and is presented in section 3 of this document.
- A preliminary exploitation assessment for the GBN and associated concepts.

Envisioned next steps are:

- Q2 to Q4 2023: Collect the details of PROBONO's exploitable results.
- Q1-Q2 2024 – Based on the market analysis: updated GBN concepts exploitation plan and Living Lab workshops.
- Q2-Q3 2024 – Updated exploitation plan, deliverable D9.3.
- 2025 – Definition of commercialisation routes for KERs.
- 2026 – Final exploitation plan development.

Exploitation is a horizontal activity for PROBONO, that has significant synergies with not only other tasks within WP9 (market analysis, IPR management and standardisation) but also with the rest of the project to ensure a proper adoption of results after the project. Continuous internal and external communication will be maintained to contribute to the cohesion of concepts and the alignment for maximising the impacts and the achievement of ambitious decarbonisation objectives.

3 Preliminary assessment of PROBONO's exploitable results

Between M10 and M12, a first exploration of the different exploitable results was executed with the partners of the project, starting with the list from the proposal and the Description of Actions, that resulted on a preliminary list presented below (*Table **2***). This list is a living document and will be iteratively updated throughout the project, as presented in section 2.2.2, and as such summarizes the ER to the date of the preparation of this report. The main objective of the preliminary or partial assessments is to maintain a timely identification of results that can be exploited already during the project, and the alignment of such results at a strategic level with both partners expectations and market demand.

No	ER name	Type[14]	Lead partner
1	GBN Digital Twins advanced e-mobility solutions	Service	INLE
2	New tools supporting stakeholder engagement in GBN development and operation	Product	SIN
3	Digital twin Intelligent GBN subsystems Monitoring Control Connectors	Product	KNT
4	Construction/ renovation workflows for offsite manufacturing	Method	VLTN
5	Visualisation tools for GBN decision making and DTs	Product	eBOS
6	Applications associated with large GB complexes and Distinct e-mobility services	Product	BLABS

[14] To be refined based on the findings during the project.

No	ER name	Type[14]	Lead partner
7	Joint developments of demand and response platform with TPF and other partners	Product	STAM
8	Flow batteries	Product	VISB
9	Advanced GBN integrated e-mobility systems and application in Madrid LL	Product	CID
10	Development of new technologies for Energy neutral GBNs	Product	TSRV
11	Roof planning services integrated in GBN solutions and planning tools linked with the GBN Digital Twin	Services	ANE
12	Second life batteries application	Services	BEE
13	High Evaporative Green Roofs with PV	Product	SOP
14	Cool roof with bi-facial PV	Product	SOP
15	Wood fiber insulation	Product	SOP
16	Assessment tool for the reuse of materials in GBNs	Product	COWI
17	Tool for linking material specific data regarding sustainability aspects such as circularity, health, environmental impact, technical properties	Product	COWI
18	Tool to improve early-stage decision making on pre-fab concrete use in buildings	Product	COWI
19	Improving automation of LCA modelling	Method	COWI
20	Recycled materials for insulation	Product	CID
21	Smart engineering technologies	Service	CELSA

No	ER name	Type[14]	Lead partner
22	Sustainable concrete	Product	ACC
23	Blueprints and DT models for pandemic-resilient GBNs	Methods	MM
24	Knowledge Graph based GBN data management and DSS tools	Methods	TUC
25	GBN Maturity Score Card	Methods	SIN
26	Online tool for exploring occupant behaviours	Product	EUR
27	ABM OB and mobility GBN-level planning decision support tools	Product	TUC
28	Digital Collaborative Engagement Tools	Product	UCD
29	Social and Behavioural Change Activities	Methods	UCD
30	Advanced design space exploration tools	Product	AU
31	Human-focused simulation and analysis tools	Product	AU
32	Development of a pre-standard out of project results	Knowledge	DIN
33	PROBONO Evaluation Framework	Methods	CAR

Table 2. Preliminary list of exploitable results.

4 Green Building Neighbourhoods concepts and definitions

This section formulates the preliminary exploitation plan of the main GBN concepts, which includes also the ecosystem and the future innovation clusters. This is based on the initial findings of the project and the interactions with the PROBONO consortium. This information will be iterated and refined internally in upcoming exploitation, replication and sustainability activities and assessments; as well as the external cooperation and alliances that the project has set up and will strengthen in the future.

4.1 Context and Background

As outlined in section 2, PROBONO generates a broad pool of results that individually contribute to a practical deployment of a GBN across Europe. However, the strategic planning of the GBN and the key concepts associated with it are seen as important prerequisites for PROBONO's future impact, including cohesion with other initiatives PROBONO is linked to.

Work Package 9 on 'Replicability, Exploitation & Commercialisation', covers multiple dimensions that will make it possible. As mentioned above this assessment focuses on the sustainability of the 'innovation cluster' initiation of the 'International GBN ecosystem', including a preliminary assessment of the value proposition of these key concepts exploring the potential sustainability pathways.

Thus, three concepts will be presented and analysed in depth in this report:

- The Green Building Neighbourhood.
- The GBN Innovation Cluster.
- The International GBN ecosystem.

The positioning of these concepts and connections with project activities from the Work Packages are presented in the following figure:

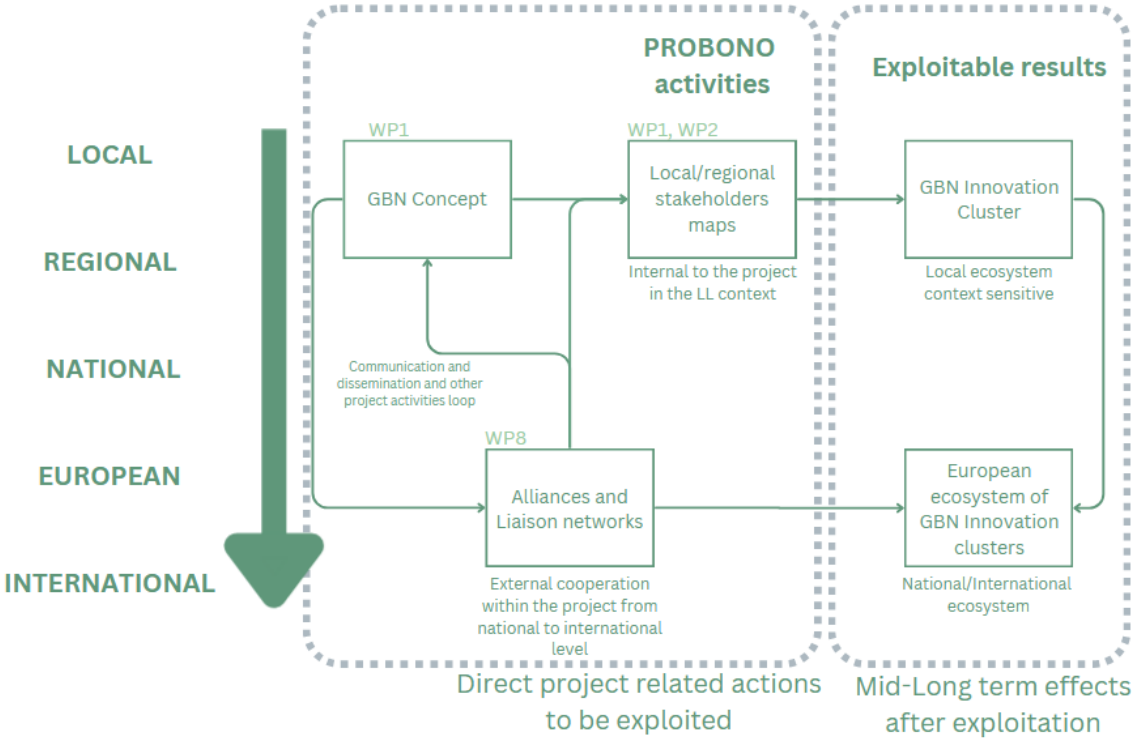


Figure 3. GBN-related concepts within PROBONO, encompassing a seamless action from the local to the international environment

As presented in Figure 3, within PROBONO activities, the cornerstone for this preliminary exploitation assessment is the **GBN concept** under development in WP1. This concept has been used to develop and establish at the same time the **local stakeholders maps** for the project's Living Labs. Moreover, this concept will also be used for the **liaison networks and alliances** to be established within the project and that will rely significantly on communication and dissemination activities, as well as the findings in other parts of the project like standardisation actions. PROBONO's report D9.7 on standardisation will also be publicly available in parallel to this document.

Regarding the mid-long term effects after the exploitation, both the local maps (that could also be considered at regional level) and the alliances, represent the starting point for the initiation plan of the European GBN ecosystem, the sustainability of which will rely on the value proposition of the GBN concept and the business case of the GBN Innovation Clusters.

4.2 Green Building Neighbourhoods

4.2.1 PROBONO's definition

As collected in the strategical vision of the GBN and the confidential deliverable D1.1, under the European Green Deal call H2020-LC-GD-2020 (topic LC-GD-4-1-2020), "green neighbourhood" is defined as follows:

> "*The term 'neighbourhood' refers to a set of buildings over a delimited area, at a scale that is smaller than the one of a district, with potential synergies, in particular in the area of energy. A 'green neighbourhood' is a neighbourhood that allows for environmentally friendly, sustainable patterns and behaviours to flourish (e.g. soft and zero-emission mobility, renewable energy, bioclimatic architecture, etc.)*" [15]

PROBONO **working description** of a GBN as: "*an ecosystem of Natural, Physical, Technical, and social attributes, interacting within a wider System of Systems. A GBN aligns the human and natural world, reducing energy use through renewable, local sources and circular resources. A GBN aspires to a net positive impact on both humans and nature, operating in line with both the natural world and urban reality. It is an urban or rural ecosystem, that minimizes human impact on the natural world, balancing both development and Quality of Life. A GBN is a people-centered social, urban, and natural area, integrating natural and human infrastructures, through positive and sustainable collaboration.* "

This definition may be subjected to refinements based on project findings. Moreover, it is expected that the definition is tailored to different audiences competences, expertise and profile; to maximise the understanding of the overall concept and the adoption of solutions at all levels.

4.2.2 Needs and challenges

The general need for decarbonising the built environment, has been highlighted by many references in the latest years. This assessment focuses on the needs and challenges that those that are working in the local and regional environments and shall make decisions are facing. As already stated in WP1 of PROBONO, through the hub and spoke model (a diagram with central

[15] European Commission. LC-GD-4-1-2020 FAQs (checked on April 2023), https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/support/faq/14273

nodes -hubs- connecting through radius -spokes-, an example is provided in *Figure **4***, page 34) and the creation of strategic case studies, for the correct development of the GBNs it is needed to identify and understand the common characteristics that underpin the creation of GBNs and their urban ecosystems in multiple different settings.

Because of their innovative nature, GBNs present challenges in their design, implementation and adoption. They require an ambitious mix of environmentally friendly approaches, solid construction methods and the integration of new technologies. Furthermore, from a practical perspective, the creation of a GBN also requires the adoption of innovative neighbourhoods and technologies by local actors and citizens themselves. For this reason, an initial definition of the main current challenges was made using the PESTEL diagram[16] developed in confidential Deliverable 1.1 and used as a basis for further discussions on potential uses with PROBONO partners.

In addition, the assessment of the context in the six PROBONO project Living Labs developed in WP2 was appreciated as feedback for the development of the GBN concept. Different aspects such as climate, size, buildings, typologies, infrastructure and demographics, as well as the technological innovations to be implemented, were taken into account to identify the needs and challenges for GBN implementation. At the same time, the GBN stakeholder map developed in WP1 and deployed in PROBONO's WP2 (presented in *Figure **4***) helped to identify stakeholder needs to be considered in the following steps.

Based on the discussions with the consortium, the key findings of the customer profiles identified, following the structure of *Figure **1***, are:

[16] PESTEL (or PESTLE) assessment (can be represented as a diagram), refers to an analysis of the external conditions (or dimensions) that affect all stakeholders in the same value chain. The six dimensions considered are: Political, Economical, Social, Technological, Legal and Environmental (PESTLE).

1. *Current jobs/responsibilities:*

- Renovation of existing assets of the built environment at different levels.
- Installation of renewable energy production and reduce dependency on non-renewable sources.
- Procurement and tendering of solutions – definition of parameters, offers selection and acquisition.
- Education of stakeholders and awareness creation on sustainability needs.
- Consider current and future usage of buildings and infrastructures and provide flexibility.
- Increased Quality of Life.

2. *Pains:*

- Lack of stakeholder engagement.
- High costs of green transition.
- Lack of funding for green transition and attraction of investors.
- Lack of technical expertise.
- Short term political interests.
- Disrupted management of data across built environment lifecycle (design, construction, operation).
- High complexity of the local and regional environments.

3. *Gains:*

- Common rules for the long term and better decision making.

- Reduced risk in high technology investment and deployment.
- Eased tendering processes.
- Increased attractiveness and value of the local environment and its assets.
- Integrate all dimensions of sustainability in decision making.
- Climate change proofing of infrastructures.
- Cohesive LCA based on norms and standards.
- Improved circularity and reduced primary resources consumption and environmental impact.

4.2.3 Value proposition

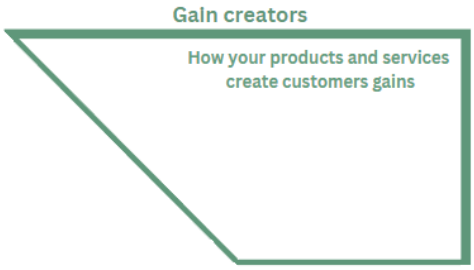
In response to the needs and barriers identified, PROBONO and the GBN concept can deliver a long-list of benefits that respond to such needs. PROBONO's market analysis to be developed will allow to iterate and refine this assessment in the near future, based on the different segments identified and the measures to quantify the value proposition of the project's products, but in particular about the GBN concept.

As previously explained and following the structure in *Figure **1***, value proposition is presented below:

1. Products and services

- GBN Concept.
- Strategic tools to assist the identification of key stakeholders and the formalisation of the GBN.
- Methodologies to quantify the transition effects and benefits for the local and regional environments to a GBN.
- Assistance on the transition towards a GBN.

2. Gain creators



- Quality of life improvements.
- Clear means to tailor innovative solutions selection, sizing, and deployment.
- Enhanced integration of social perspective increasing overall stakeholder acceptance of interventions.
- Conformity with regulations and standards.
- Affordable energy.
- Environmental impact monitoring based on clear indicators.
- Benefits accounting.

3. Pain relievers:

- Reduced living costs.
- User-friendly green local environments.
- Improved social interaction in the neighbourhoods.
- Increased happiness.
- Mitigated environmental impact.
- Mitigated inappropriate social behaviours.

- Reduced workload on bureaucracy, communication and energy-related services.
- Standardisation.

4.2.4 Competitive advantage analysis and core messages

Taking into consideration the perception on the GBN Concept value proposition, the **competitive advantage analysis and the core messages** of PROBONO's GBN concept rely on:

- **Reduced environmental impact** of local and regional built environments, reverting into a more sustainable living based on circularity, reduced use of non-renewable sources and mainstreaming affordable renewable energy and better decision making.
- **Enhanced quality of life** of all stakeholders in a local or regional environment. On one hand, professional audiences and authorities, whose efforts and workloads will be streamlined in a long-term vision with clear ways to measure effectiveness of actions. On the other hand, citizens will live and make use of healthier spaces with higher value.
- **Stakeholder engagement and involvement**, taking part in all parts of the process based on their roles and competences. Being aware of what is expected and what can be obtained, with the flexibility to be tailored to the particularities of local environments.

These core messages can be finetuned to the multiple profiles and stakeholders that have an influence on the GBN (see section 4.3.1 for further references on the stakeholder map concept associated to the GBN).

4.2.5 Sustainability pathways

PROBONO's GBN concept, despite being still a work-in-progress framework, combines a wide pool of know-how, processes and products; encompassing not only the strategic GBN vision, but also the long list of results of the project and other innovative solutions that may be identified already or still unknown; all contributing to a practical deployment of the GBN concept.

The GBN concept as a framework on its own, can pave the way for multiple exploitation and sustainability pathways for the concepts, know-how, processes, methods or products making it possible. These potential sustainability pathways are presented in the following table, taking into consideration who the main adopters could be to sustain the results, aligned with PROBONO's targeted audiences

Exploitation and sustainability pathway	Adopter	Pros	Cons
Enhancement of public knowledge	All professional audiences	- Free access to concept. - Shared vision to allow further Research Development and Innovation projects. - Enables further products and services. - Can increase demand for GBN solutions. - Contribution to legislation packages (inc. the Fit for 55 package).	- Unclear responsibilities for sustainability.
Standardisation	All professional audiences	- Aligned vision that can be applied by all stakeholder. - Sustained by multidisciplinary experts.	- Existing consensus that need to be taken into account (ongoing).
Development of new products and services	All professional audiences	- Contribute directly to mitigate environmental impact. - Increased specialisation and more efficient deliveries.	- Depend on market attractiveness and demand. - May not be accessible by all. - Profitable by economies of scale.

Table 3. Sustainability pathways for the GBN concept.

Exploitation routes. (how the particular products/services are brought to the market) depend on the partners responsible for its development (in this case, the adopters presented in second column) and agreements reached during the project (based on the list provided in section 3), while standardisation or public knowledge may depend on the creation of bodies that can grant their sustainability, as disclosed in section 4.4 below.

The engagement of PROBONO's targeted audiences in the upcoming project communication and dissemination activities, will enable the deeper exploration and refinement of the sustainability pathways for the GBN concept and the project's LL. A specific assessment for the GBN sustainability is further described in section 4.3.4 as part of the GBN Innovation Cluster exploitation assessment.

4.3 GBN Innovation Cluster

4.3.1 Definition and initiation

There are few references available on the 'innovation cluster' concept. The figure of the 'cluster' as such belongs to organisations that "*support the strengthening of collaboration, networking and learning*" (as extracted from the European Cluster Collaboration Platform[17]). As introduced in section 4.1, the concept of the GBN Innovation Cluster relies on one of the pillars of the GBN concept: the GBN stakeholders and their roles, as illustrated in Figure 4 by the *map of GBN stakeholders* developed in WP1:

[17] European Cluster Collaboration Platform. Cluster Definitions, (checked on April 2023), https://clustercollaboration.eu/cluster-definitions

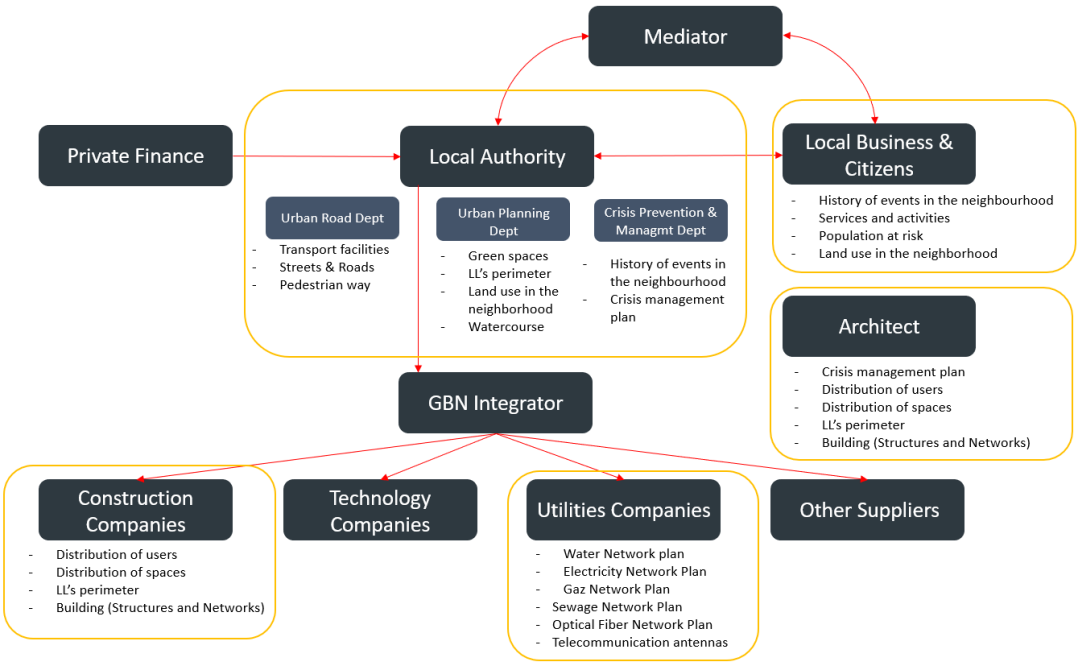


Figure 4. Map of GBN stakeholders (extracted from PROBONO's D1.1)

Thus, the GBN innovation cluster can be defined as the organisation or network of local or regional stakeholders that are competent and expected to be required in a certain local environment in order to design and deploy a GBN. The work of the GBN Innovation Cluster towards their effect in the local and regional environments shall be measurable on qualitative or quantitative manners, in terms of the capacity to bring the expected positive effects on nature and quality of life.

This is a working definition that will be refined during the project similarly to the GBN concept, and it also involves the methods for the stakeholder analysis that were tailored and applied to a GBN under PROBONO's WP2.

4.3.2 Needs and challenges

The needs and challenges of the GBN Innovation Cluster are completely aligned with the ones analysed for the GBN concept and disclosed in section 4.2.2. However, since the concept of the 'innovation cluster' is strictly linked to the local or regional environment where it is expected to be allocated, the analysis of the *customer* profile and the stakeholders' map shall be particularly analysed when exploring how to successfully deploy a GBN and create the Innovation Cluster as an enabler of it.

4.3.3 Added value

In line with the argument on section 4.3.2, it is considered that the value proposition of the GBN can be extended to the 'Innovation Cluster', since this is a refinement on how the GBN concept is deployed in practice replicating the work done during PROBONO preparatory actions and the actual execution of the project. Core messages: '*Reduced environmental impact*', '*Enhanced quality of life*' and '*Stakeholder engagement and involvement*'; are applicable also when setting up the GBN Innovation Cluster and towards all targeted audiences.

4.3.4 Sustainability pathways

In this case, given the ambition and the scope of the deployment of the GBN Innovation Cluster, sustainability will be assessed making use of the Five Case Model. A best practice guidance for the public sector to understand the viability of a project or a programme, that in the case of PROBONO refers to the deployment of the GBN and the establishment of the Innovation Clusters[18].

The 5 cases assessment of the GBN Innovation Cluster is presented below (definitions based on reference provided):

Strategic case – *robust synergies that justify the need for change*

The strategic case of the GBN, has been largely discussed within PROBONO's early phases (WP1), based on multiple references collected so far and also the long-term vision of the SDGs, the European Green Deal and the climate neutrality objectives of the EU. The main dimensions that justify the establishment of the GBN and the GBN Innovation Cluster are:

- Climate neutral energy supply.
- Built environment contribution to air and environmental quality and biodiversity.
- Mobility and transportation.
- Nature-based solutions.
- Digitalisation.

[18] Flanagan, Joe, and Paul Nicholls. Public Sector Business Cases using the Five Case Model: A toolkit (2007).

- Inclusiveness and accessibility.

Economic case –*value returned for the money invested*

GBNs provide a pathway to obtain increased quality of life from investing and deploying novel solutions in the local and regional environments. These benefits can be quantified from multiple perspectives, which include, inspired by PROBONO's KPIs:

- Optimisation of built environment lifecycle processes (design, construction, operation, maintenance, refurbishment and deconstruction). Reducing time and costs.
- Optimised demand and increased flexibility of the energy system.
- Increased energy and resources efficiency and circularity.
- Reduced dependency on non-renewable sources of energy and materials.
- Reduction of GHG emissions, embodied energy and air pollutants.
- Improvement of indoor and outdoor air quality.
- Reduced inequalities and accessibility barriers.

Commercial case – *viability of the commercial premises*

Similarly, to the 'economic case' described above, GBNs, and the more nailed down approach of the GBN Innovation Cluster and the stakeholders maps; provide an excellent environment for disruptive innovations in the four dimensions considered in the definition (*natural, physical, technical and social*, as introduced in section 4.2.1). These innovations deployment is usually hindered by the lack of guidance and references, plus the lack of incentives and potential non-profitability due to reduced applicability and impossibility to apply economies of scale. An ambitious and strong deployment of the GBN and GBN Innovation Clusters will significantly boost the attractiveness of sustainable products and services, and enhance their market viability and thus, the commercial viability of the GBN as a whole.

Financial case – *affordability of the study case*

The required investment for the decarbonisation of the built environment has been estimated at 9.2 trillion USD yearly until 2050 to achieve net-zero emissions[19]. This is probably the major challenge the transition is facing. However, the GBN approach allows a higher specialisation degree in all stakeholder groups, while facilitating the dialogue, participation and acceptance of disruptive technologies; leading eventually to more efficient and affordable products and services, as presented in the 'commercial case'.

The EU Taxonomy for sustainable activities can ease the process of integrating and enhancing the attractiveness of sustainable solutions in investment pipelines. At the same time, in the short term, uncertainties and first barriers can be overcome thanks to the available Recovery Funds or the Social climate fund. The contribution of the ecosystem for GBN Innovation Clusters will play an important role on assessing the viability of these models and the development of evidence-based policy recommendations, that make it possible.

Management case – *capacity to achieve the proposed case*

The GBN stakeholders map provides an excellent overview of the key players that may be required for the practical GBN deployment in local/regional scenarios. This approach and the application calendar shall be tailored to each reality, based on the starting point at all levels (from individual competences, opportunities and motivations; to a high-level assessment of resources available and current context) and the realistic objectives that could be set up.

It is important to highlight that PROBONO proposes two key roles for the GBN design and deployment:

- The GBN integrator: a figure that understands, coordinates and achieve the different components of the GBN.
- The mediator: a figure that represents individual and collective interests in relation to the GBN.

These figures may be represented by an individual, an organisation or a group of individuals/organisations. In any case, it is noticeable that this 'management case' is integrated as part of the maturing process of the GBNs.

[19] McKinsey & Company. Decarbonizing the built environment (2022).

4.4 European ecosystem of GBN Innovation Clusters

4.4.1 Definition and initiation

The European ecosystem of GBN Innovation Clusters builds on the work of the project to form alliances beyond the LL of the project and the consortium as a whole. External collaboration within PROBONO is important to maximise the visibility and impact of the project (as set out in the Grant Agreement), but also to ensure cohesion between different local and regional environments and to facilitate the exchange of experiences and good practises on the way to GBNs.

As outlined in the previous sections, there can be several ways to become a GBN. However, PROBONO offers a methodology that simplifies the transition and provides clear added value for all stakeholders in the local environments.

Thus, the European Ecosystem of GBN Innovation Clusters will be a network and an alliance that will become a one-stop shop for all these environments and all stakeholders involved in their journey towards becoming a GBN or for those who have already achieved it.

4.4.2 Needs and challenges

The needs and challenges that justify the creation of an Alliance of GBN Innovation Clusters are similar to the ones that PROBONO have identified to initiate the alliances and liaison activities during the project, as listed below:

- The lack of clear and homogeneous definition of what a GBN is, what are the roles and responsibilities and the key pathways to make it sustainable.
- The atomisation of references and experiences that hinders the identification of guidelines, best-practices and flagship initiatives that can emerge as examples and for other interested environments.
- The atomisation of targeted audiences based on the broad range of topics that shall be addressed to achieve the GBN status.
- The potential fatigue or lack of interest from stakeholders that shall play a strong part on the transition to a GBN and also in the cooperation with other local environments.

4.4.3 Added value

The added value of the proposed alliance and ecosystem model relies on the **shared efforts to achieve the ambitious environmental goals of the European Commission** by 2030 and 2050 and **maximise the impact of the multiple innovations reaching the market that will make it possible**. These efforts will be sustained by the following:

- Progress towards convergence and standardisation of methods and concepts for achieving climate neutrality at local and regional level, contributing significantly to national and European sustainability.
- Ensure cohesion and consistency on the messages shared towards relevant stakeholders in order to create awareness and spread the word on the GBN concept, GBN Innovation Clusters and overall sustainability lifestyles and built environment.
- Optimised efforts to reach out the atomised audience at all level, which as mentioned above will facilitate awareness creation and engagement.

This goes way beyond PROBONO's and the sister projects' ARV and oPEN Lab activities; but to other large-scale initiatives running in parallel (like the NetZeroCities project) or in the future (linked for example to the implementation of the Built4People Research and Innovation agenda). So, in addition to the above-listed statements, the main goal of all these initiatives is in general to have a practical contribution to:

- EU Mission on Climate-Neutral and Smart Cities implementation, by identifying and promoting concrete solutions to the biggest decarbonisation challenges.
- Proposals based on evidence and experience insights to the Fir for 55 package, also as a way to create a virtuous cycle of innovation for decarbonisation.

4.4.4 Sustainability pathways

The initiation of the International Ecosystem starts with the liaison activities that are being planned in parallel to the creation of this preliminary assessment for its own sustainability. Thus, the assessment developed in this section and the potential sustainability pathways will be discussed with all the actors involved while shaping the actions. Different scenarios for the exploitation and sustainability of the GBN ecosystem can be imagined as presented in the following figure:

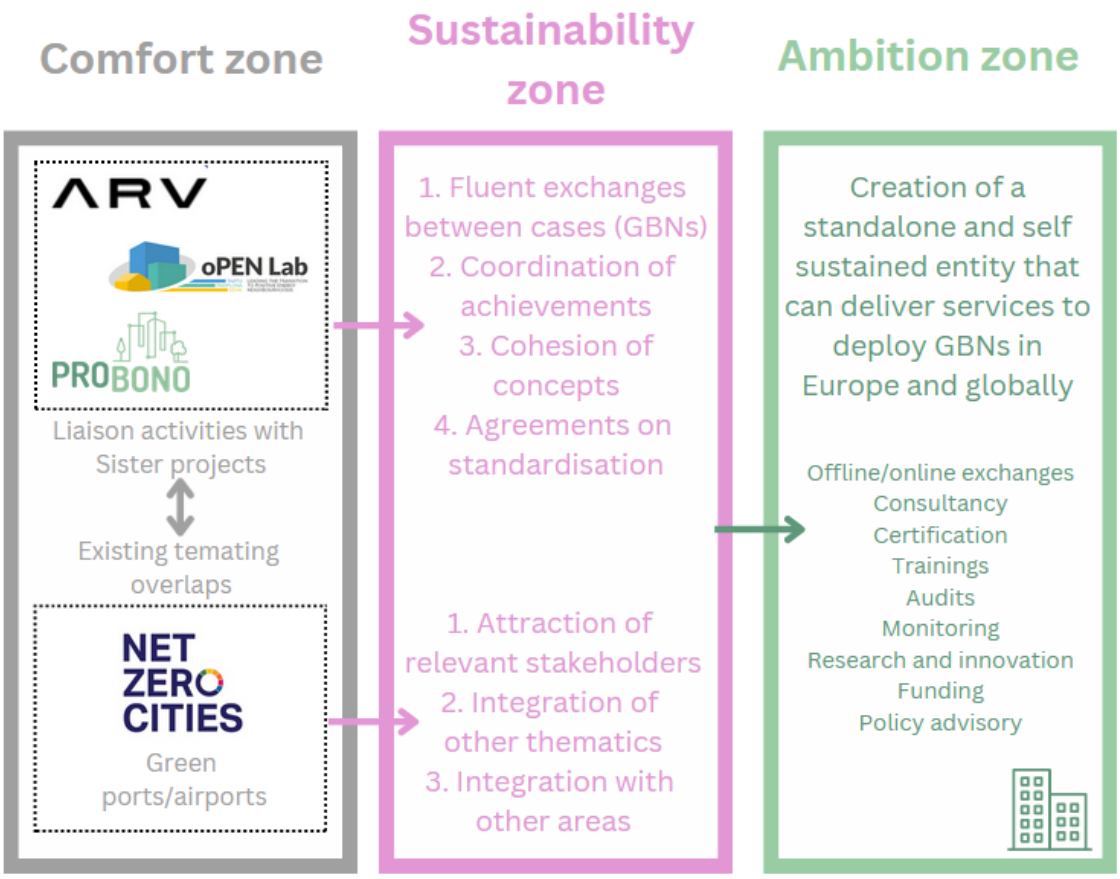


Figure 5. Scenarios of the GBN ecosystem

What is presented as a **comfort scenario** responds the current situation within PROBONO. Liaison activities and potential joint actions are already being discussed and planned both with: i) the 'sister projects' and; ii) other projects with thematic overlapping through the Green Deal projects call (same under which PROBONO was funded, as presented in *Figure **5***).

The realistic **sustainability scenario** would mean that:

i) Sister projects are capable of coordinating their efforts and exchange best practices; ensuring cohesion and joint standardisation actions.

ii) Involvement of additional projects to be integrated in the loop of GBN innovation. Including other areas beyond the built environment as such that are relevant, such as food systems or mobility and transportation.

This scenario would respond to the creation of an ecosystem for deployment of GBNs. However, a final and **ambitious scenario** could be oriented towards the creation of a new association, that may deliver services including:

- Online and offline interaction between GBNs, GBN Innovation Clusters and other local/regional that aim becoming a GBN.
- Consultancy services on the creation of the GBN Innovation Clusters and how to deploy the solutions at all levels required to become a GBN.
- Audits, monitoring and certification of professionals and achievements.
- Training to all stakeholders.
- Further research and innovation projects that can make the GBN transition more efficient or quality of life even higher.
- Provide funding and policy advisory for GBN deployment.

All these services are of public interest when considering the value proposition presented in section 4.4.3. The complete and quantified business model will be assessed in upcoming exploitation activities within PROBONO. However, it can be imagined that the financial structure would require to reach an agreement to create a figure that supported by a combination of private and public investment and revenues delivered services.

5 Conclusions and next actions

This deliverable provides an initiation and a preliminary sustainability plan for PROBONO's concepts on Green Building Neighbourhoods: the GBNs, the GBN Innovation Cluster and the International Ecosystem of GBN Innovation Clusters. To this end, key findings (some of them still not definitive) have been taken into consideration to develop this first exploitation assessment of the project. Moreover, all partners have been involved to develop a joint vision on what is the value proposition for GBNs, in order to maximise the attractiveness of project's learnings and stakeholders' willingness to adopt sustainable innovations.

The methodology and the approach used, combines on one hand mature and validated methods for assessing the exploitation of innovation projects. On the other hand, methods for assessing strategic large-scale projects and business models have also been integrated to address the complexity of a flagship project like PROBONO.

The main key findings of the value proposition for GBNs are:

- The reduced environmental impact of the built environment.
- Enhanced quality of life for all with no compromises on accessibility, inclusiveness and growth.
- Stakeholder engagement and involvement to promote attractiveness and commitment on sustainability.

The main target group is key decision-makers in local (urban, peri-urban and rural) and regional settings, which may include, for example, urban planners from city councils. However, the sustainability pathway assessment highlights the importance of collaboration at all levels (reflected in the stakeholder maps and the mature GBN Innovation Cluster concept). Future continuations of this deliverables will explore these dimensions more deeply, also in line with the implementation of PROBONO activities. Next steps for exploitation, replication and sustainability of GBNs and related concepts will, iterate the conclusions of this deliverable, as mentioned before, based on the progress of the project and the maturity of parts under discussion, such as the linkage activities and alliances.

In view of the next steps for the assessment of exploitation, this report has also provided a preliminary list of the 33 exploitable results identified in the project. This list will be iteratively updated as the project progresses to ensure the future exploitation of PROBONO results both during and after the completion of the project.