proGIreg

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Deliverable 5.6

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Abbreviations

BMC	Business Model Canvas
D	Deliverable
EU	European Union
FC	Follower Cities
FRC	Front Runner City
iBMCat	interactive Business Model Catalogue
NBE	nature-based enterprises
NBS	nature-based solutions
NBS BMC	nature-based solutions Business Model Canvas
WP	Work Package

Executive Summary

The overarching objective of proGIreg is to demonstrate the integration of NBS into (partly) self-sustained business models. NBS can exploit their full potential for improved city sustainability and resilience only when considering and valuing all sustainability dimensions. The project's NBS on post-industrial sites are co-designed, co-implemented and co-managed by local communities and organisations, such as NGOs, public authorities, associations, businesses incl. community-based start-ups, and citizens. This transdisciplinary setting facilities social innovation. Business models allow for demonstrating the overall functionality and setting of NBS including circular economy approaches. The development capacity of preferably self-sustained business models goes beyond purely economic figures by integrating biodiversity, health, social cohesion, etc. into holistic processes. NBS business models do not necessarily have to be economically viable as long as the overall benefits for society and environment is considered higher than the associated costs.

Osterwalder (2004) defines the business model 'a representation of how a company buys and sells goods and services and earns money'. Business model concepts have emerged on a system-level dimension relatively recently. Although business model thinking stems originally from business world scholars, it can be utilized for activities of not per se or primarily business-oriented organizations. This report presents a NBS-tailored modification of the strategic management template "Business Model Canvas" from Osterwalder and Pigneur (2004) as well as the results of its application for the NBS implementations carried out in the Living Labs of the four Front Runner Cities of Dortmund, Ningbo, Turin, and Zagreb. The modifications build on earlier works seeking to integrate sustainability and NBS into business model thinking. The proposed Nature Based Solutions Business Model Canvas (NBS BMC) consists of 14 building blocks and allows to holistically capture the business models of NBS implementations. The resulting business model catalogue aims to highlight market opportunities for business-oriented NBS stakeholders, but also public-private partnership and social entrepreneurship models.

In total, 23 NBS implementations in the four Front Runner Cities were interviewed in order to fill the new NBS BMC template. For facilitating comprehensibility and comparability, interviews were carried out with NBS key contact persons to fill the NBS Business Model Canvas following guiding questions for the 14 building blocks. For allowing a tailored access to the NBS business models, different analysis approaches of the collected interview data are presented. This allows different stakeholders with varying objectives, backgrounds, and motivations to select NBS business models of their interest. In order to structure and classify the NBS business models towards a business model catalogue four main analysis paths were used:

(1) Pestoff triangle between state, market and community,
(2) degree of profit orientation,
(3) target groups: customers and beneficiaries, and
(4) financial benefits: revenue streams vs. cost reduction.

The research results on the business model task of WP5 have been compiled into an interactive Business Model Catalogue (iBMCat). The format allows for browsing, searching and printing the content in many different ways. A couple of entry points are prepared that help to navigate and explore the Business Model Catalogue in a tailored and user specific manner.

The Pestoff triangle approach builds the core classification grid for the Business Model Catalogue. Firstly, it allows to position NBS business models based on their organisational governance between state, market, and community. Additionally, the triangle approach differentiates between formal vs. informal, non-profit vs. profit, and public vs. private activities. Most NBS are within the public and/or third sector domains. However, some NBS are managed and implemented also by market-oriented private businesses. By using the Pestoff triangle, it is possible to cluster types of business models. The main types are

- public provision,
- sales, and
- diversified business models.

A further detailing of the public provision NBS is important. While some are city-internal with varying degrees of co-design (top-down approaches), others are led by the project municipalities together with further collaboration partners from public, private, and third sector. Several NBS implementations from Turin and Dortmund belong to the diversified business model. They can be further distinguished into public-private partnership or sponsorship/donation models bridging public and private as well as diversified approaches relying on services, sales or rental concepts. Three proGIreg NBS are implemented and run by businesses with a clear profit orientation belonging to the sales business models.

Parallel to the positioning of NBS implementations in the Pestoff triangle between state, market, and community, the degree of profit-orientation allows clustering NBS by their economic mission. Three NBS implemented in Turin, NBS 2 New soil, NBS 4 Aquaponics, and Orti Generali (NBS 3.2) show the strongest degree of profit orientation and NBS entrepreneurship.

Furthermore, the newly developed NBS Business Model Canvas differentiates between the two target groups of beneficiaries and customers. Customers are paying for the value offering, especially goods and services. Contrarily, beneficiaries gain from the NBS values without paying directly for it. While customers generate revenue streams, the focus on beneficiaries demand other financial remuneration measures (financing), such as public funds or grants. Thus, it is crucial to consider and distinguish between these two main target groups. Since several implemented NBS are not aiming for any profit, a significant number of proGIreg case studies create no or only low revenue streams and at the same time no or only indirect cost reduction measures.

Due to shortage of public budgets, new approaches including productive green infrastructure measures are required. The analysis reveals that it is suitable to integrate entrepreneurial thinking from early on in the process. While this is inherently integrated in private, business-oriented actor groups, this is partly out of the box of public and community actors. Entrepreneurial thinking goes beyond exploiting promising revenue streams, but also utilizing

financing models and measures to reduce costs, especially in the maintenance and evolution phase of NBS. To do so, the cooperation of different stakeholder groups is deemed a suitable way towards the mainstreaming of NBS. By matching public, private, and third sector, new alliances can be developed in order to result in mutual trust, higher levels of acceptance as well as creating more flexible and innovative milieus. The suitable combination of stakeholder groups depends on the type of NBS, required resources, activities, objectives. Overall, it is important to highlight that many NBS have an economic dimension by offering jobs, revenue paths, new NBS entrepreneurship, but also by allowing cost reduction measures for public entities and beyond.

1. Introduction

1.1. Introduction to the project

Productive Green Infrastructure for post-industrial urban regeneration (proGIreg) is developing and testing nature-based solutions (NBS) co-creatively with public authorities, civil society, researchers and businesses. Eight NBS, which will support the regeneration of urban areas affected by deindustrialisation, have been implemented or are going to be deployed in four front-runner cities: Dortmund (Germany), Turin (Italy), Zagreb (Croatia) and Ningbo (China). The follower cities of Cascais (Portugal), Cluj-Napoca (Romania), Piraeus (Greece) and Zenica (Bosnia and Herzegovina) in the meantime receive support in developing their strategies for improving nature-based solutions at local level through co-design processes. The NBS to be tested are depicted in Figure 1:

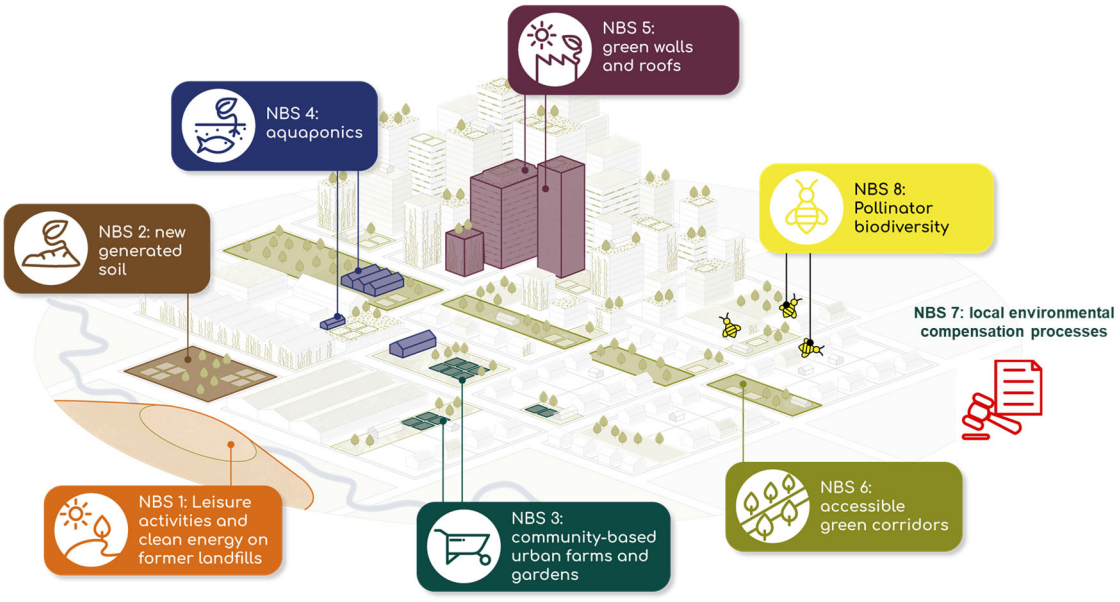

Figure 1. Spatial representation of proGIreg NBS (RWTH)

- → NBS 1: Renaturing landfill sites for leisure use and energy production
- → NBS 2: New regenerated soil thanks to biotic compounds for urban forestry and urban farming
- → NBS 3: Community-based urban farms and gardens
- → NBS 4: Aquaponics
- → NBS 5: Capillary Green Infrastructure on walls and roofs
- → NBS 6: Making post-industrial sites and renatured river corridors accessible for local residents
- → NBS 7: Establishing protocols and procedures for environmental compensation at local level
- → NBS 8: Pollinator biodiversity improvement activities and citizen science project

1.2. Introduction to WP 5 and Task 5.3

The Business Model Catalogue (Del. 5.6) is the final contribution of WP 5 "Market readiness, barriers, and upscaling" of the EU HORIZON 2020 project proGIreg. WP 5 aims at detecting barriers to implement NBS, to find solutions to overcome them (Tasks 5.1 and 5.2 with corresponding Deliverables; see Figure 2), and to develop a catalogue of business models for NBS (Task 5.3). ProGIreg's overarching objective of demonstrating NBS-integration into (partly) self-sustained business models require emphasising upon possible bottlenecks for NBS when entering the market and identifying suitable business models. WP 5 builds especially on the NBS pilot implementation within WP 3 and WP 4's benefit assessment and monitoring during and after the NBS pilot implementation.

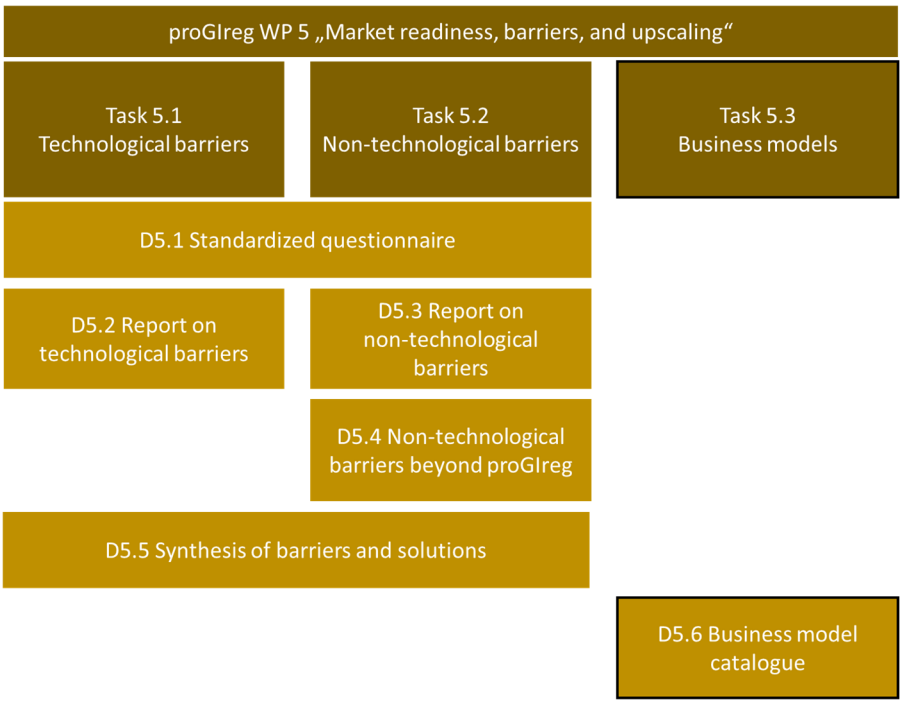

Figure 2. Sequence of WP5 deliverables (D) on barriers and business models

The co-designed (WP 2), co-implemented (WP 3), and assessed (WP 4) NBS implementations are analysed with regard to their underlying organizational structure and business model in Task 5.3. The report identifies and classifies business models in form of a Business Model Catalogue. This catalogue highlights market opportunities, social entrepreneurship models, public-private partnership arrangements when implementing and maintaining NBS.

2. Structure of the Business Model Catalogue

This report summarizes and presents the activities carried out and findings extracted from Task 5.3 activities.

Following the executive summary and introduction, this chapter briefly presents the report's structure. The following chapter on the theoretical background focuses on business models and the connection between business models and nature-based solutions. This new match is recently gaining attention by a number of EU-funded research and innovation projects aiming for economically self-sustaining NBS implementations and mainstreaming. The next chapter's methodological approach firstly introduces the strategic management template Business Model Canvas and secondly its modifications towards sustainability and nature-based solutions. This is followed by the newly developed nature-based solution Business Model Canvas (NBS BMC). This NBS BMC consists of 14 building blocks. For each of the building blocks guiding questions are formulated and used to capture the business models of the project's implemented NBS in the four Front Runner Cities of Dortmund, Ningbo, Turin, and Zagreb. These data build the foundation for a business model catalogue. This catalogue is the result of four main analysis approaches and presented online in form of an interactive business model catalogue. The results' section presents the key findings using the four analysis approaches (1) Pestoff triangle between state, market and community, (2) degree of profit orientation, (3) target groups: customers and beneficiaries, and (4) financial benefits: revenue streams vs. cost reduction. The filled NBS BMCs are presented in the results' section for detailed information. Conclusions finalize this report.

3. Theoretical background: business models

NBS can exploit their full potential for improved city sustainability and resilience only when considering and valuing all sustainability dimensions. The project's NBS on post-industrial sites are co-designed, co-implemented and co-managed by local communities and organisations, like NGOs, public authorities, associations, businesses incl. community-based start-ups, and citizens. This transdisciplinary setting promotes social innovation and circular economy approaches. Business models allow to demonstrate the overall functionality and setting of NBS. The development capacity of preferably self-sustained business models goes beyond purely economic figures by integrating biodiversity, health, social cohesion, etc. into holistic processes. In the following, business models are briefly introduced. However, it is important to mention that NBS business models do not necessarily have to be economically

viable as long as the overall benefits for society and environment is considered higher than the associated costs. Thus, financing models are crucial for NBS business models.

The concept of and thinking in the logic of business models has risen since the mid-1990s, although the first appearance dates back to the 1960s (Osterwalder, 2004; Henriksen et al., 2012). Osterwalder (2004) defines business model ‘a representation of how a company buys and sells goods and services and earns money’ (Osterwalder, 2004: 14). A rising number of definitions and interpretations have emerged since then. Business models explain how companies do businesses (Henriksen et al., 2012); they a) describe ‘the rationale of how an organization creates, delivers and captures value’ (Osterwalder and Pigneur, 2009: 14), stand for the ‘design of organizational structures to enact a commercial opportunity’ (George and Bock, 2011: 83f.), show ‘how a firm is able to earn money from providing products and services’ (Boons and Lüdeke-Freund, 2013: 9), and explain ‘how value is created for the customers and how value is captured for the company and its stakeholders’ (Henriksen et al., 2012: 31).

Business model concepts have emerged on a system-level dimension as a relatively new unit. Business models aim to explain how firms operate and do business holistically. Organizational activities play an important role in the various conceptualizations of business models, which seek to explain how value is created and captured. The identification of the three questions ‘who’, ‘what’, and ‘how’ are essential for the analysis of business models (Henriksen et al., 2012).

Boons and Lüdeke-Freund (2013) highlight four generic components to be viewed at when analysing business models: (1) value proposition, (2) supply chain, (3) customer interface, and (4) financial model. They are suitable for extracting insights and knowledge on value creation, relationships, and success factors; additionally, it allows to compare companies with competitors. Business models consist of interlocking elements – or building blocks – that, taken together, create values; for example customer value propositions and profit (Johnson et al., 1996). From the vantage point of profit-oriented businesses, business models allow to set up a supportive overview of how to create and capture value and support knowledge creation and awareness to identify required changes to keep a competitive advantage or for future innovations.

4. Business models and Nature-based solutions

Although business model thinking stems originally from business world scholars, it can be utilized for activities of not per se or primarily business-oriented organizations, e.g. NGOs, public authorities, social enterprises to name a few. NBS implementations encompass a wide range of interventions, some of which can create direct monetary values, e.g. by selling goods, like food items from nature-based farming practices (food forests, permaculture orchards, …) or charging fees for services, e.g. nature-based education. Since many NBS implementations are led by public entities, like municipalities, many of them prioritize the generation and (public) provision of non-monetary values over monetary values. Still, these

types of NBS can be integrated into business model thinking and summarized in tools, like the strategic management template Business Model Canvas and modifications or adaptations of it (see below). This requires to think open and consider the business model tools for NBS organisation independently of their degree of profit orientation or perception of classical business entities.

The European Commission defines NBS as “as a way to address societal challenges with ‘solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions” (Faivre et al., 2017). This definition highlights the equality of the three sustainability dimensions, including the economic domain (referred to in the definition via cost-effectiveness and economic benefits). From a business model angle, the economic benefits can occur from numerous value propositions, which are not necessarily bound to direct economic aspects. Yet, the value proposition can stem also from social and environmental sustainability pillars building the business model foundation and contribute to the business model by establishing relevant revenue streams.

Since the late 2010s, EU research and innovation projects have contributed to the growing knowledge on NBS business models (Mayor et al., 2021). Accelerated by the Covid19 pandemic, NBS implementations are challenged by budget allocation dilemmas for local governments. Although more and more project implementations are able to show NBS’ multi-functionality and cross-sectoral benefits, “public budgets for NBS investment are often insufficient to drive their mainstreaming” (Mayor et al., 2021: 2). Several studies (i.a. Bockarjova et al., 2020; Jacobs et al., 2016; Croci et al., 2021) demonstrate the value of nature and NBS; also in monetary sense. “However, the financing remains a key challenge for wider application of NBS. It remains a significant gap between articulating the value of nature and finding stakeholders who are actually willing to pay for nature” (Mayor et al., 2021:2). Another crucial aspect is the predominant concentration on the capital investment phase only. Mayor et al. (2021) also argue that NBS appreciate over time including in most cases a continuity of financing demand, including operational or stewardship costs. This is different to grey infrastructure, which are depreciating over time. However, durability of green and grey infrastructures have to be taken into account. Grey infrastructures also require restorations or demolition and new constructions after its lifetime. With regard to grey infrastructures, the generation of financial revenues is key for the sustainability, evolution, and expansion of NBS to exploit its potential for more sustainable city landscapes.

Among a set of NBS projects funded by the EU commission, the EU project Naturvation for instance developed a Business Model Catalogue for urban NBS, in which they present eight different business models by using their project specific approach (Toxopeus, 2019). One of the take home messages of the Naturvation project highlights: “Taking action on nature-based solutions does not only depend on establishing the right policy conditions and financial resources, but also on establishing business models that can ensure their sustainability over time. Nature-based solutions often create a complex array of public and private benefits, and developing business models that are able to capture and realise this value can be

challenging" (Naturvation, 2019). Following these findings that NBS require sound business models to deliver values and benefits towards sustainability and resilience in the long run. In their approach, they focus on four main building blocks of the business model; value proposition, value delivery, value capture, as well as enabling conditions and risks. Based on the Naturvation experiences, eight NBS business models are proposed in the catalogue. These are risk reduction, green densification, local stewardship, green health, urban offsetting, vacant space, education, and green heritage (Toxopeus, 2019).

Rather recently, the term Nature-based enterprises was created to bring together the nature-based perspective of interventions and the business dimension of these activities (McQuaid et al., 2020). "Nature-based enterprises (NBEs) use nature as a core element of their product/service offering. Nature may be used directly by growing, harnessing, harvesting or restoring natural resources in a sustainable way and/or indirectly by contributing to the planning, delivery or stewardship of sustainable nature-based solutions" (McQuaid et al., 2020: 5). Due to their rootedness in nature, NBE embraces a huge variety of types. NBE include among others the a) creation, restoration, and management of ecosystems, b) greening of buildings (e.g. living green walls and roofs), c) green public urban spaces (e.g. urban forestry, urban gardening …), d) management and treatment of (waste) water, e) sustainable food production / agriculture (e.g. agroforestry, beekeeping, regenerative farming), f) sustainable forestry and biomaterials, as well as g) sustainable tourism, health and wellbeing (e.g. agri- and eco-tourism, nature-based tourism).

NBE can also use nature in indirect manners. Examples are financial services offering carbon offsetting, natural capital accounting, and investment for biodiversity and conservation. Indirect use of nature can also be exploited in smart technology, monitoring and assessment; education, research and innovation activities; as well as advisory services (McQuaid et al., 2020).

5. Methodological approach

This chapter introduces used materials and methods for developing the Business Model Catalogue. After introducing the well-known strategic management template Business Model Canvas, modifications of this business-focused tool towards sustainability and NBS integration are presented briefly. Based on these earlier works in the business model thinking domain, the own NBS Business Model Canvas is released. This NBS Business Model Canvas of the proGIreg project is used to collect information on the individual business models of NBS implementations in the Front Runner Cities Dortmund, Ningbo, Turin, and Zagreb. The data collection process based on interviews is presented in the following chapter, followed by analytical frameworks considered to result in the Business Model Catalogue. For allowing open and wide access, the Business Model Catalogue is publicly available online.

5.1. Business Model Canvas

For structuring and visualizing business models, Osterwalder and Pigneur (2009) developed together with a large group of supporters the strategic management template Business Model Canvas (BMC). This is a follow-up activity of Osterwalder's dissertation on the ontology of business models (Osterwalder, 2004). BMC has been developed to capture the rationale behind business models in an as easy as possible way, but without oversimplifying the business model's logic and key features. It presents business models in a holistic manner (see Figure 3). The widely applied strategic management template summarizes key information on how a business or organization works in nine basic building blocks. Osterwalder, Pigneur and more than 470 practitioners from 45 countries published "Business Model Generation", in which the Business Model Canvas is presented in detail, back in 2009. The BMC is a template to document not only existing, but also to develop and visualise new business model ideas. BMC is a tool, which provides helpful overviews of companies to emphasise key success factors, to detect barriers, to compare competitors, and to generate business ideas and innovations. The BMC's four main components are customers, offer, infrastructure, and financial viability, which are fitting to the nine basic building blocks building the full BMC picture. Additionally, the BMC template allows working on the desirability, feasibility, and viability of business ideas or business developments.

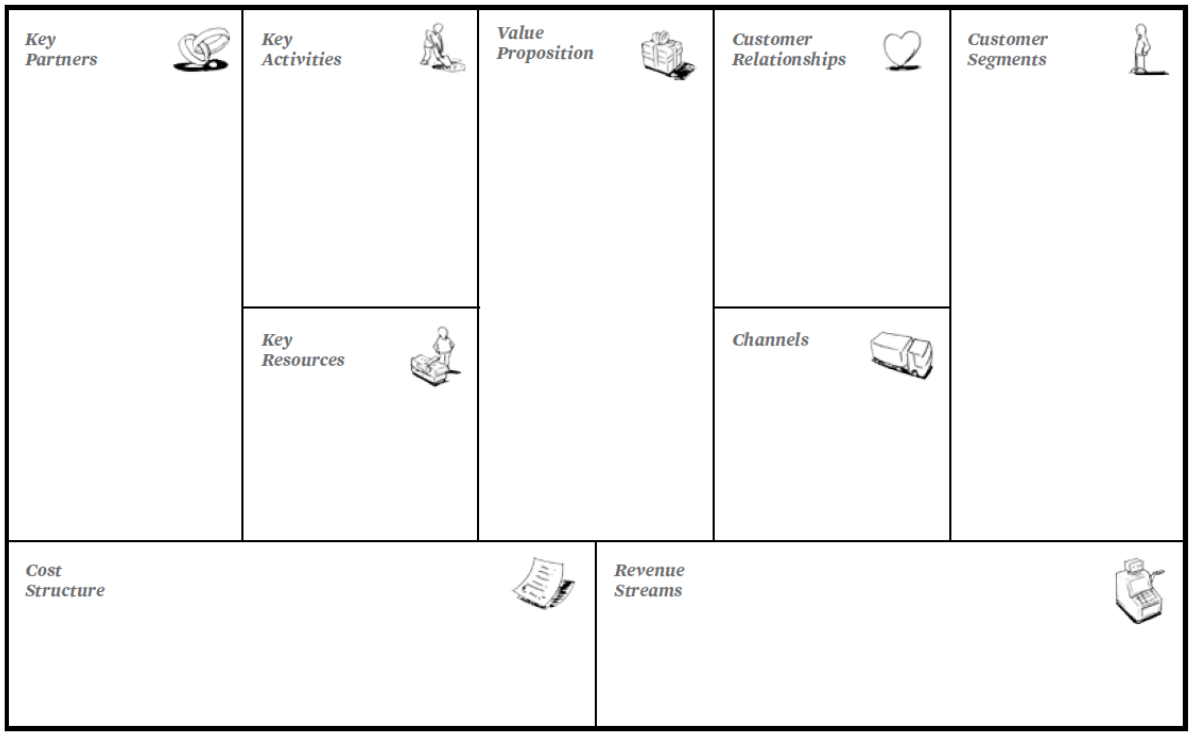

Figure 3: Business Model Canvas (Osterwalder and Pigneur, 2009)

The nine basic building blocks of the BMC are: value proposition, customer segments, customer relationships, channels, revenue streams, key resources, key activities, key partners, and cost structure. These main elements of the Business Model Canvas are also

considered in proGIreg's Business Model Canvas for NBS. However, further building blocks are added, altering the traditional building blocks to some extent.

The nine basic building blocks are briefly introduced here following Osterwalder and Pigneur (2009) with their brochure "Business Model Generation". Customer segment builds the heart of any business model and the basis for a prosperous business development. The customers can be grouped based on their common needs, behaviours, ability or willingness to pay for values (goods, services, and other values), channels to reach them, and requirements for proper customer caretaking. Customers are differentiated according to market segments tailored to specific customer requirements; either mass market or niche market, which is tailored to specific customer requirements.

The value proposition addresses the needs and requirements of specific customer segment. It consists of a bundle of products and services, which includes apart from tangible values also intangible ones. Quantitative values, e.g. price or speed of service, go hand in hand with qualitative values, e.g. design, inclusion, or non-marketable ecosystem services.

The customer segments and value proposition build two key building blocks of the Business Model Canvas. They are connected via channels and customer relationships. Channels describe how a company or organization reaches customer segments to deliver the value proposition. It includes much more than just the delivery of products. The interface with customers is carried out via communication, distribution, sales channels, and after sales arrangements. The channels can be internally offered, external ones offered by partners, or a mixture of both. The customer relationships between company/organization and customers range from personal to automate. The main reasons for customer relationships are acquisition of customers, retention of customers, and boosting of sales (upselling). Categories of customer relationships are for example self-services, dedicated personal assistance, automated services, and co-creation.

The fifth building block – positioned in the bottom right corner – covers one of two building blocks on financial viability, the revenue streams. This building block summarizes the monetary income coming from the customer segments benefiting from the offered value propositions and paying for it. Two prominent ways of ensuring income are (1) transaction revenues resulting from one-off customer payments, and (2) recurring revenues via ongoing or continuous payments, e.g. monthly fees, quarterly rents, etc.

The three building blocks left of the value proposition provide an overview of the company's infrastructure. These are key resources, key activities, and key partners. The most important assets required to make a business model work are condensed under key resources. The main distinctions are between physical, financial, intellectual, and human resources, which can be either owned by the company or organization or leased in from key partners (see below). The key activities describe the most important things a company has to do in order to make the business model run. The activities can belong to production (especially manufacturing firms), problem solving (consultancies, hospitals, etc.), but also platforms and networks (ebay, amazon …). The main suppliers and partners that make the business model work are put into the building block key partners. The reasons for working together with

partners can be a) optimization of the business activities by reducing costs, outsourcing or sharing of infrastructure, b) risk reduction, and c) access and acquisition of resources and activities the company does not possess adequately. Apart from the prevalent buyer-supplier relationship other partner coalitions can be important, especially, strategic alliances between non-competitors, cooperation (partnerships between competitors), and joint ventures to develop new businesses.

The ninth building block, the cost structure, completes the Business Model Canvas. It is positioned at the bottom complementing the financial viability, which consist of the revenue streams and cost structure. The main cost items are summarized here. They can include investment costs, but also operational costs. Two different concepts can be distinguished here: cost-driven (minimizing costs wherever possible) and value-driven (focus on design and value creation; premium value proposition).

With the help of these nine basic building blocks of the Business Model Canvas a company or organization can be described on one sheet of paper. It helps to simplify the complexity of businesses to key elements without oversimplifying the required efforts and interconnectedness of business elements.

5.2. Modifications of the Business Model Canvas

The traditional BMC tool, as developed by Osterwalder and Pigneur, plays a pivotal role for the “business-oriented world” on profit maximization. When considering activities more holistically and with a stronger sustainability lens, the traditional Business Model Canvas is limited. However, the sustainability dimension can be integrated into this traditional BMC under the centrally positioned building block Value Proposition. For example, Ferranti and Jaluzot (2020) use the traditional BMC to increase green infrastructure valuation tools’ impact. However, to better consider and represent holistic thinking and sustainability dimensions, several variations and alterations to the traditional BMC have been developed in the second half of the 2010s and early 2020s.

One alteration is the so-called Triple Layered Business Model Canvas that uses one layer for each of the three sustainability dimensions: economic, environmental, and social (Joyce and Paquin, 2016; see Figure 4). The economic layer remains exactly the same as the traditional BMC from Osterwalder and Pigneur (2009). The environmental and social layers keep the structure of nine building blocks from the economic layer. This not only results in a horizontal coherence within each of the three layers, but also in a vertical coherence. The social layer focuses for example on governance, employees, scale of outreach. The environmental layer follows the same logic and asks for detailing, among others, supplies and out-sourcing, production, materials, end-of-life, distribution, and use phase. The functional value builds the centrally positioned environmental building block, while the social value takes this pivotal role for the social dimension of the Triple Layer Business Model Canvas.

Another modification of the traditional BMC from Gerlach adds the sustainability of business activities not by adding layers of the same structure, but by adding building blocks to the traditional BMC from Osterwalder and Pigneur (Gerlach, 2015; see

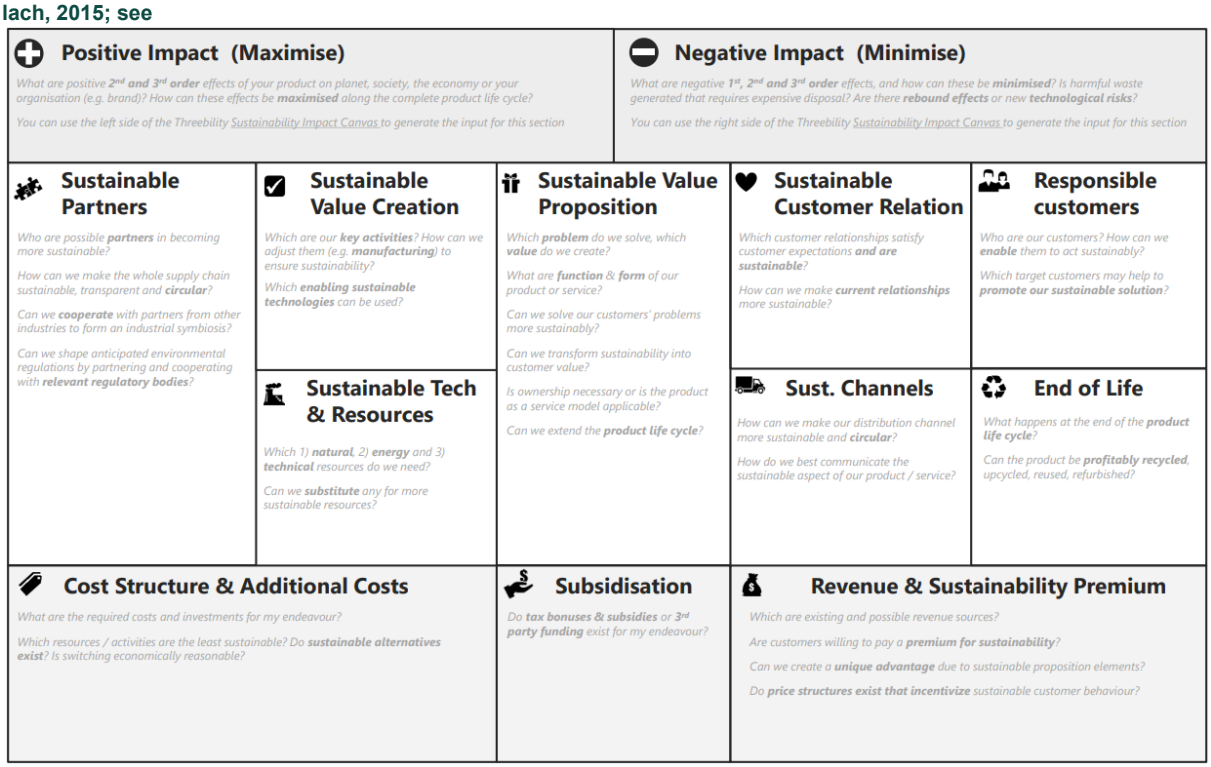

Figure 5). This template from Gerlach adds aspects crucial for (more) sustainable production and business model innovation, e.g. end-of-life, subsidisation as well as positive and negative externalities for the wider society and environment. By using this tool, it enables the users to maximise the sustainability impact of the business in general or of specific products or services focused on when filling the sustainable BMC from Gerlach. The top part, which is consisting of the positive and negative impact, can be further detailed by analysing and/or anticipating not only direct first order effects, but also indirect second order as well as systemic third order effects. The second order effects focus on the application of a technology or product, e.g. substitution or optimisation (positive impact to be maximised) or induction, obsolescence (negative impacts to be minimised). The systemic third order effects cover impacts like rebound effects or new risks.

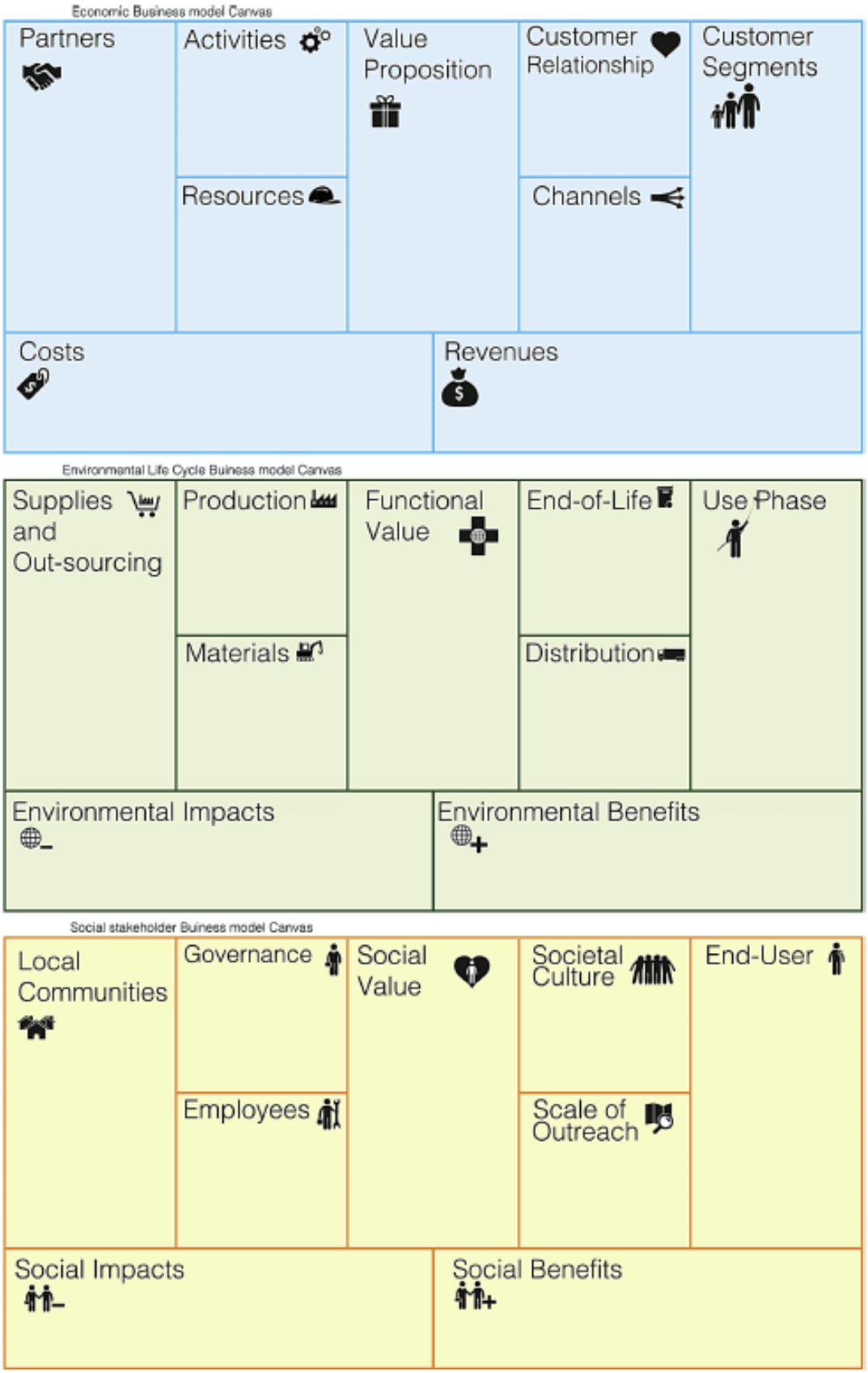

Figure 4: The Triple Layer Business Model Canvas (Joyce and Paquin, 2016)

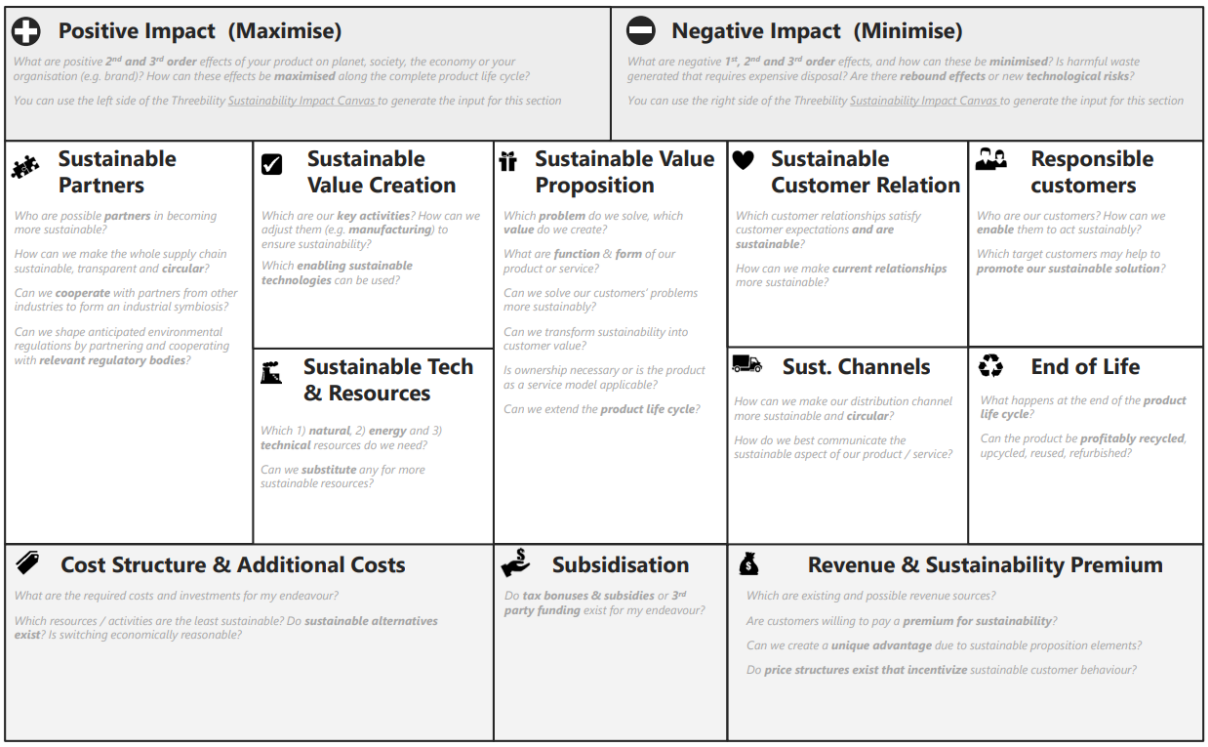

Figure 5: The Sustainable Business Model Canvas from Threebility (Gerlach, 2015)

In addition to these and further modifications of the traditional BMC, a growing body of approaches have tried already and tested in Living Labs adjustments of the strategic management template Business Model Canvas towards the concept of nature-based solutions. For instance, the EU funded projects Connecting Nature, EdiCitNet, UNaLab, and Naturvation developed modifications of the Business Model Canvas to pay suitable attention to NBS specifies (UNaLab, 2018; Connecting Nature, 2019; Naturvation, 2019; Toxopeus, 2019; McQuaid et al, 2020). The Connecting Nature approach sticks to the general structure of the traditional BMC from Osterwalder and Pigneur, but add key beneficiaries, governance, and cost reduction. By adding beneficiaries, the Connecting Nature approach allows to consider target groups in a broad way, including beneficiaries, who are not directly paying, but benefiting from NBS interventions. Governance is added to highlight management, internal organisation, and decision-making of NBS implementations and maintenance. Additionally, the financial part is added with a third building block, cost reduction. This reflects the possibility to reduce costs by implementing NBS, e.g. by taking advantage of permaculture principles, waste reduction and/or valorisation, use of volunteers, etc. EdiCitNet's approach adds the third dimension by proposing the diamond model (EdiCitNet, 2021). For more insights into these and other BMC modifications towards the visualisation of NBS business models, please use the links in the reference section.

5.3. proGIreg's Business Model Canvas for NBS

To capture the business models of proGIreg's NBS implementations and developments, an adapted tool was developed. It builds on the traditional BMC and its modifications, which are briefly introduced before. For holistically visualising the NBS business models, proGIreg's NBS Business Model Canvas consists of 14 building blocks (see Figure 6). A sequential order to go through the tool step (building block) by step (building block) is proposed in Figure 7. This newly presented NBS Business Model Canvas supports the development of a Business Model Catalogue of NBS implementations in Front Runner Cities' Living Labs. The catalogue aims to highlight market opportunities for business-oriented NBS stakeholders, but also public-private partnership and social entrepreneurship models.

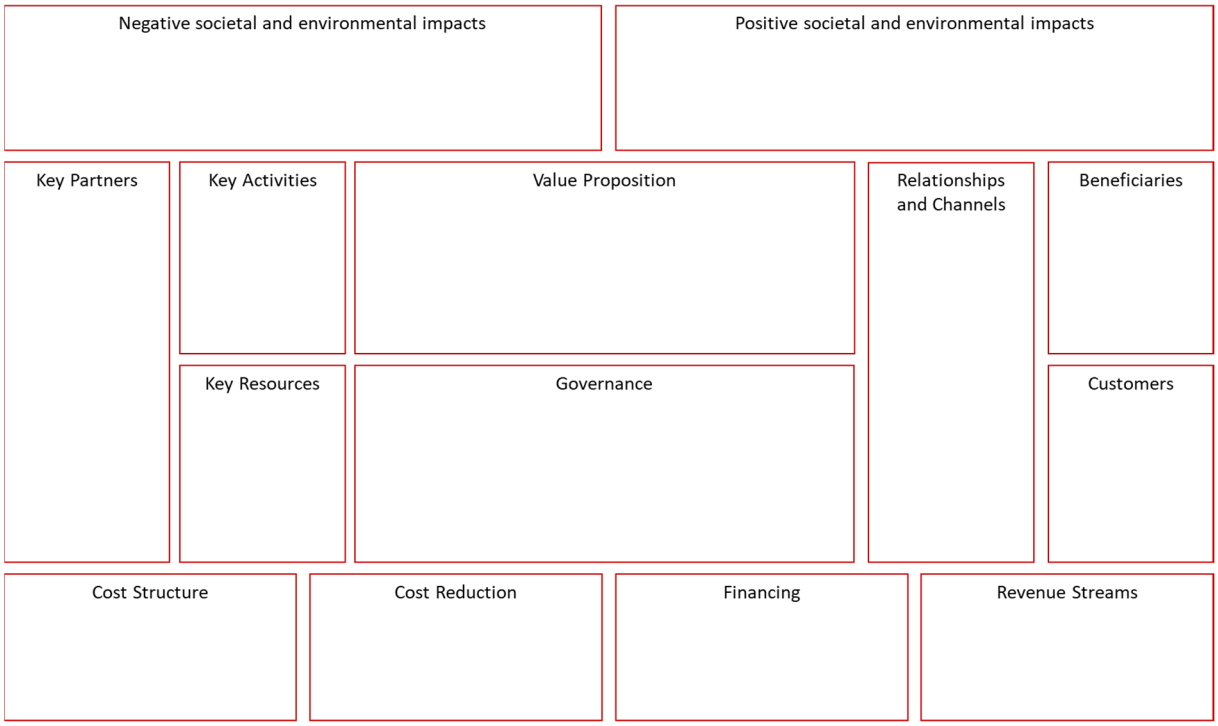

Figure 6: ProGIreg's NBS Business Model Canvas (own elaboration)

This NBS-tailored BMC template integrates some building blocks of other BMC modifications. However, it re-structures and re-organizes the building blocks. The value proposition remains centrally positioned. It includes tangible (good and services), but also intangible values. The value proposition – as well as the customers and beneficiaries (see below) – build key components to derive a NBS Business Model Catalogue. The governance of NBS implementations plays a crucial role for which reason it is positioned centrally below the value proposition. This follows the Connecting Nature proposal. The governance block bundles the organizational structure (Williamson, 1991), ownership (e.g. cooperative, not-for-profit, privately owned for profit, publicly traded for-profit…) (Young, 2013), and decision-making policies of the NBS (Zavadskas and Turskis, 2011). Hierarchy, transparency, consultation, profit sharing and other issues are subsumed under the building block governance. To the right side, the customers and beneficiaries along with the relationships

and channels are positioned. Customers are peoples, groups or entities, who are paying for the offered values (value proposition), while the beneficiaries are not directly paying for the NBS values. Accordingly, the bottom part differentiates between two main possibilities of generating money for NBS maintenance and evolution as well as paying back investment costs of the NBS: revenue streams and financing. The revenue streams ally with customers as main target group, while financing is linked to beneficiaries. The money customers are paying for the received values is summarized under revenue streams, while financing is required when the NBS is offering values for beneficiaries without getting paid for it directly by them. Financing is mainly realised by public funding measure following the principle of public money for public goods.

Figure 7: Stepwise path through proGIreg's NBS Business Model Canvas. The numbers in this figure depict the recommended order on how to go one-by-one through the 14 building blocks. The following guiding questions per building block follow the same order. (own elaboration)

The central left side keeps the structure of the traditional BMC detailing the infrastructure side of the business model. The key resources, activities, and partners are listed in the three building blocks, while the bottom left part focuses on costs (cost structure) and ways to reduce costs (cost reduction). The latter can be realized by reduced investment costs, e.g. by material re-use or valorisation, lower maintenance costs of the NBS (compared to other uses), use of volunteers, self-sustaining system (e.g. permaculture orchards, flower meadows instead of intensively mowed lawns) or other cost reduction measures. The top segment of proGIreg's BMC highlights the main positive (right) and possibly also negative (left) social and environmental impacts. This integration of the business model's societal

effects into Business Model Canvas templates originates from the Sustainable BMC proposed by Gerlach (2015) (see above).

5.4. Interviews following a catalogue of guiding questions

Key contact persons of the NBS implementations in the four Front Runner Cities Dortmund, Turin, Zagreb, and Ningbo were interviewed to fill proGIreg's NBS Business Model Canvas (see above). In total, 23 NBS were analysed using the template. The analysed NBS are ten in Turin, six in Zagreb, five in Dortmund, and two in Ningbo (see Table 1). While the interviews took place on-site in Dortmund and Zagreb, the data collection in Turin and Ningbo was realised by personal online interviews. The interviewers are familiar with the local conditions in Turin due to earlier visits, e.g. Turin's international replication workshop. In Ningbo, the NBS implementations are only known by photos. The interviews took place in winter period 2022/2023 (October 2022 – March 2023).

Table 1: Business model interviews per NBS and Front Runner City.

NBS	Dortmund	Turin	Zagreb	Ningbo
NBS 1: Leisure use and energy production	●			
NBS 2: New regenerated soil		●		
NBS 3: Community-based urban farms and gardens	●	●●	●●	●
NBS 4: Aquaponics	●	●	●	
NBS 5: Capillary GI on walls and roofs		●●	●	
NBS 6: Access to post-industrial sites and renatured river corridors	●	●	●	
NBS 7: Protocols and procedures for environmental compensation		●	●	●
NBS 8: Pollinator biodiversity	●	●		

In order to allow comprehensibility and comparability, guided interviews were carried out to fill the NBS Business Model Canvas for each NBS interviewed. The guiding questions are briefly introduced here per building block. Since the stage of NBS development differed significantly from already running until planning phase at the time of the interviews, the guiding questions asked for details on today's situation, but also predictions for the future.

- **Value Proposition**
    - Which values do you create and offer? Products and goods? Services? Any other quantitative and/or qualitative values? Any tangible and/or intangible values?
    - Which problems are you solving for the customers and/or beneficiaries?

- Which needs are you fulfilling for the customers and/or beneficiaries? How do you contribute to customers' and/or beneficiaries' satisfaction?

- **Governance**
  - How is the ownership (land, NBS…)?
  - How are you structured organisationally? How are you organised internally? How is the organisational hierarchy?
  - How is your decision-making conducted? What about transparency, consultations, profit sharing, and non-financial criteria?
- **Customers**
  - Do you have customers paying for the created and offered value?
  - What type of customers do you address? Individual people, groups, companies, other entities? What are the socio-demographics and socio-economics of the people? (Age, education, purchasing power…)
  - Which market segment are you looking for? Mass market, niche market…?
- **Beneficiaries**
  - Who are the beneficiaries of your NBS values?
  - What type of beneficiaries do you address? Individual people, groups, companies, other entities? What are the socio-demographics and socio-economics of the people? (Age, education, purchasing power…)
  - Which beneficiaries are most important for your NBS?
- **Customer relationships and channels**
  - How are your relationships with your customers and/or beneficiaries? (Personal, automated, self-service, community-based/co-creation…)
  - How do you reach your customers and/or beneficiaries? Through which channels? (www, social media, face-to-face, newspaper…)
  - If applicable, channels for communication, distribution, sales, and after sales
- **Revenue Streams** (direct link to customers)
  - How do you earn money?
    - One-time payments and/or recurring revenues?
    - Sales, usage fees, membership fees, subscription fees, licenses, renting, leasing, …

- For which values and from which customers do you receive revenues?
- How much is your financial revenue? Which revenues are most relevant?

- **Financing**
  - Do you receive any financing or financial support for your NBS and its offered values? (Public money, subsidies, grants, public-private partnership models, donations/sponsorships, EU or other funding measures (incl. proGIreg), tax incentives…)

- **Key Resources**
  - Which key resources are required to make your NBS work? (Physical resources, financial resources, intellectual resources, human resources)

- **Key Activities**
  - Which key activities do you carry out to make your NBS work? (Including co-creation, co-implementation, production activities, marketing/sales activities, service provision activities, dissemination and networking, R&D…)

- **Key Partners**
  - Do you need partners to offer your NBS to your target group(s)?
  - Who are your key partners?
    - Value chain partners, buyer-supplier relationship (materials, product components, infrastructure…)
    - Partners for knowledge, skills (experts)
    - Inter- and transdisciplinary partners
    - Advisory/Consultancy partners
  - For which purpose are they for? (Acquisition of specific resources or activities required to offer the NBS, optimisation, economies of scale, risk reduction)

- **Cost Structure**
  - What are your main cost items?
  - Do you have fixed (salaries, rent, investment costs…) and/or variable costs (energy costs, fuel, seasonal worker…)?
  - How are the cost positioned time-wise? Prior implementation (co-design phase), implementation phase incl. physical construction (if applicable), and/or post implementation (maintenance, operation, evolution phase)

- **Cost Reduction**

    - Are you able to reduce costs with the implemented NBS (compared to earlier/others use types)?
    - If applicable, how do you reduce costs?
        - Resources: low tech solutions, volunteers…
        - Activities: self-sustaining principles, lower maintenance costs, e.g. via permaculture principles, less mowing of public green areas, etc.
        - Partners and other ways to reduce costs

- **Positive impact for society and environment**
    - What are the (possible) societal and environmental positive impacts of your NBS?
    - How can the positive impact be sustained or maximised?
- **Negative impact for society and environment**
    - What are the (possible) societal and environmental negative impacts of your NBS?
    - How can the negative impact be minimised?

5.5. Analysis approach

The data and information received during the interviews build the basis to fill proGIreg's NBS Business Model Canvas (see Figure 6) for each NBS interviewed (see Table 1). For allowing a tailored access to the NBS business models, different analysis approaches are offered. This allows different stakeholders with varying objectives, backgrounds, and motivations to select NBS business models of their interest.

Four main approaches are briefly introduced here and used then for the online presentation of the Business Model Catalogue (see next sub-chapter) as well as in this report's results and discussion chapter. The four approaches to structure and classify the NBS business models towards a Business Model Catalogue are:

1) Pestoff triangle between state, market and community,
2) degree of profit orientation,
3) target groups: customers and beneficiaries,
4) financial benefits: revenue streams vs. cost reduction.

The different analysis approaches use specific building blocks for positioning the 23 interviewed NBS interventions. These approaches allow to detect certain patterns and

cluster-like NBS groups with similar results for the criteria analysed. The analysis on main target groups focuses on the two building blocks customers and beneficiaries positioned to the very right side of the canvas. The degree of profit orientation and the aspect on financial benefits focus on revenue streams and cost reduction measures.

The Pestoff triangle positions the NBS implementations between state, market, and community (see Figure 8). To do so, the building block governance plays a pivotal role (Pestoff, 1998; Pestoff, 2008; Defourny and Nyssens, 2012; Pestoff, 2014).

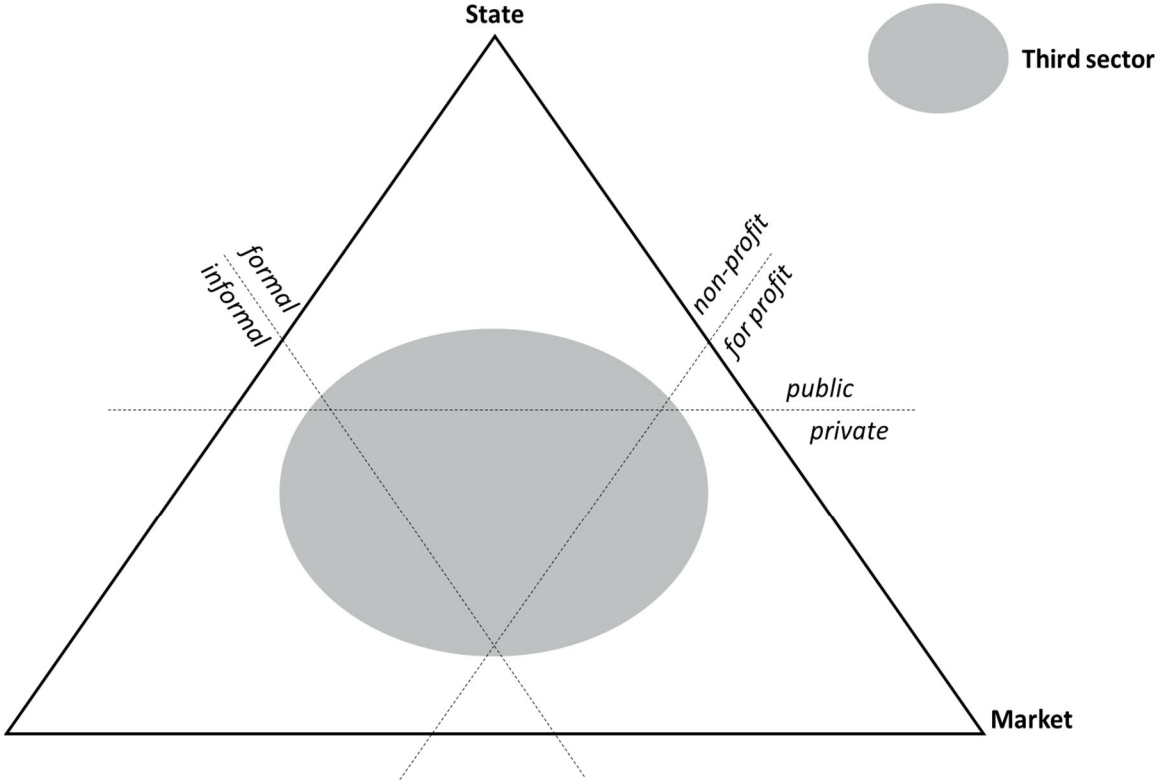

Figure 8: Pestoff triangle (Pestoff, 1998 & 2008)

The Pestoff triangle positioned the third sector into a triangle between the corners state, market, and community. Associations, social enterprises and public-private-partnership models are typical for the third sector bubble positioned centrally in the triangle. This triangle is also referred to as the welfare triangle (Pestoff, 2014). Many NBS activities in proGIreg and beyond bring together different stakeholders, go beyond profit maximisation and pure capitalistic thinking, formalise community activities, and create hybrid organizational structures. Thus, the Pestoff triangle is considered a suitable and beneficial analytical tool for the interviewed NBS under the proGIreg umbrella.

5.6. Online presentation of the Business Model Catalogue

The research results on the business model task of WP5 have been compiled into an interactive Business Model Catalogue (iBMCat). The iBMCat is based on a document format called TiddlyWiki. The document format is interactive, yet self-contained in one single file, which can be displayed and used on all major web browsers and major operating systems without installing anything. The document can be loaded from a website, but it can also be used in an offline fashion from a local file system.

The format allows for browsing, searching and printing the content in many different ways. A couple of entry points are prepared that help to navigate and explore the Business Model Catalogue in a tailored and user specific manner. The interface consists of tagged flash cards, that are easy to consume and filter, catering to the information requirements of the users. This link allows access to the iBMCat:

https://fh-swf.sciebo.de/s/XAhpEa0u7Ud4XQb.

Please note that the iBMCat does not work from within the online storage system sciebo. Please download the file (top right corner) and open in your favourite web browser. Some insights are presented in Annex 1.

Navigation

The main navigation of the Business Model Catalogue resides in the right-hand side column. We prepared entry points leading to the content from different starting points. If you are interested in how we generated and compiled the research data, start with the links collected under the keyword Methodology. The Front Runner Cities are listed below that. Selecting one of these allows you to find the use cases that have been implemented in the specific city. Below that, the different Nature Based Solutions that were implemented in different partner cities of our project are located. The last section of the navigation provides direct entry points to the general types of business models that were identified in the analysis. A final section lists other European funded projects with similar topics that might be of interest.

Search

TiddlyWiki offers a powerful full text search function. The search entry field is located near the top of the navigation column on the right. Search results are displayed in a dynamic search result list. Pressing Ctrl+Shift+F will focus the search box. After the search results open, the up and down arrow keys can be used to navigate through the results, the enter key can be used to select the search result that should be opened.

Tags

Tags are the 'yellow pills' that are displayed below the title of every flash card headline. Clicking on tags displays a list of other cards that share the same tag. The tag system of TiddlyWiki is a little bit different than other tag systems. Essentially, it is a way of relating one card to other cards. The tags are powerful short cuts for navigating between cards of similar content. A tag “Methodology” will offer a direct path to other cards that describe the methodology of this research. It is highly recommended to explore the contents of the iBMCat by using the tag system.

Printing cards

It is easily possible to compile sub collections of the content into a printed document or into a pdf. After closing all unwanted cards, those that shall be displayed in the collection are opened. Pressing the key for printing in the browser opens the built in print dialogue. The operating system will offer saving the 'print' as a pdf file. The generated file will only contain cards that are currently opened. This allows to generate customized reports from the iBMCat document suiting the interests of the users.

Create your own

It is possible to create and use new flash cards, called tiddlers in the TiddlyWiki terminology, by clicking the plus icon on the top right hand side of the main page of the iBMCat. The user has to be aware that saving new content requires a little bit of setup. This is due to safety mechanism used in web browsers. Therefore, TiddlyWiki needs a helper when wanting to change the wiki file. Instructions for different can be found in the Getting Started section of the TiddlyWiki homepage.

6. Results and Discussion

The results and discussion section shows the main analysis outputs. The individual NBS implementations are positioned with their underlying business models into the four earlier introduced analysis approaches; (1) Pestoff triangle between state, market and community, (2) degree of profit orientation, (3) target groups: customers and beneficiaries, and (4) financial benefits. Additionally, selected NBS are presented with proGIreg’s NBS Business Model Canvas for detailed insights.

6.1. NBS between state, market, and community

The Pestoff triangle (Pestoff, 1998 & 2008) builds the core classification grid for the Business Model Catalogue. Firstly, it allows to position NBS business models based on their organisational governance between state, market, and community. Additionally, the triangle approach differentiates between formal vs. informal, non-profit vs. profit, and public vs. private activities (see Figure 8).

The four Pestoff triangles per Front Runner City are summarized in Figure 9 to present the organisational location of NBS between state, market, and community. Besides the individual small triangles, all NBS implementations are presented in Figure 10).

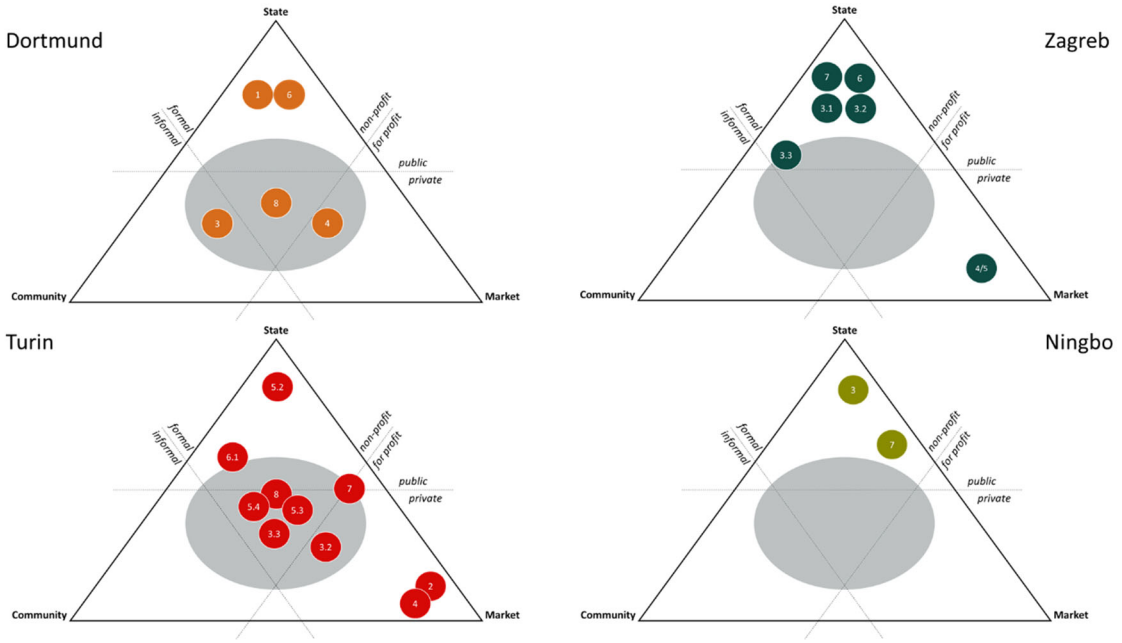

Figure 9: Position of Front Runner Cities' NBS implementations within the Pestoff triangle. Dortmund top left, Turin bottom left, Zagreb top right, and Ningbo bottom right.

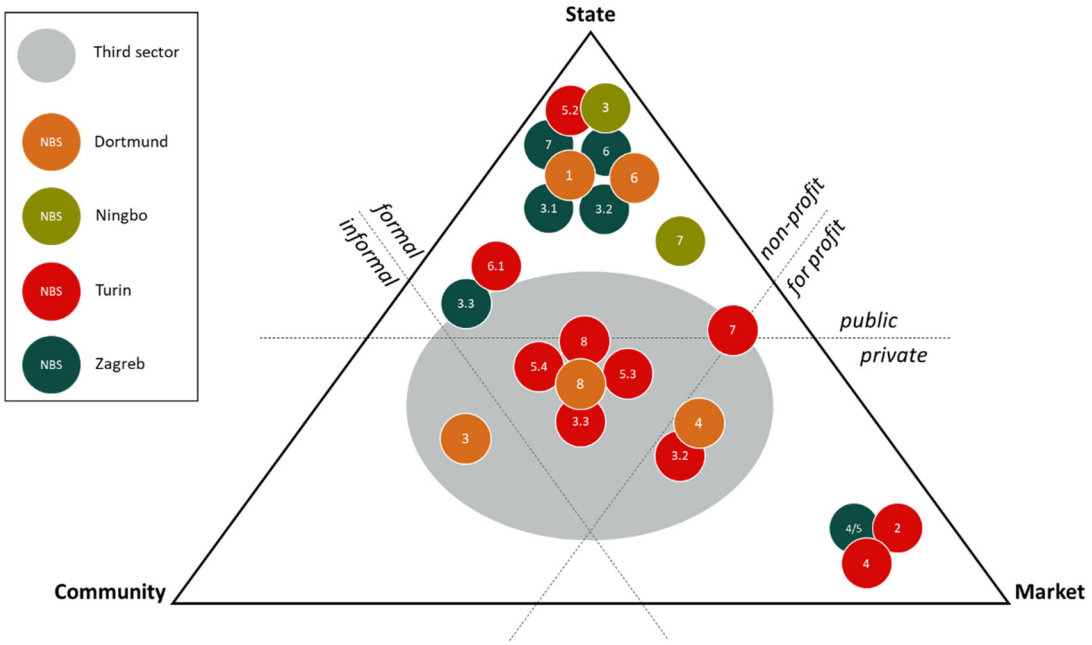

Figure 10: NBS implementations in the Pestoff triangle nutshell

Most NBS are positioned within the public and/or third sector domains (see Figure 9 and Figure 10). The greyish coloured area within the formal and non-profit field towards the state is dominating. However, some NBS are also positioned in the market corner for profit or at least on the edge between for profit and non-profit including public-private-partnership constellations. The following paragraphs are briefly introducing the NBS implementations and their position in the Pestoff triangle before detailing individual business models.

Dortmund Living Lab

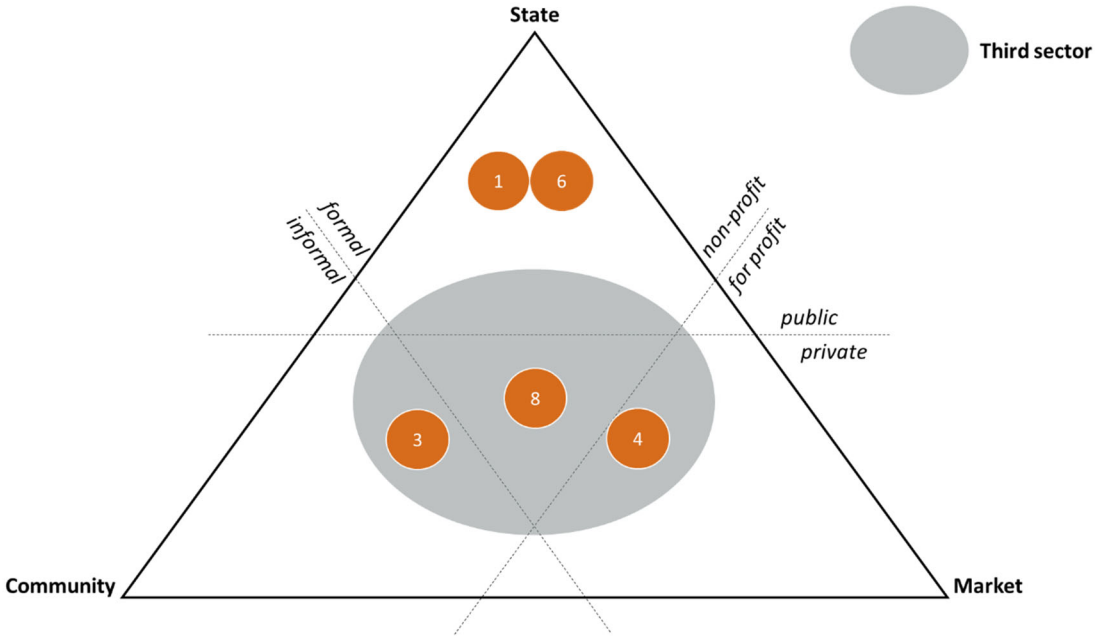

Figure 11: Position of Dortmund's NBS implementations within the Pestoff triangle.

Two NBS for public provision are co-designed and implemented; however managed internally by the City without external commitments (NBS 1 and 6) (see Figure 11). The remaining three NBS in Dortmund are positioned in the third sector circle. NBS 3 is a community-led food production (permaculture orchard); church, civil society, and an NGO are collaborating. For the successful implementation of NBS 8 (pollinator biodiversity) a new citizen association was founded.

Contrarily, Dortmund's NBS 4 (Aquaponics) is positioned towards for profit at the right side of the third sector circle. A local NGO is working together with a public university to increase the Technology Readiness Level of Aquaponics on post-industrial sites and for establishing viable business models based on a rental concept added with sales and side activities leading into a diversified approach.

Turin Living Lab

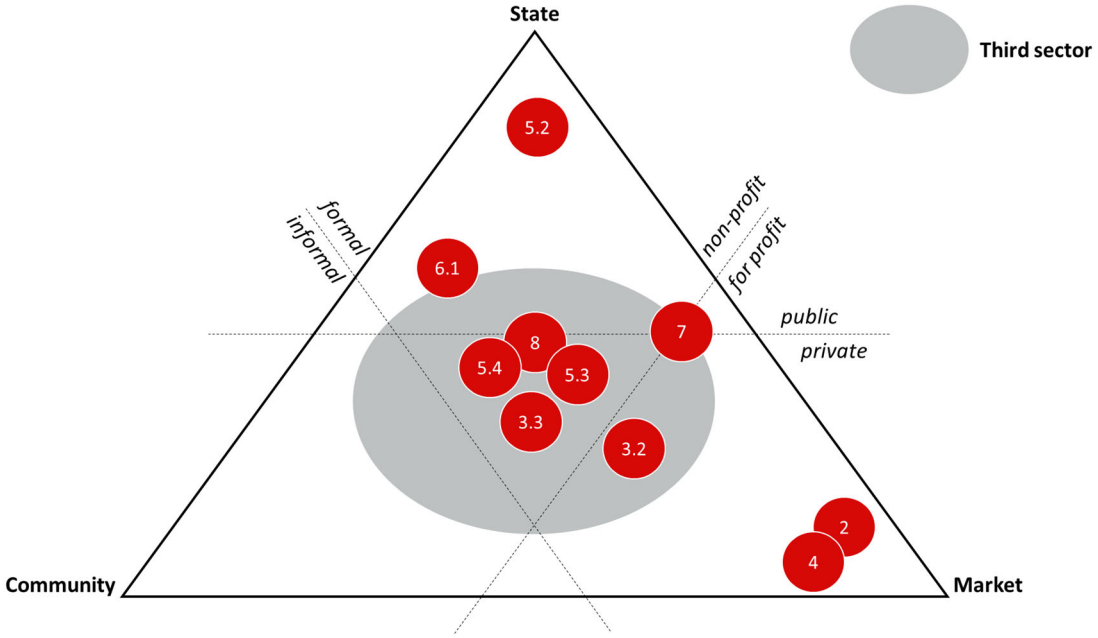

Figure 12: Position of Turin's NBS implementations within the Pestoff triangle.

Most NBS are located below the public-private divide being private-driven (see Figure 12). Two NBS have an explicit market and business focus seeking profit. These are the new soil NBS (NBS 2) carried out by a private business and the Aquaponics NBS (NBS 4) run by another private company. Additionally, two other NBS on the for-profit vs. non-profit threshold: the urban farm Orti Generali (NBS 3.2) and a public-private sponsorship (donation model) of NBS 7. Orti Generali is a diversified social enterprise running a kiosk, a rent-a-garden concept, courses, and education services creating significant income streams.

Besides the donation model, three NBS focus primarily on public provision activities; the indoor green wall in a school (NBS 5.2), a cooperation of the City of Turin with the third sector to develop and implement an ecosystem path connecting the Living Lab with residential areas (NBS 6.1), and butterfly gardens managed by an association together with the City and the University of Turin (NBS 8).

Several of Turin's NBS belong to the third sector. In addition to the already named NBS 3.2, 6.1, 7, and 8, these are community-led pollinator-friendly garden boxes run by a third sector team (NBS 3.3), outdoor green wall realised by a social cooperative in cooperation with the city (NBS 5.3), green roof to provide ecosystem services (NBS 5.4).

Zagreb Living Lab

All NBS belong to the public area except for the mini urban farm of NBS 4/5 (see Figure 13). The company behind the mini urban farm, which is merging Aquaponics with green walls and roofs, aims to sell produce, but also systems. The remaining five NBS are either managed by or at least led by the City of Zagreb together with other public entities or an NGO (NBS 3.3).

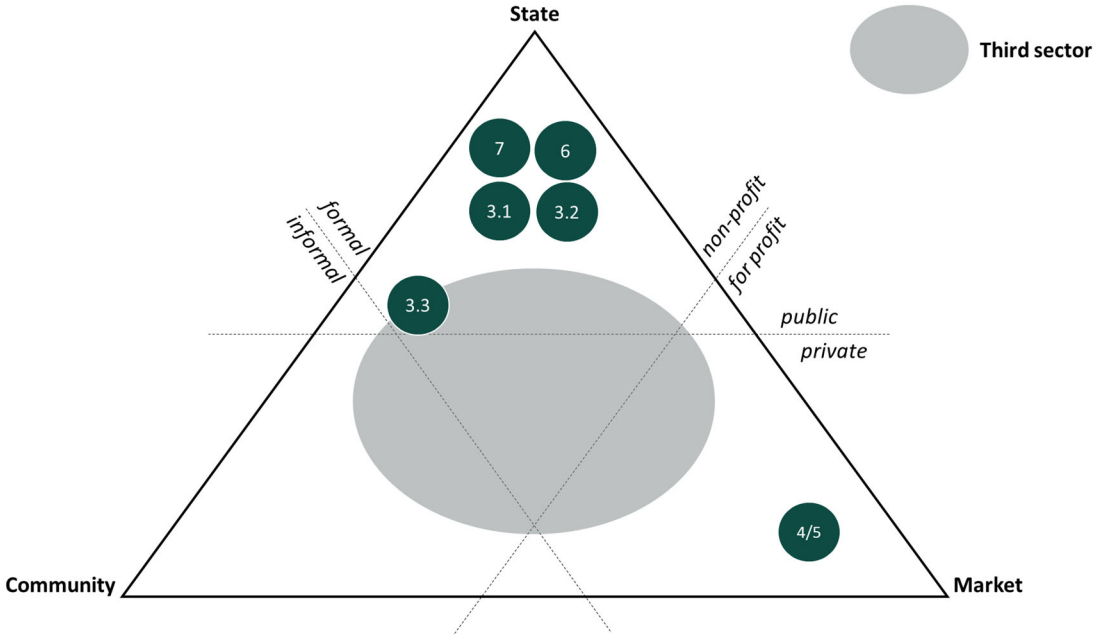

Figure 13: Position of Zagreb's NBS implementations within the Pestoff triangle.

Ningbo Living Lab

The two NBS are both belonging to the public sector (see Figure 14). Both are not aiming for income, but provide public goods instead. For NBS 7, a light public-private-partnership model (cooperation) is implemented in form of a signed management contract.

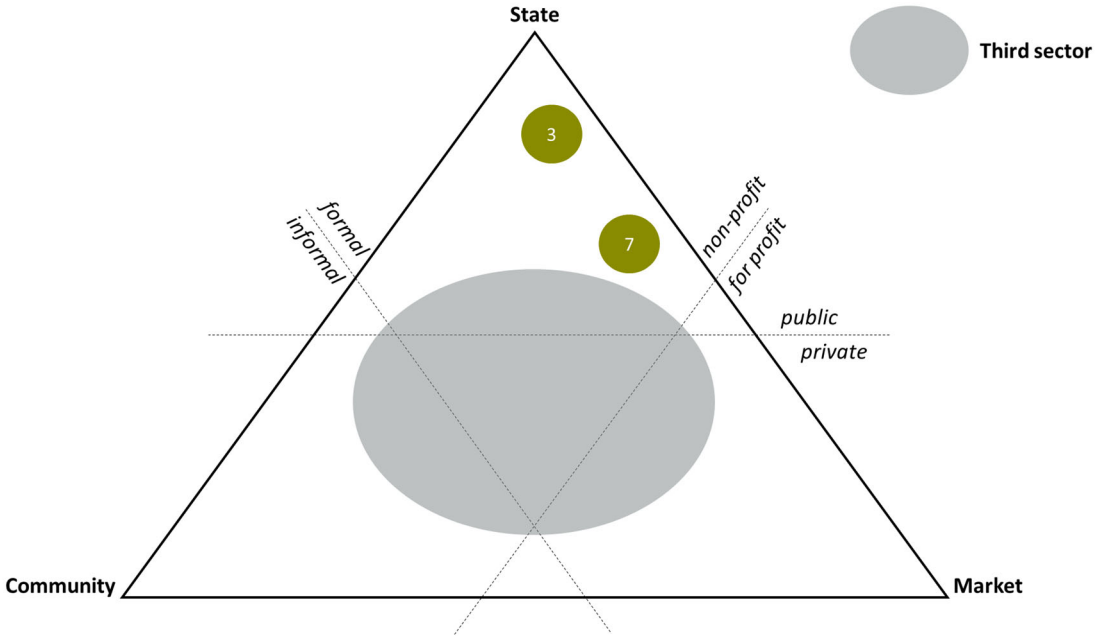

Figure 14: Position of Ningbo's NBS implementations within the Pestoff triangle.

Business model clusters

By using the Pestoff triangle it is possible to cluster types of business models. The main types are public provision, sales, and diversified business models, which can be further detailed including public-private partnership or sponsorship/donation models bridging public and private as well as diversified approaches relying on services or rental concepts (see Figure 15).

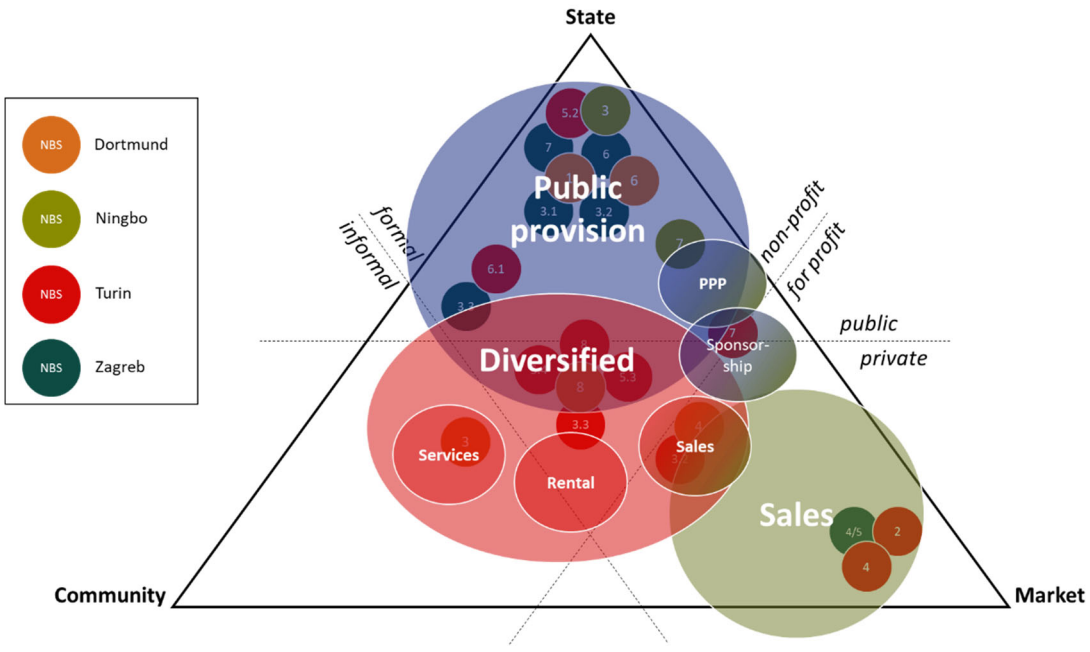

Figure 15: NBS business models

Public provision

The public provision is – together with the third sector initiatives – most important (see Figure 15 and Figure 16 bottom) among the proGIreg NBS implementations.

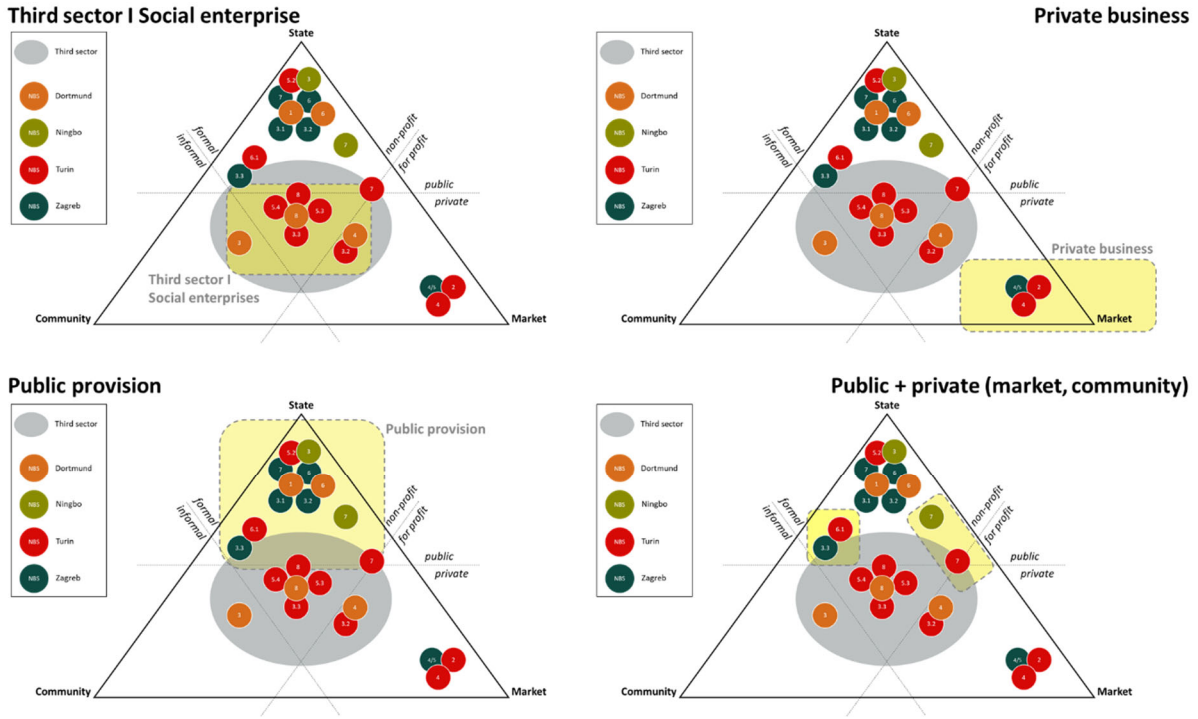

Figure 16: NBS business models: third sector and social enterprises (top left), private businesses (top right), public provision (bottom left), and public institutions together with community or private businesses (bottom right).

All FRC implemented public provision NBS: five from Zagreb, three from Turin, and two in Dortmund and Ningbo respectively. When further detailed, public provision NBS reveal some differences between them. While some are city-internal with varying degrees of co-design, others are led by the FRC in collaboration with partners from the public, third or private sector.

City-internal public provision

Examples of city-internal public provision NBS are the sport exercise park in Dortmund's Gustav-Heinemann-Park (NBS 1, see Figure 17), Ningbo's urban lake planting (NBS 3, see Figure 18) as well as the modernization of an existing urban garden (NBS 3.2, see Figure 19) and urban planning guidelines (NBS 7, see Figure 20) in Zagreb. Since solely the cities are named under the business model's building block governance, they can be seen as common top down approaches. However, with varying degrees of co-design and community participation. This block is centrally positioned below the value proposition, which differs according to the NBS implemented.

The sport exercise park in Dortmund within the wider Gustav-Heinemann-Park aims to serve as a magnet and anchor point for local people of all ages (see Figure 17). The green area with high quality of stay promotes physical activities, exercises, and leisure time outdoors near residential areas, schools, kindergarten, and further infrastructures. While the implementation is originating from proGIreg financing, continuous maintenance after the project's lifetime is assured by the municipality's green space department. Rooted in the co-design results and political approval, a sport devices specialist was responsible for construction. Wood chips and other minor modifications contribute to a lively and attractive park for multiple uses and functions in the heart of the LL.

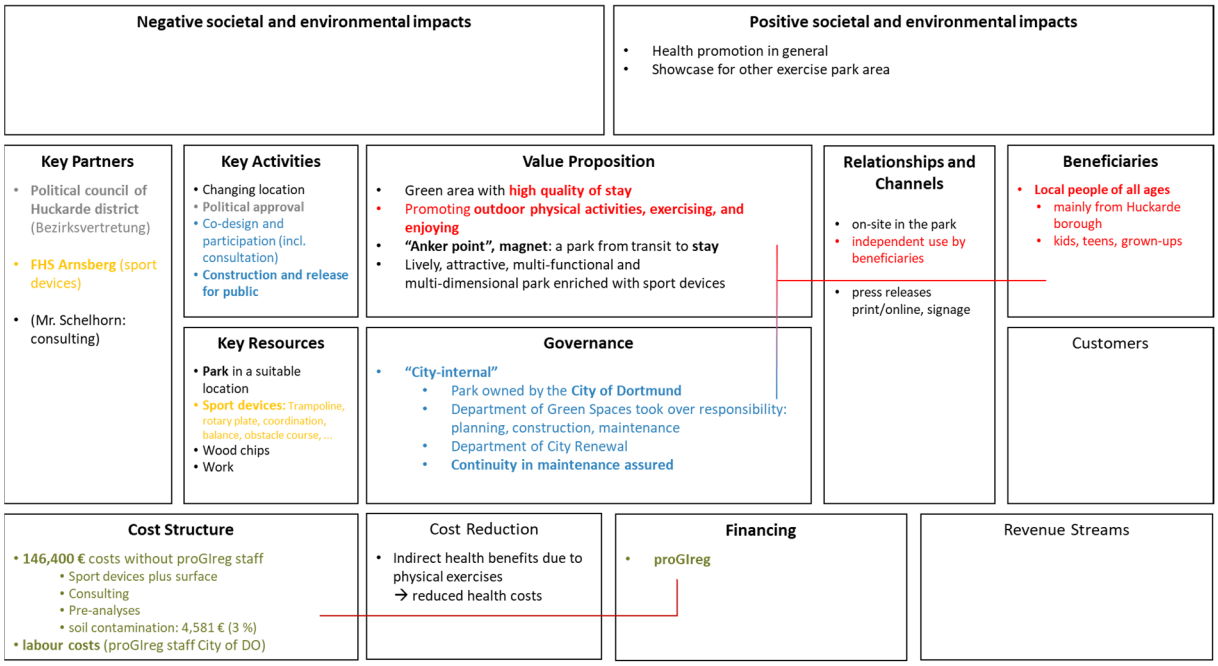

Figure 17: NBS 1 Dortmund: Sport exercise park Business Model Canvas

Ningbo's planting along the shoreline of the urban Moon Lake intends to improve the water quality (see Figure 18). The water purifying and environmental upgrade of the lake targets local residents for recreation and tourism purposes around the lake. Beyond the local context, the Moon Lake NBS implementation serves as a showcase for other waterbodies in Ningbo and other Chinese cities. The planting is financially covered by state financing in form of inter-governmental cooperation. However, further positive local economic effects are anticipated in form of increased expenses in businesses around the lake (cafés, small shops …). Increasing rents might develop in the neighbourhood of the Moon Lake. The costs for the five km shoreline planting covered by state money are first the investment costs of around 400,000€ and second the running costs of calculated five to ten per cent of the investment costs per year. The planting was carried out by to local companies; supported by the University of Ningbo in the planning and monitoring mainly.

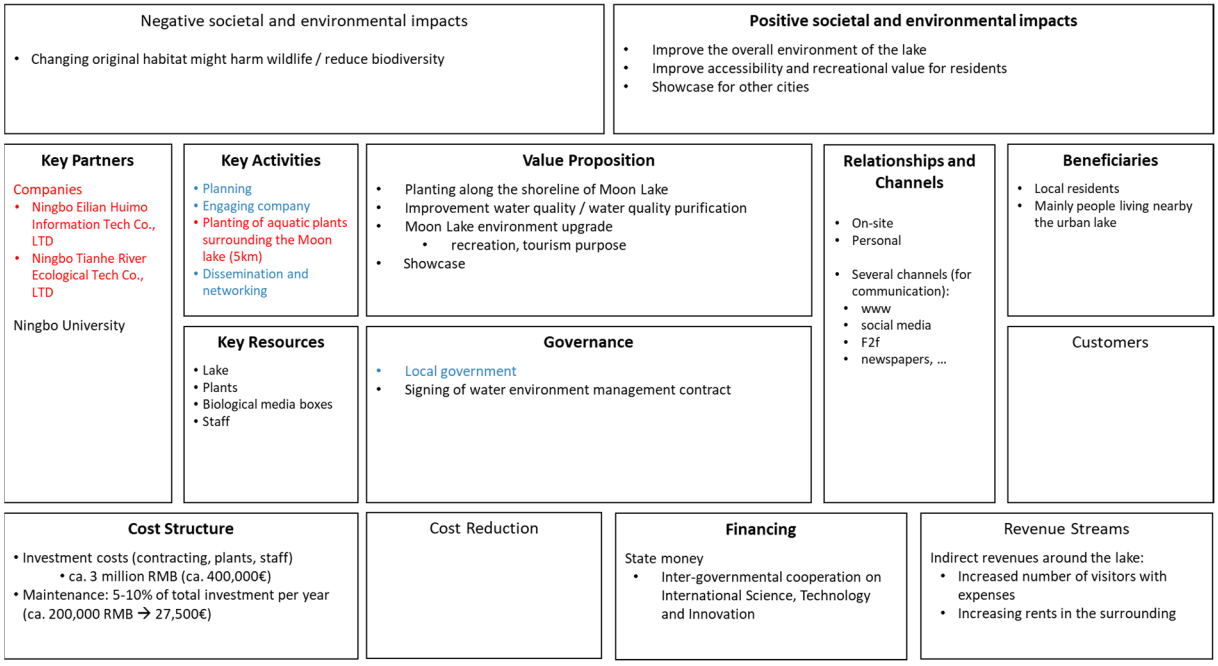

Figure 18: NBS 3 Ningbo: Urban lake planting

The modernisation of an existing urban garden in Zagreb's suburb of Sesvete is realised with proGIreg funds (see Figure 19). These funds allow better access to water along with a water quality upgrade for the gardeners. Overall, the City of Zagreb runs 14 urban gardens in the city: one in the Sesvete LL. The gardens benefit the local population. Following certain selection criteria, local residents receive two-year contracts for garden plots of 50m² for free. The gardens are on city-owned land, allowing food self-supply, saving significant food purchase costs. Thus, selection criteria include income; low income groups are prioritised. The gardens are maintained by the City holding Zrinjevac, while the water purification system financed by proGIreg is implemented by an external company. All gardens have waiting lists, demonstrating high interest and demand in urban and community gardening. Some plots are rented by local community groups and NGOs. Besides the food self-supply, the gardens also serve as a meeting place for the local community. The water upgrade allows to maintain the interest in the garden and contribute to the overall attractiveness of the post-industrial Sesvete LL. It is one puzzle piece of several NBS implementations in close vicinity to each other.

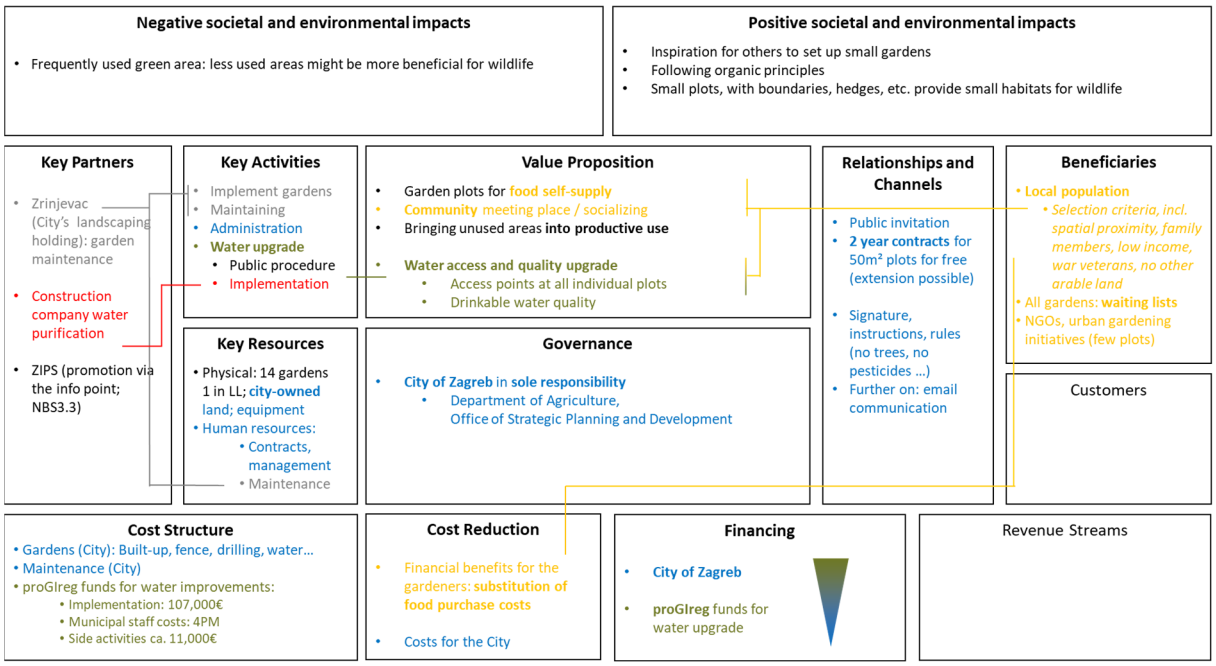

Figure 19: NBS 3.2 Zagreb: Modernization of urban garden Business Model Canvas

Another type of NBS carried out internally by the City of Zagreb is the development of guidelines for application in Zagreb's municipal urban planning (NBS 7, see Figure 20). This NBS goes beyond physical implementation, but promotes a strategic paradigm shift towards a regulatory framework for urban planning. This shift fosters the transition from grey to green and from internal governance to co-design and participatory processes together with local stakeholders. Within the municipality, this calls for overcoming silo thinking. The beneficiaries are threefold: local government and politicians within the City of Zagreb, but also governments beyond Zagreb when the guidelines developed for Zagreb will be replicated in other cities and regions. Additionally, it fosters citizen empowerment in co-designed planning processes leading towards a greener and more inclusive city. Initially, the guidelines are not aiming to create direct financial revenues, but might turn out to be a saleable service in the future. The City of Zagreb receives consultancy from two Faculties of the University of Zagreb and the so-called "Renewal Program Team" consisting of City and University staff. A key resource required to be successful in the guidelines' implementation is a mindset change in planning. This is especially true for the citizen involvement, but also valuing green over grey.

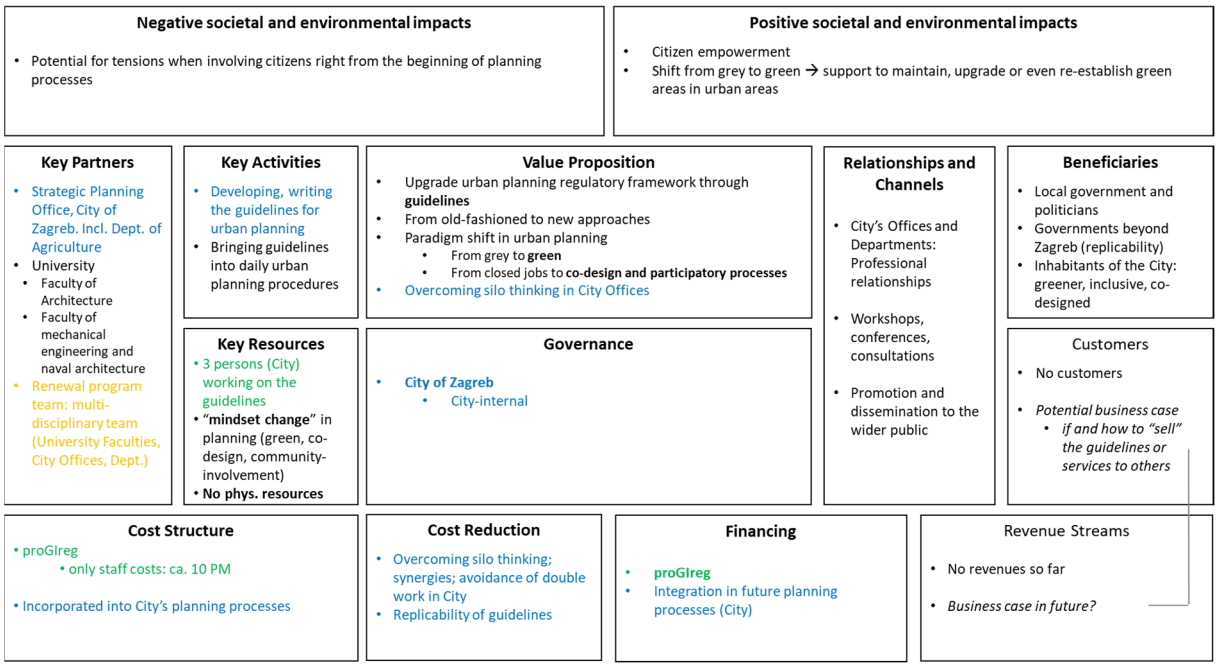

Figure 20: NBS 7 Zagreb: Urban planning guidelines Business Model Canvas

City-led public provision

A set of NBS implementations is led by cities in cooperation with other public or private partners. Two examples of public cooperation are a place-based learning indoor green wall in a Turin school (NBS 5.2) and the newly established inclusive therapeutic garden in Zagreb (NBS 3.1) (see Figure 21 and Figure 22Figure 22). Since in each NBS three public entities collaborate, it can be labelled "public³ NBS".

In Turin, the City of Turin works together with the school and the Politecnico di Torino. The academic partner led the co-design and co-creation for place-based learning (green lab) as well as research on the abatement of indoor contamination by green wall solutions. Furthermore, it aims to be replicable, which leads to a wide range of beneficiaries (school pupils, families, teachers, school administration, scientists, other schools and public institutions). The City of Turin ensure longer-term maintenance to pay for a professional gardener also after proGIreg. Since the green wall is located under a roof window, no additional artificial lighting is required. That way they save running costs.

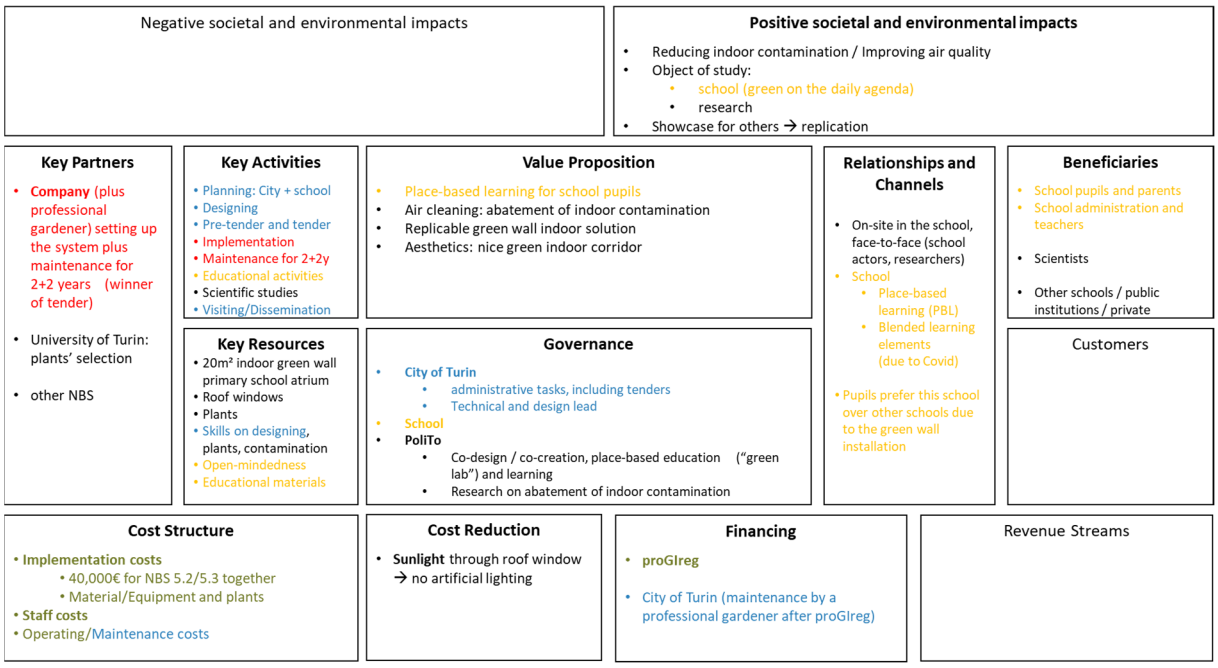

Figure 21: NBS 5.2 in Turin: Indoor green wall solution in a school

The second "public³ NBS" is the therapeutic garden in Sesvete, Zagreb (NBS 3.1) (see Figure 22). Led by the City of Zagreb in cooperation with public day-care centres and the City's landscape holding, inclusive therapy is offered in the garden for children and grown-ups with and without physical and/or mental disabilities. The day-care centres take care of the inclusive therapy measures as well as dissemination activities, mainly via social media. The City of Zagreb carried out the co-design phase, released a tender for the design, and commissioned the construction to the City landscape holding Zrinjevac. The proGIreg funding was supplemented by additional funding by the City of Zagreb. The therapeutic garden serves as a good practice showcase encouraging replication for valuable therapy and inclusion offers in gardens.

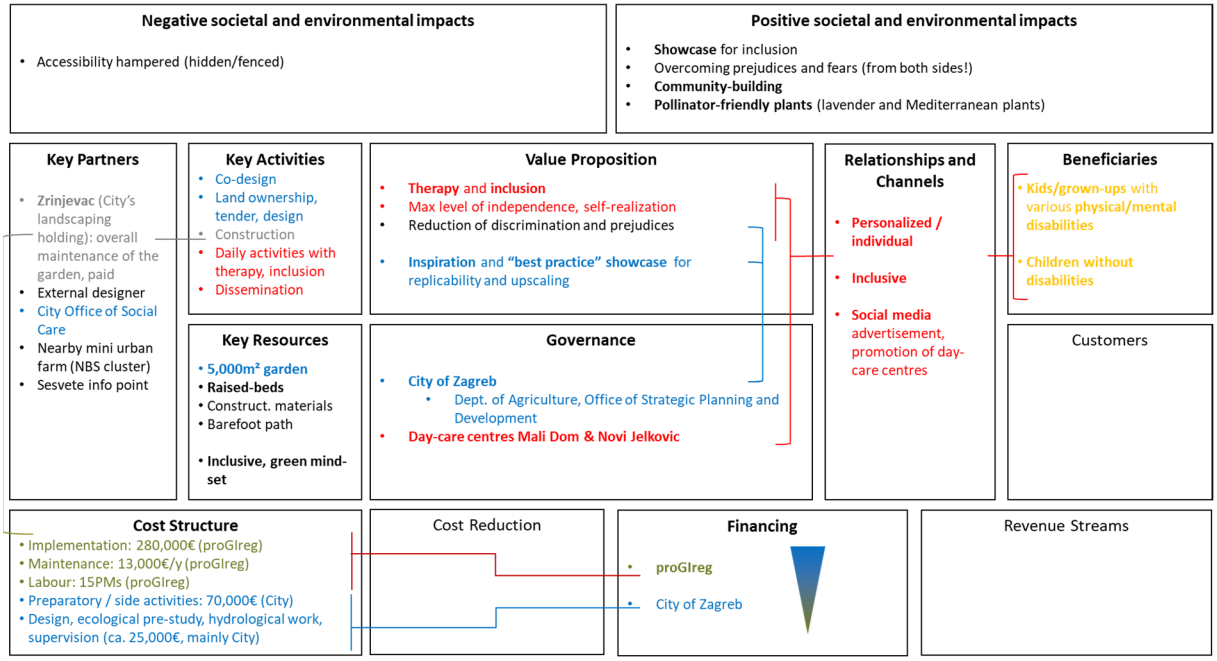

Figure 22: NBS 3.1 in Zagreb: Therapeutic garden in Sesvete, Zagreb

Strategic tools to improve public green areas build the core value of NBS 7 in Turin (see Figure 23). Besides the theoretical framework, this NBS relies on a donation/sponsorship model for practical implementations. Private companies build the main group of donators, but also individuals and small communities contribute small financial shares to the model allowing to, for instance, plant trees in an urban environment. This NBS calls for a paradigm shift by bringing in private actors for social responsibility actions. The recognition of public green areas as "urban commons" builds the basis for strategic tools. The theoretical framework supports urban planners and cities' planning departments to improve public green areas. However, also the wider community benefits from the upgrade of public green areas by means of the donation/sponsorship model. To ensure the improvement of public green areas, a software was bought with proGIreg money for allowing high-quality mapping and spatial analyses and monitoring of green areas. This includes already existing green areas, but also grey areas with potential for greening; both on the ground and on also roof constructions as possible sites for greening activities.

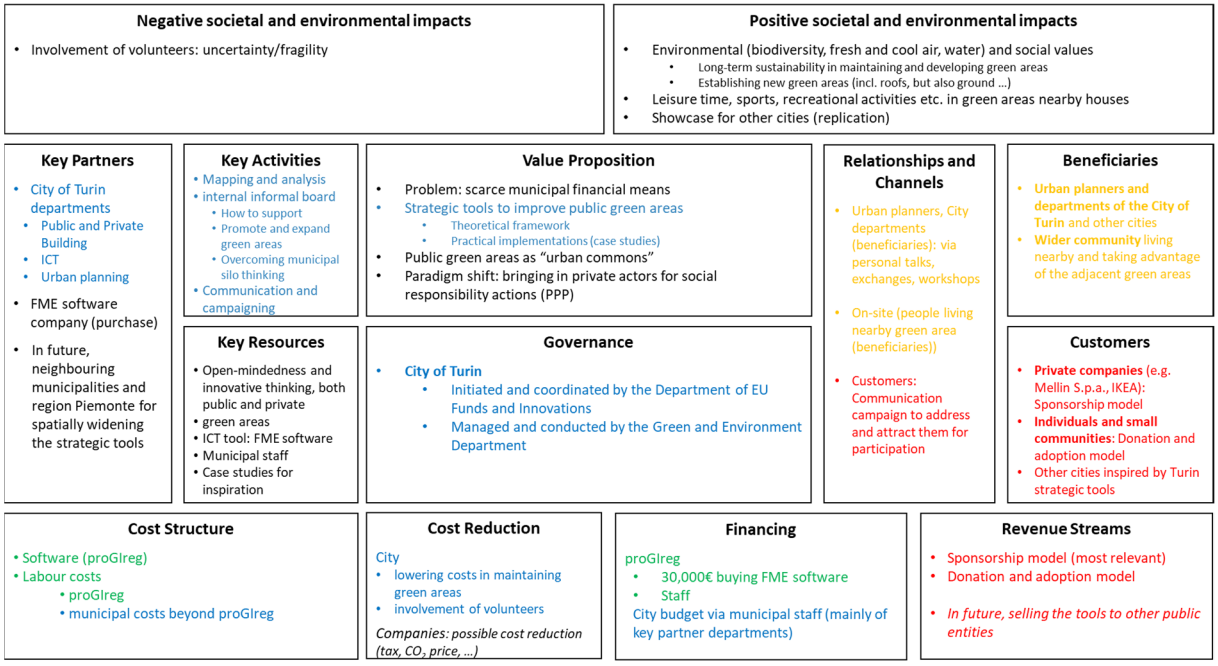

Figure 23: NBS 7 in Turin: Sponsorship model in a public-private cooperation

Some NBS implementations within the proGIreg project are realised by cities with the third sector (associations, NGOs) and active communities; namely the ecosystem path in Turin (NBS 6.1) and the community meeting place "info point" in Sesvete, Zagreb (NBS 3.3) (see Figure 24Figure 24 and Figure 25). Key for the Turin "ecosystem path" is the cooperation of the City of Turin with the charity association Fondazione Mirafiori and the University of Turin. The wider population living nearby are directly benefiting from the 800m path, aiming to serve both people and nature. Connectivity, quality of stay, but also pollinator-friendly islands and step stones are building elements of the ecosystem path resulting in an open, welcoming environment for people and wildlife, especially pollinators. The NBS is led by the City of Turin including designing by a municipal landscape architect and the tender announcement for physical implementation of the path. Fondazione Mirafiori ensured continuous citizen involvement; also by bringing in further associations. The ecosystem path is designed and implemented with a dedicated focus on landscape designing aspects, especially hexagon shaping. Additionally, a modular implementation is assured to allow replicability in Turin and beyond in other cities and regions.

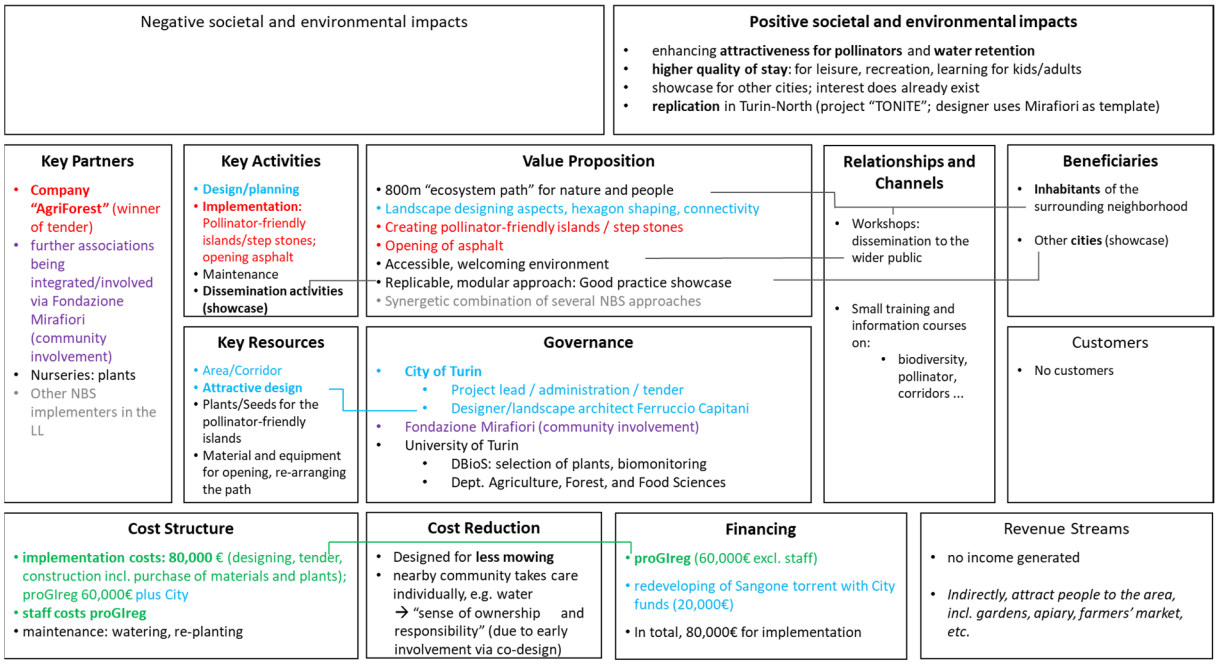

Figure 24: NBS 6.1 in Turin: Ecosystem path in Mirafiori Sud

The City of Zagreb developed a meeting place – the so-called info point (NBS 3.3) – together with the NGO ZIPS (see Figure 25). It acts as a hub for the other NBS implementations and their communication and dissemination activities and supports community-building for citizens of Sesvete. Individuals, but also clubs, i.e. chess club or a mountaineer group, take advantage of the newly created community space for meetings and events. While the overall building reconstruction is covered by City of Zagreb funds, interior of the info point and staff costs by proGIreg funding (ZIPS, City of Zagreb).

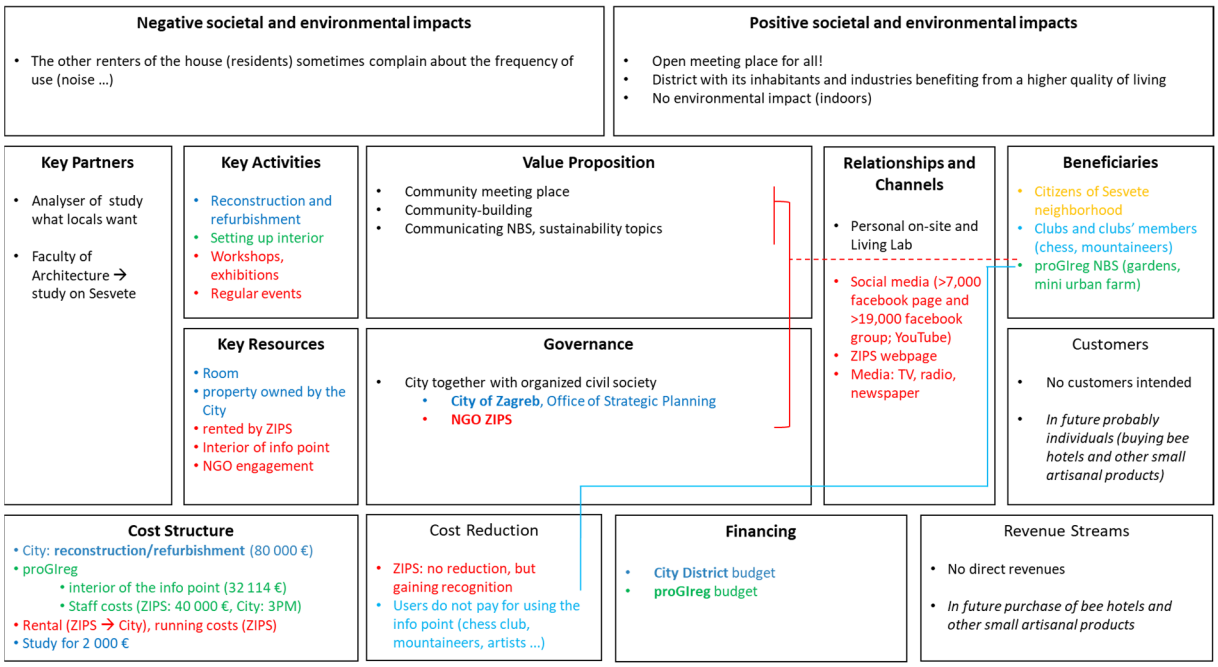

Figure 25: NBS 3.3 in Zagreb: Meeting in Sesvete – the info point

The remaining public provision NBS are presented in the following figures, but without being discussed any further. These NBS are the path at Deusenberg landfill site (NBS 6) in Dortmund (see Figure 26), the management contract (NBS 7) in Ningbo (see Figure 27), and the cycling path in Sesvete (NBS 6) in Zagreb (see Figure 28).

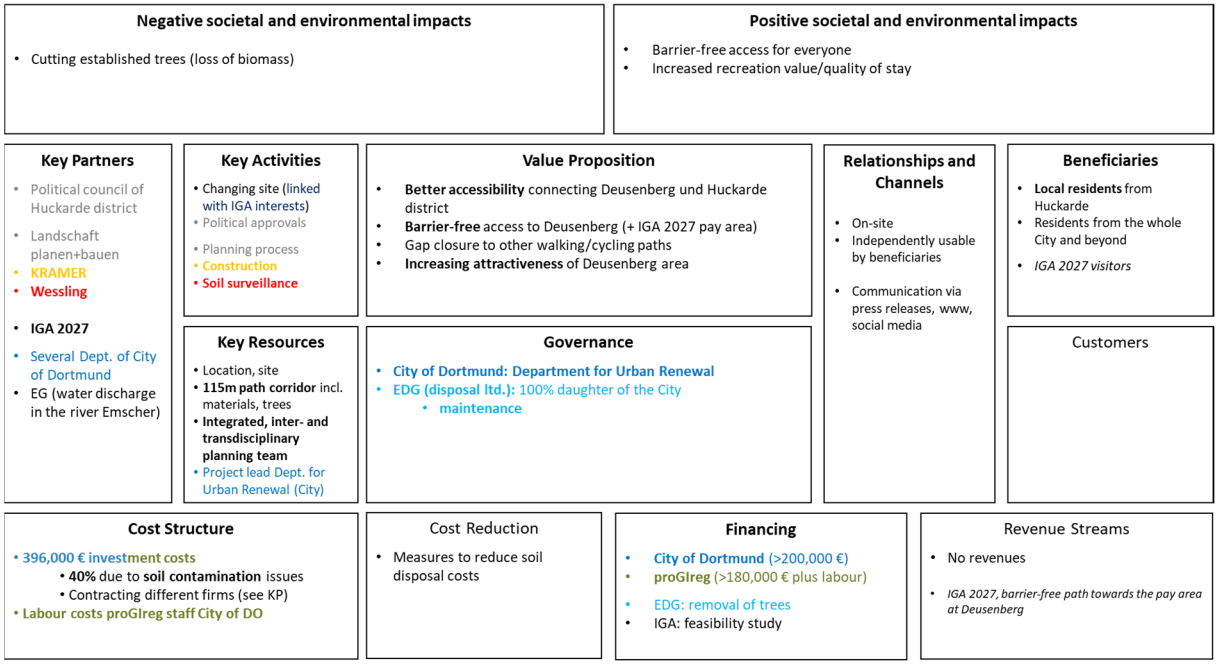

Figure 26: NBS 6 in Dortmund: Deusenberg path

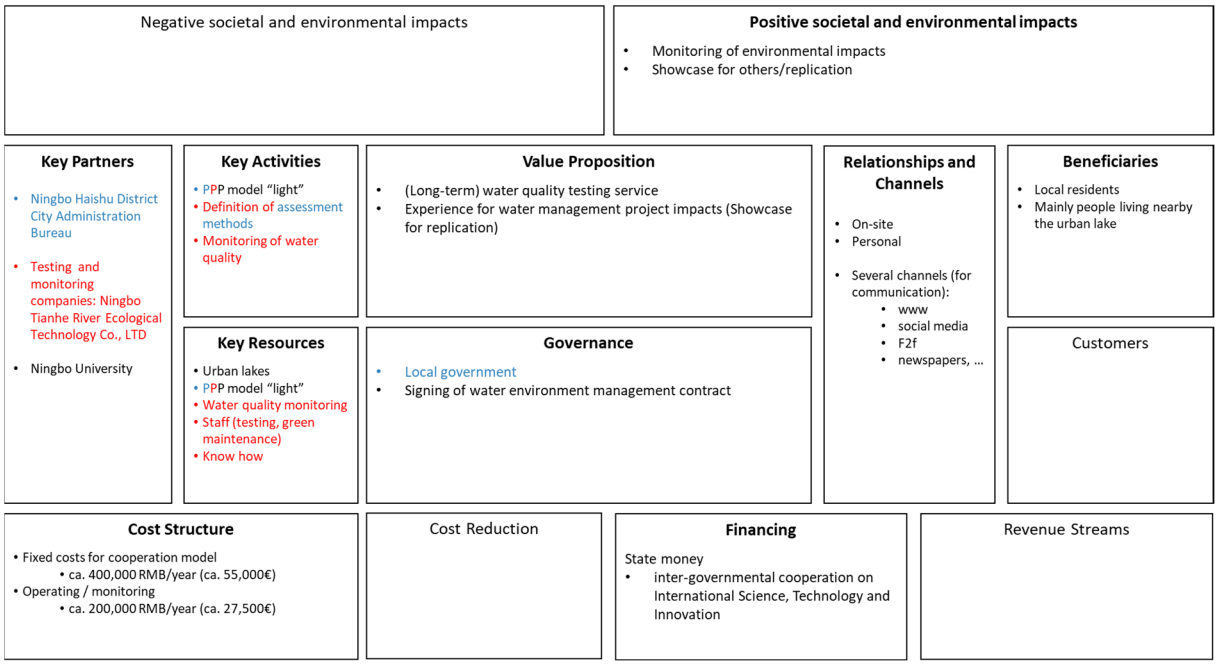

Figure 27: NBS 7 in Ningbo: Management contract for water quality testing in a public-private-partnership "light" model

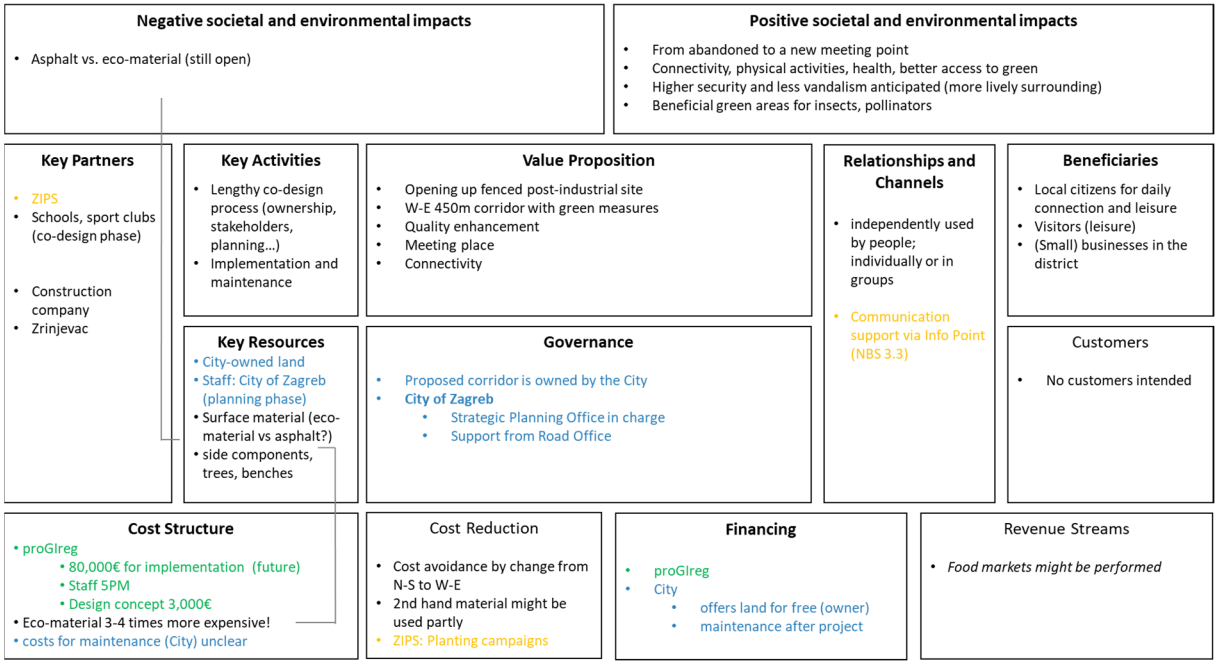

Figure 28: NBS 6 in Zagreb: Cycling path through Sesvete living lab

Diversified business model

Several NBS implementations in Turin and Dortmund belong to the diversified business model (see Figure 15, Figure 16 top left). Five are centrally positioned in the third sector circle of Pestoff's triangle (see Figure 29): pollinator-friendly wooden garden boxes (NBS 3.3), outdoor green wall at homeless shelter (NBS 5.3), and the green roof Spazio WOW (NBS 5.4) from Turin as well as the Dortmund and Turin NBS 8 on pollinator biodiversity. Dortmund's food forest is positioned more towards the community with a very active local church, while the garden Orti Generali in Turin (NBS 3.2) and Dortmund's Aquaponics system (NBS 4) are positioned on the edge between non-profit and for-profit towards the market corner of the third sector.

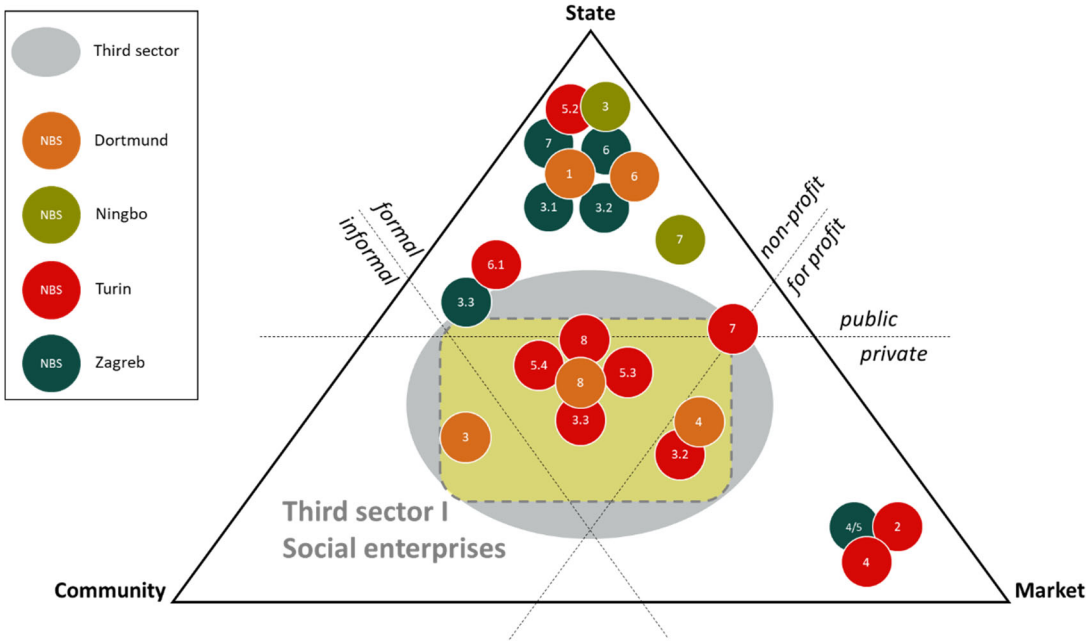

Figure 29: Third sector NBS

In Dortmund, the non-profit association “Naturfelder Dortmund e.V.“ was founded to manage the implementation of flower meadows in urban environments (NBS 8) (see Figure 30). This association foundation, in which a wide range of actors participate as members, has a long-term perspective beyond the project lifetime. The core values established by Naturfelder Dortmund e.V. are citizen involvement, education, awareness rising, but also to contribute to a mindset change in public administration on how to maintain public green areas in a more pollinator-friendly manner, e.g. in form of flower meadows or lower mowing frequency during vegetation season. Overall, it can be highlight that the implementation of flower meadows is a rather cheap and easy to implement NBS as long as land owners are willing to offer their land for these activities. One of the obstacles, which can occur occasionally, is the aesthetics of pollinator-friendly areas. For a certain period of time, the flowers provide a nice scenery, while in some seasons, mainly autumn and winter, they might result in an unwanted look. However, still valuable for pollinators and other wildlife.

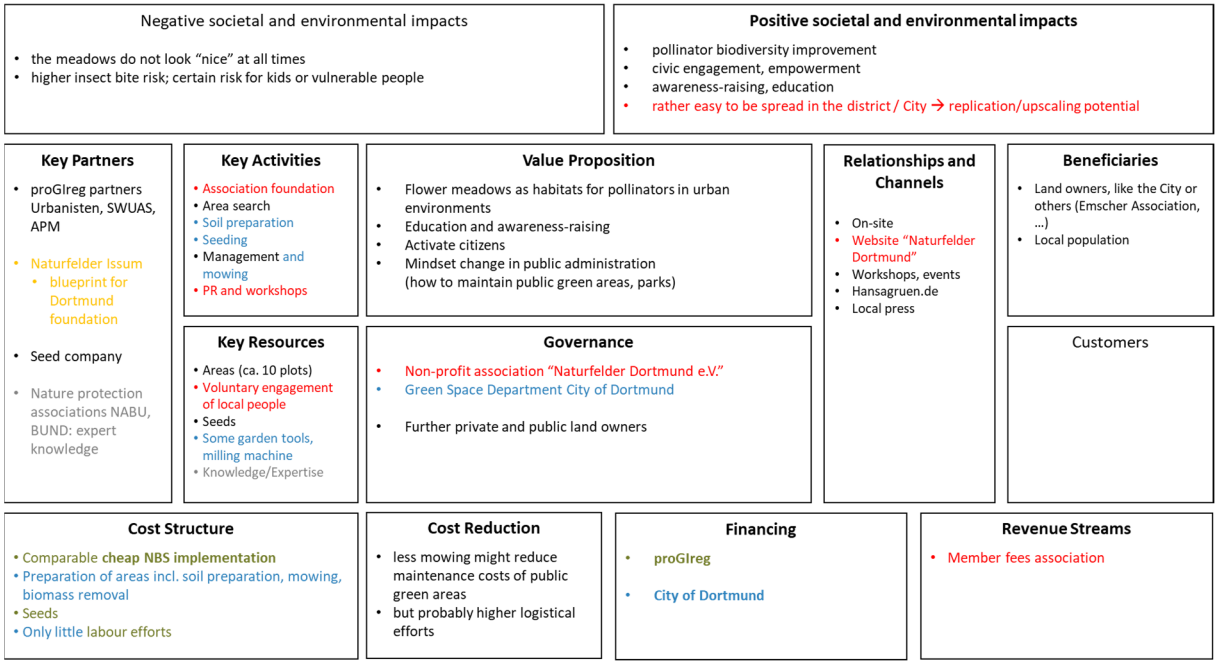

Figure 30: NBS 8 in Dortmund: Flower meadows and association foundation

In Turin, NBS 8 is implemented in collaboration of several involved entities from research, social associations, health institutions, and the City of Turin (see Figure 31). The butterfly gardens are run as a citizen science project including social and inclusive activities for people with mental and physical disabilities and further educational activities for a wider group of people (kids, teachers, refugees, social housing residents, Alzheimer patients, elderly people, and ordinary laymen). While the financing is currently coming from proGIreg only, the responsible group is aiming for a partly self-sustaining business model in future. To reach this, they intend to charge activities with costs, e.g. for lessons, but also for educational or social activities, like planting or the construction of butterfly gardens in wooden raised-bed garden boxes. Overall, the costs for implementation are also rather low in relation to other more technical NBS. However, it allows to contribute to citizen welfare via positive environmental and social effects. Key is the close collaboration of skilled personnel and experts from both social and inclusive as well as environmental and biodiversity backgrounds.

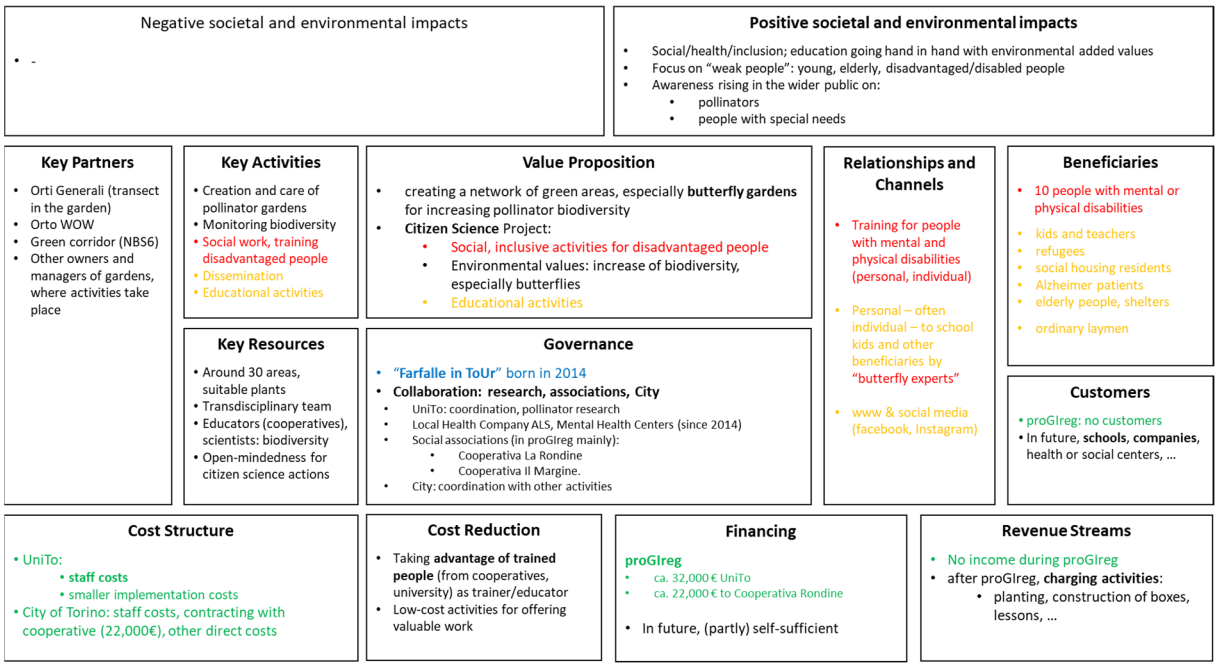

Figure 31: NBS 8 in Turin: butterfly gardens in Mirafiori Sud

The butterfly garden NBS is closely working together with other NBS implementations carried out under proGIreg, especially Orti Generali (NBS 3.2), the wooden garden boxes Orto WOW (NBS 3.3) and the ecosystem path (NBS 6) within the Mirafiori Sud living lab.

The wooden garden boxes Orto WOW (NBS 3.3) shows some similarities with NBS 8 (see Figure 32). Orto WOW aims to revitalize abandoned or under-used urban areas in a green and inclusive manner; here 16 wooden garden boxes to allow (food) production in raised-bed gardens. While food, especially basil and rockets, are cultivated in four of the 16 boxes, the remaining boxes are planted with aromatic, melliferous plants supporting nearby honey production. For realizing this "urban common", the local NGO "Orti Alti" coordinates activities, while partners belonging to the "Pact of Collaboration" are realizing, implementing, and operating the wooden garden boxes' activities. The Pact is comprised of a multi- and transdisciplinary team. Members are, among others, Fondazione Mirafiori, associations of beekeepers, the Italian farmers' association Coldiretti, and the City of Turin. Furthermore, social and health entities are involved to offer services for one of the main beneficiaries, disadvantaged people with mental and cognitive disorders. The other beneficiaries are a social restaurant receiving food produce (basil, rockets) for pizza, but also the inhabitants living nearby, especially elderly people and young families. Additionally, some goods (honey) and services (rent for kids' parties, donations for outdoor gym activities) are sold. These already existing smaller revenue streams are intended to be increased in line with the expiring proGIreg financing.

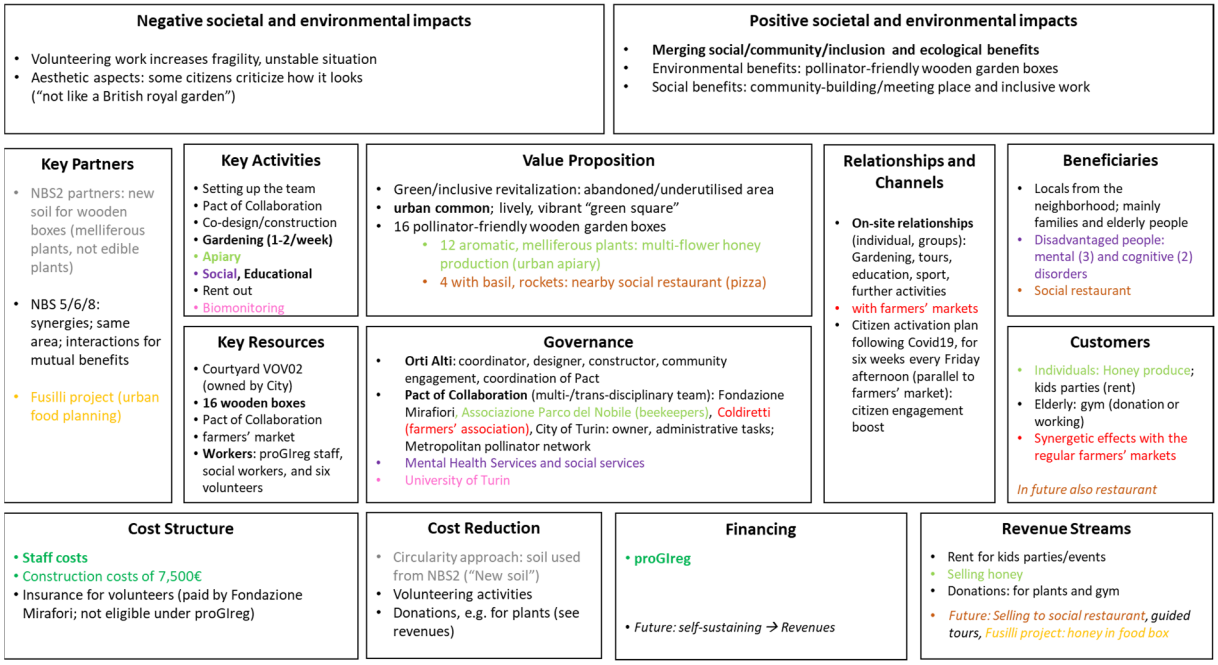

Figure 32: NBS 3.3 in Turin: Pollinator-friendly wooden garden boxes

While the green wall solution in a school building (see Figure 21) is managed by three public entities, the second green wall (NBS 5.3) in Turin's living lab is implemented by the City of Turin together with the social cooperative of the homeless shelter and the Politecnico di Torino PoliTo (see Figure 33Figure 33). The homeless people receiving care in the homeless shelter are the key beneficiaries since the green wall allows outdoor interaction with green. After proGIreg, the two walls are maintained by a professional gardener with City budget.

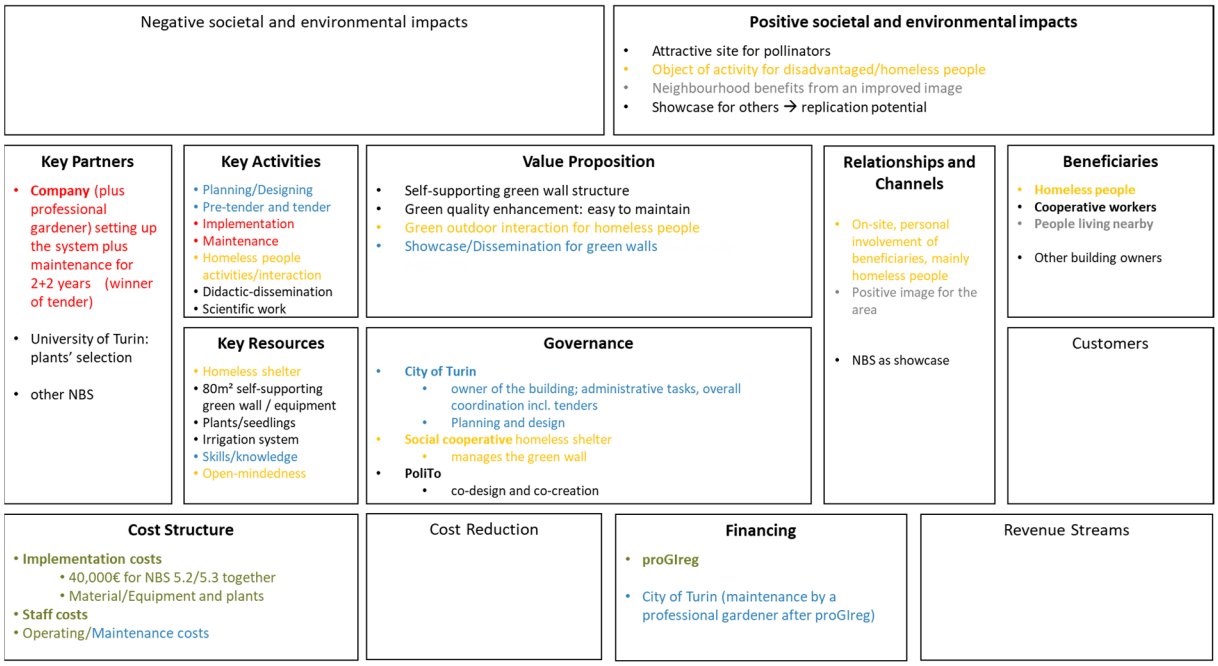

Figure 33: NBS 5.3 in Turin: Outdoor green wall homeless shelter in Turin

Another implementation of the NBS 5 family on green walls and roofs in Turin's living lab, is the extensive green roof solution on top of an abandoned, public building (NBS 5.4) (see Figure 34). Like the wooden garden boxes of NBS 3.3 in the same location, the NGO Orti Alti coordinates the extensive green roof implementation and maintenance. Together with the City of Turin, an association of beekeepers, and the University of Turin they planned and implemented a 140m² low tech, extensive green roof, which aims to attract pollinators, but also to withhold water in case of heavy rainfalls and flash floods. The City of Turin owns the building and nearby land, for what reason they keep the permission and administration, but also the maintenance in their hands. The maintenance of the green roof solution is done by the association of beekeepers once a year highlighting the extensive character of the NBS. Although it is considered a rather small intervention, the costs are quite high. Due to the high costs, some elements, like an external stairs construction, were not realized. This results in a lack of accessibility. However, the dissemination and education activities are offered nearby in combination with other NBS implementations, including urban gardens, the butterfly gardens, and the ecosystem path. An external company constructed the green roof, while another company provided the plant seeds (>20 species). Since this NBS is collaborating with another EU funded project, called "CWC interreg", an irrigation system including an eleven m³ cistern and a pumping system to the roof, could be installed with their financial means.

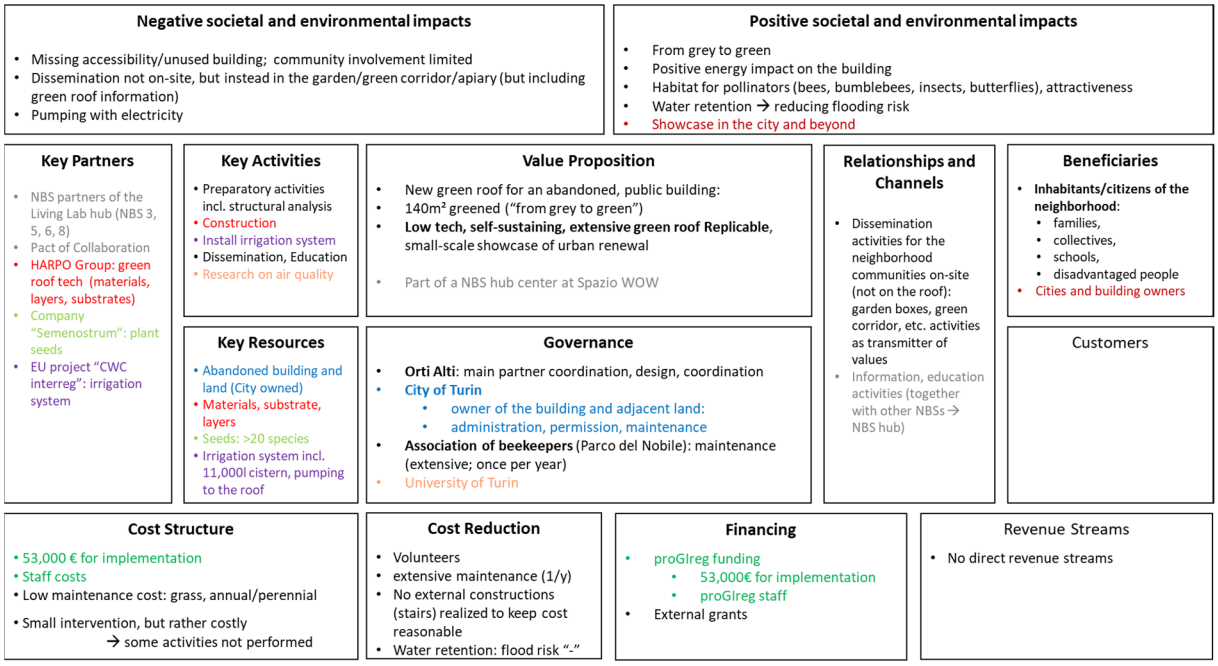

Figure 34: NBS 5.4 in Turin: Extensive green roof

Dortmund's food forest (NBS 3) is positioned the furthest towards the informal/community sector (see Figure 35). The food forest is implemented by a rather loose coalition. It is located on the property of the church St. Urbanus and with their approval and supervision. The church is strongly committed to the project goals and works closely together with the two project partners concerned, the NGO "Die Urbanisten e.V." and the South-Westphalia University

of Applied Sciences. The church adds also budget to the NBS, especially by providing a water access point and pay the fresh water consumption. During the co-design phase, the team was able to gather a group of interested local people taking care of the garden. These interested active people are coming from different backgrounds and institutions, especially church members, scouts members, locals living in the vicinity of the new garden, and members of the NGO “Die Urbanisten e.V.”. The team implemented a self-sustaining food forest following permaculture principles. Before implementation, the area was used only little without taking advantage of the site’s potential for quality of stay and urban wildlife habitats. The food forest planting allows a transition from unproductive to productive urban green aiming to harvest a variety of food along with improved biodiversity. Additionally, social values can be provided via the food forest, including education and knowledge creation, but also social interactions and community-building as well as a sense of belonging, responsibility, and ownership. The food forest is not primarily looking for customers paying for good or services. However, certain revenue streams might be established with the end of the proGIreg project. The main beneficiaries are the active gardeners, but also children learning in the newly established food forest. It is used as a green, outdoor classroom for certain learning modules of schools being situated nearby. Additionally, people of the neighbourhood enjoy the food forest environment. The increased biodiversity location is also used by a beekeeper placing the beehives at the fringe of the food forest. This rather cheap NBS benefits from the early engagement of experts on permaculture principles and (self-sustaining) urban gardening concepts. Thus, they are considered as key partners for the co-design phase.

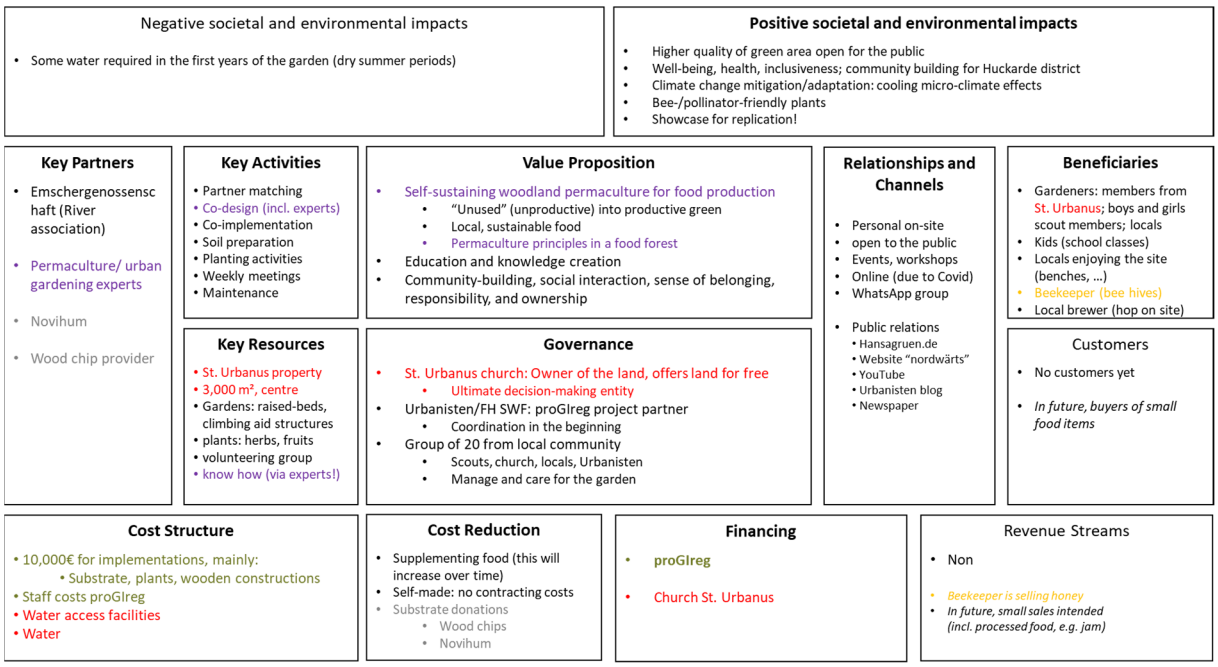

Figure 35: NBS 3 in Dortmund: Food Forest St. Urbanus

Two NBS of the third sector cluster borders the non-profit / for-profit divide (see Figure 10). These are the urban garden Orti Generali in Turin (NBS 3.2) and Dortmund's aquaponics system (NBS 4) (see Figure 36 and Figure 37). Orti Generali benefits a large group of people with different values. The social enterprise "Orti Generali s.r.l. Impresa sociale" runs an urban farm on the property of the City of Turin. The concession for three hectares allows urban farming activities for several target groups. Local citizens (>1,200) and disadvantaged people benefit from education and dissemination activities initiating community building and social inclusion. Besides these main beneficiaries, Orti Generali rents 160 gardening parcels to local citizens. The social enterprise offers next to a standard fee (50m² for 25€; 75m² for 35€; and 100m² for 45€ per month), also reduced rents for people in social difficulties and young people below 35 years. The yearly revenue for this income pillar accounts for ca. 45,000€. Sales via the garden kiosk generate even higher revenues with around 75,000€. Additional significant income streams are coming from fees for courses and educational activities. Thus, education for the wider public is offered without any charge, while schools, practitioners, and newcomers are paying for these activities. About one hectare of the garden is reserved for educational purposes including a greenhouse and didactic garden. Furthermore, food trees, chicken, a greenhouse, and an apiary complement the urban farm. For the future, another 2.5 hectares will be added to the farm of Orti Generali via a new concession of the City of Turin. This is line with a long waiting list of people interested in renting gardening parcels. The social enterprise aims to be financially self-sufficient on short notice. They were very successful in applying for public funds. The proGIreg money can be interpreted as leverage money for further funds and grants. Despite this financial aim (self-sufficiency), their food donations for people in economic difficulties validate their strong social mission.

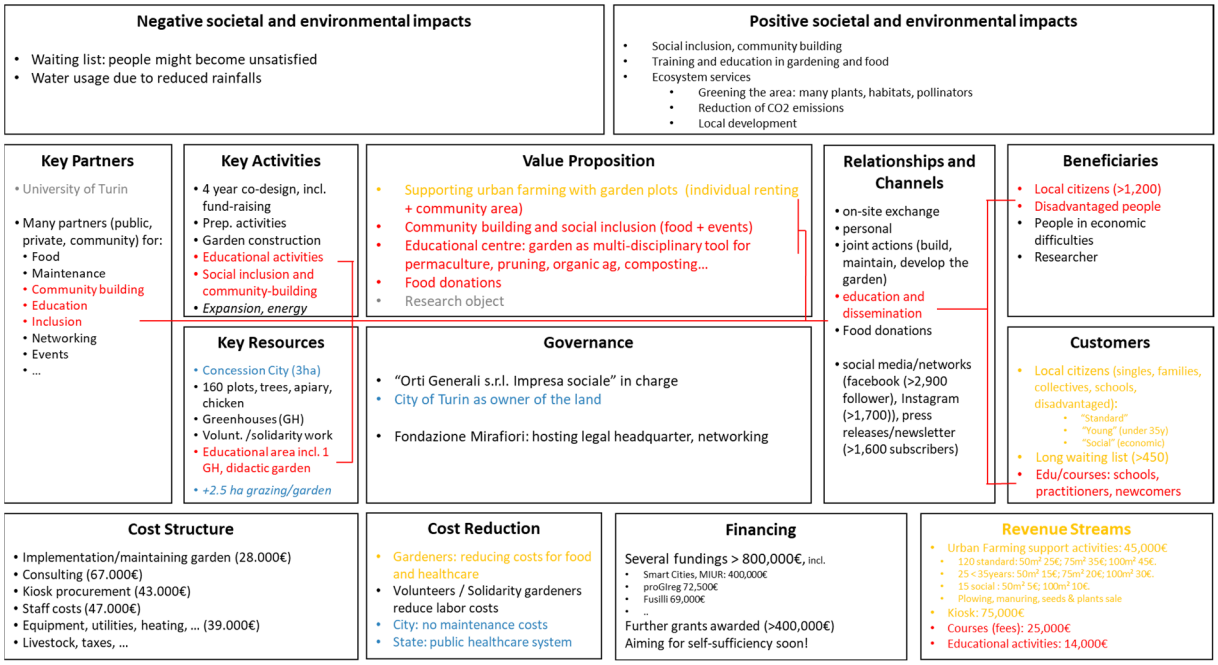

Figure 36: NBS 3.2 in Turin: Orti Generali

Dortmund's aquaponics system (NBS 4) contributes to research and development on aquaponics, especially towards technological innovation, energy optimization, and business models. Since the building permission for the two greenhouses (two identical greenhouses for research purposes) turned out to be a lengthy process, the aquaponics team is able to start the aquaponics production only in the last year of the project. The planning and implementation team consists of a university, an NGO, and a private business specialised in aquaponics (considered a key partner due to their expert role). The business model will be – to a certain degree – similar to Orti Generali. With the launch of vegetable production in so-called Deep Water Culture (DWC) systems, the team is aiming to obtain customers, especially local people and gastronomy. With regard to the vegetables (and later fishes), the revenues will be exploited by a renting concept, but also via direct sales of produce. The renting approach aims to copy the quite common "rent-a-field" concept (in German: *Mietgarten, Selbsterntegarten*) into greenhouses and more specifically to the raft level of DWC. In addition, services, like courses and tours, contribute to the revenue site. In order to set up a viable business model, the significant planning and implementation costs have to be considered. However, the stronger research focus lies on the optimization during operation, especially via energy optimization. Both greenhouses are not equipped with any additional heating, but using water tanks for heat storage extending the growing season. Furthermore, no artificial lighting of the vegetables is considered for cost reduction purposes. A longer term perspective for the two greenhouses and aquaponics is the International Garden Exhibition (IGA) 2027, which is going to take place – among other places in Ruhr Metropolitan Area – in proGIreg's living lab in Dortmund. Thus, the heritage foundation as owner of the Hansa coking plant, agreed to prolong the rental contract with the aquaponics team until IGA 2027.

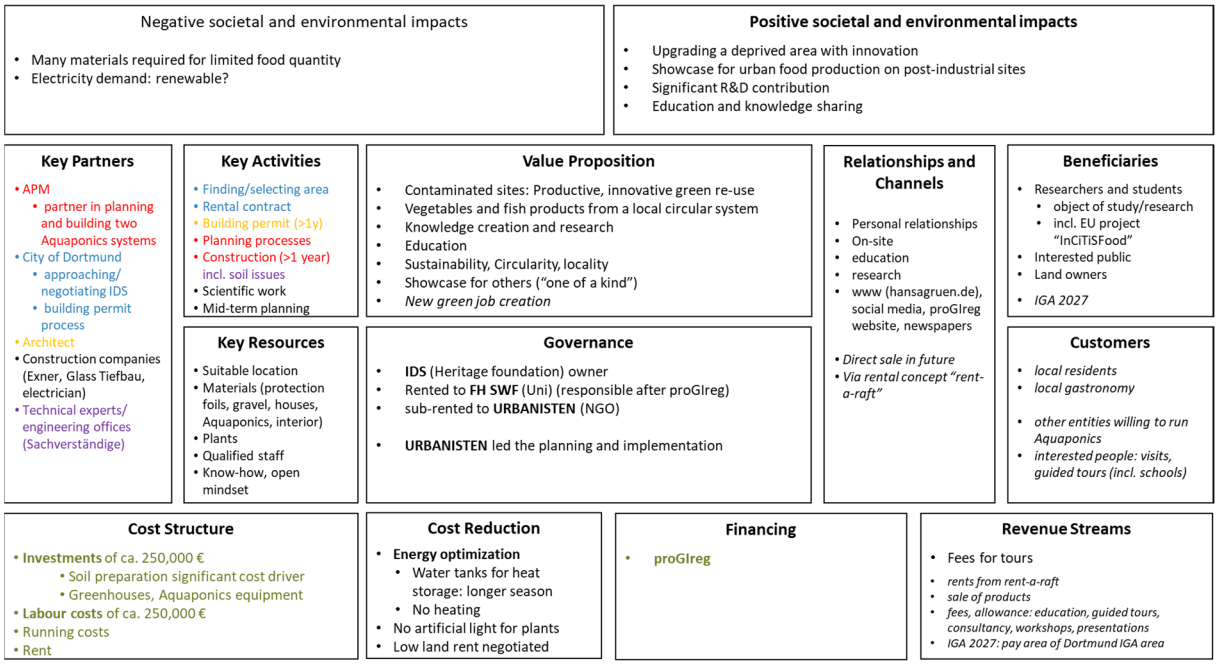

Figure 37: NBS 4 in Dortmund: Aquaponics system

Sales

Besides the business models public provision and diversified NBS, three proGIreg NBS are implemented and run by businesses with a clear profit orientation (see Figure 15, Figure 16 top right). The two from Turin are the new soil NBS (NBS 2) and the aquaponics system (NBS 4), while the mini urban farm merging NBS 4 and 5 in Zagreb builds the third sales-oriented business model. All three are run by private businesses.

The new soil NBS from Turin (NBS 2) upgrades deep excavation soil and material for the development of saleable new soil (see Figure 38). The company dual srl realized a new soil composition within the proGIreg project for further improvement of later use, especially in public green areas. Financially, the new soil NBS is lucrative since the company gets paid for taking the deep excavation material. They do not have costs for this one main resource, but in contrary it is even an income for them. The main customers are private landscaping companies realising public green areas, both for new green areas, but also for upgrading existing public green. Additionally, private people and households are buying small portions of the new soil for their private green. Dual srl realises different qualities of new soil; for landfills only of low quality, while for parks the quality standards are higher resulting also in a higher price. For food gardens the quality most be the highest.

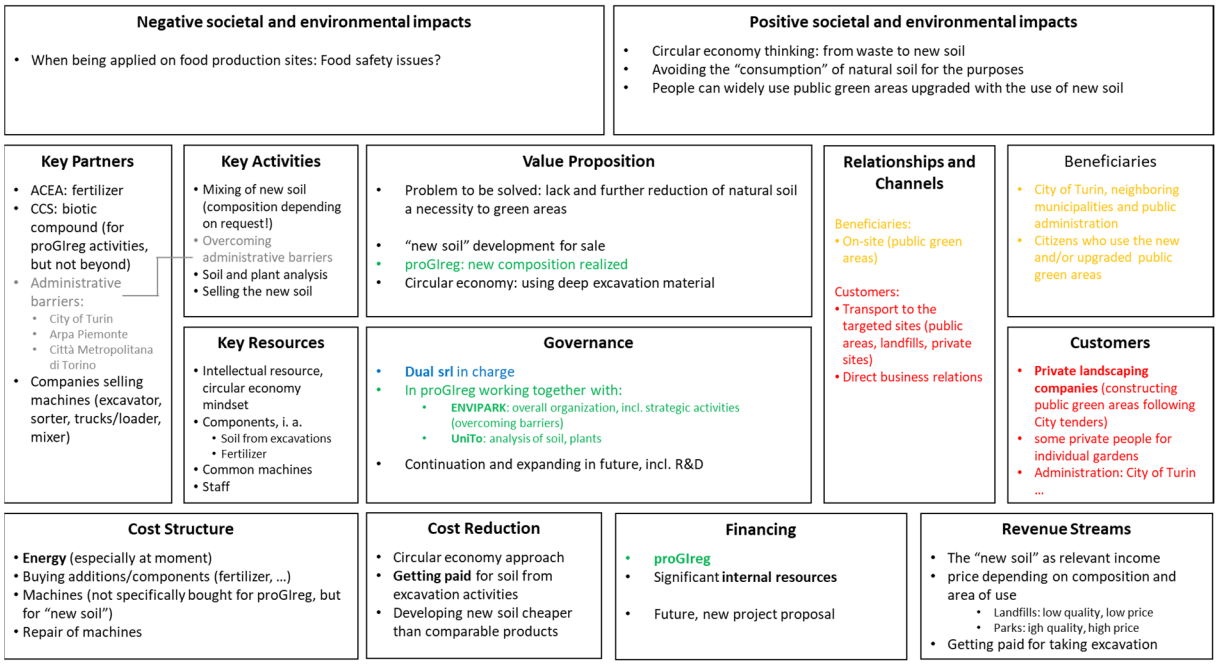

Figure 38: NBS 2 in Turin: New soil from dual srl

The company "Mitte Garten" runs the aquaponics system in Turin's living lab Mirafiori Sud (NBS 4) (see Figure 39Figure 39). "Mitte Garten" won the public tender. They built and run the system as a single entity. The aquaponics system in the living lab complements another larger system. The aquaponics production brings together vegetable production – basil, lettuce, and recently also tomatoes – and fish breeding, in this case carp. The key customers – also from the Mirafiori Sud system – are restaurants via direct sale. The basil production is

most profitable so far. Additionally, “Mitte Garten” offers visits and courses for rehabilitation centres and schools. Since the system in Mirafiori Sud is integrated in an already existing greenhouse, the costs could be reduced. Further measures to reduce costs are the combination of vegetables and fishes in one tank (fishes eat the plant roots). By doing so, there is no need for two components, one for vegetables and one for fishes, like it is the case in Dortmund. Both concepts have pros and cons, which have to be considered in the local context. It is an important showcase for innovative and new ways of how to grow food in cities and also in post-industrial areas.

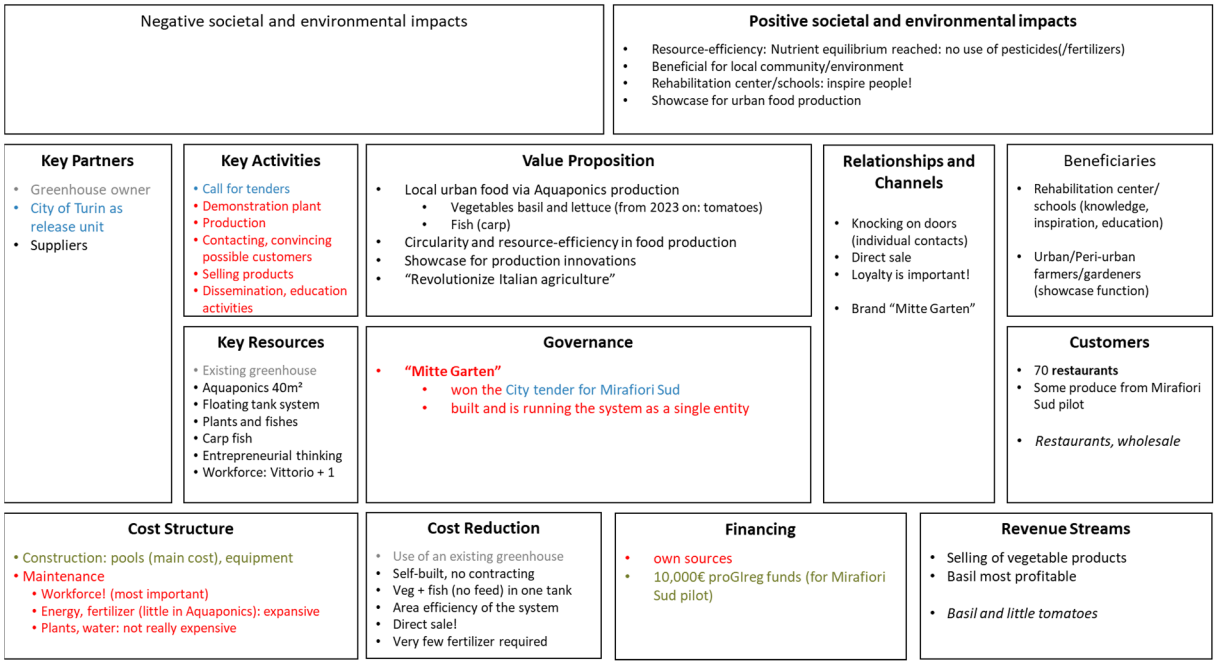

Figure 39: NBS 4 in Turin: Aquaponics system from “Mitte Garten”

In Zagreb, the two NBS on aquaponics (NBS 4) and green roofs and walls (NBS 5) are merged together in a mini urban farm (see Figure 40). The company Vesela Motika uses the living lab mini urban farm for research and development purposes mainly in order to optimize (and customize) their business. It is relying on indoor farming produce mainly. The goods from Sesvete living lab are not sold, but the other production in Zagreb is sold to end users, HoReCa (hotel, restaurant, café/catering). Additionally, the company developed a small niche market in selling their systems to other businesses, for instance innovative peri-urban farmers around Zagreb. They aim to extend this market segment further. By merging indoor aquaponics with outdoor green walls and roofs (NBS 4 + 5), the costs can be reduced. Additionally, solar panels make the system partly independently from the public grid and volatile energy prices. In addition to their customers (business-to-consumers and business-to-business), the NBS benefits researchers and projects for R&D in this field of technological and production innovations in urban agriculture. Furthermore, students use the NBS implementation for practice-based learning units in university’s curricula.

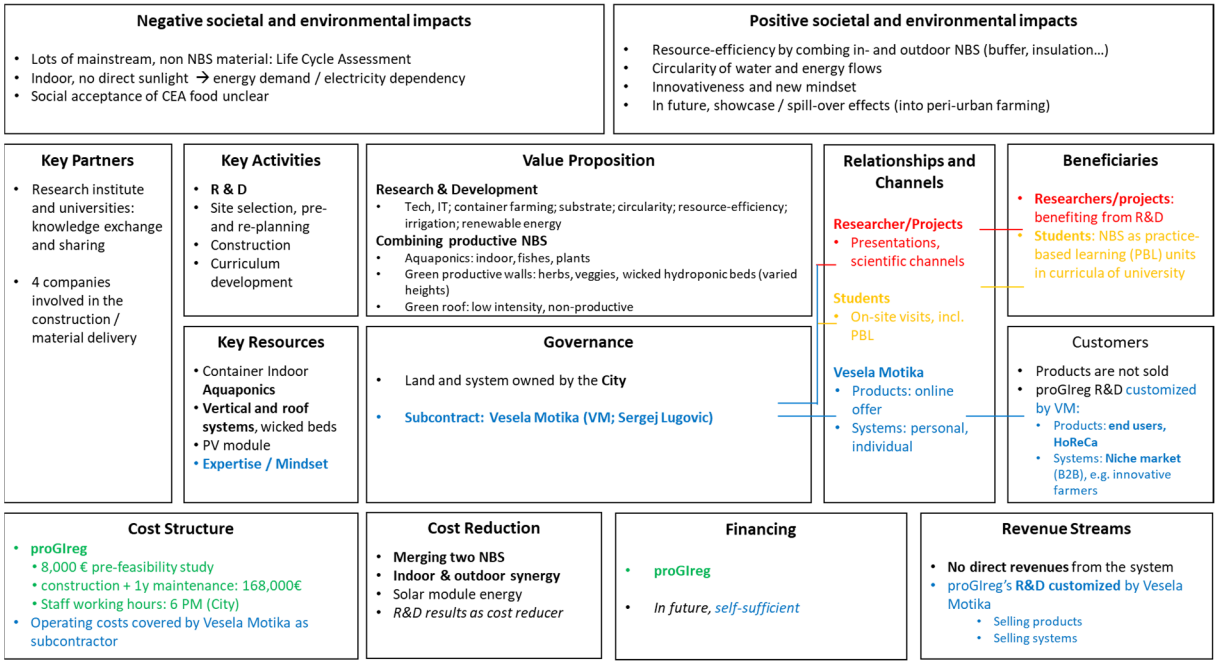

Figure 40: NBS 4 and 5 in Zagreb: Mini urban farm

6.2. Degree of profit orientation

Parallel to the positioning of NBS implementations into the Pestoff triangle between state, market, and community, the degree of profit-orientation allows clustering NBS regarding economic focus (see Figure 41).

- Three NBS in Turin, new soil NBS 2, aquaponics unit NBS 4, and Orti Generali (NBS 3.2) show the strongest degree of profit orientation. The two businesses running NBS 2 and NBS 4 aim at economic viability of the NBS. The social enterprise managing the urban garden "Orti Generali" (NBS 3.2) aims at financial self-sufficiency within the next 3-4 years. Several income streams build a robust foundation but demand suitable management and coordination. All NBS with a certain profit orientation aim for even higher degree in future.

However, several NBS implementations are not oriented towards economic viability and profit-making. These NBS belong to either:

- public provision cluster (both, city-internal and city-led)

  → Examples include sport exercise park (NBS 1) and Deusenberg path (NBS 6) in Dortmund, planting activities along the Moon Lake in Ningbo (NBS 3), and the modernization of an existing urban garden (NBS 3.1) or the therapeutic garden (NBS 3.2) in Zagreb.

- third sector cluster

  → outdoor green wall (NBS 5.3) and extensive green roof (NBS 5.4) in Turin. S

- Some NBS are positioned between no (very left of Figure 36) and strong (very right) profit orientation. This diverse group includes NBS implementations, which are starting with small sales/of-

fers, such as the food forest in Dortmund (NBS 3), but also public-private-coalitions, like the donation/sponsorship model in Turin (NBS 7) and the public-private-cooperation of NBS 7 in Ningbo.

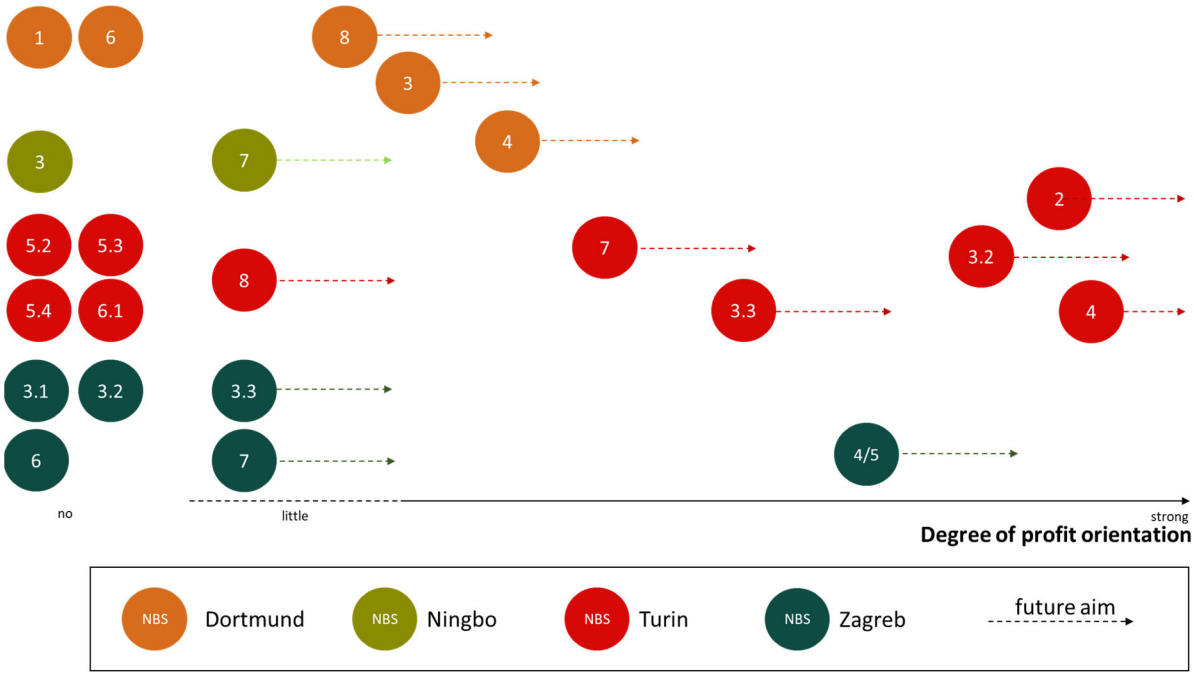

Figure 41: Degree of profit orientation for all interviewed NBS in the four living labs

6.3. Main target groups: customers and beneficiaries

The newly developed NBS Business Model Canvas (see Figure 7) differentiates between the two target groups of beneficiaries and customers (see Figure 42). It is crucial to consider and distinguish between the two main targets groups. These two building blocks are positioned to the right side of the template:

- Customers pay for the offered values, especially goods and services - resulting in revenue streams.
- Beneficiaries gain from the NBS values without paying directly for it. Beneficiaries demand other financial remuneration measures (financing), such as public funds or grants.

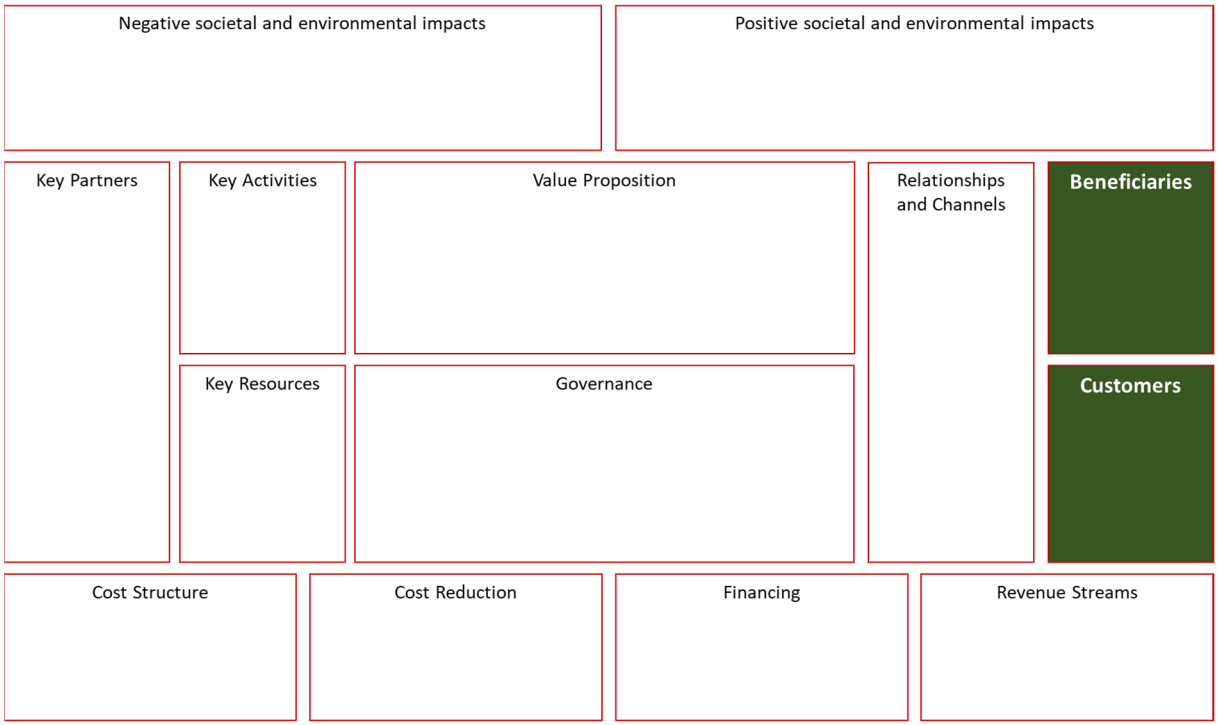

Figure 42: Beneficiaries and customers in proGIreg's NBS Business Model Canvas

Most proGIreg NBS implementations serve a significant number of beneficiaries (see Figure 43). The majority of NBS is open to the public, without any access barriers. Others have limited access, but only one – the extensive green roof on an abandoned building in Turin (NBS 5.4) provides no direct access. Its primary objective are environmental benefits. Additionally, education and knowledge creation take place in close proximity to the roof without demanding physical access of beneficiaries. Some NBS have customers also, some even many. Orti Generali is a promising example (NBS 3.2, Turin) of how to combine customers with beneficiaries. Local citizens (>1,200) and disadvantaged people benefit from education and dissemination activities initiating community building and social inclusion. Customers are the people or small groups who are renting a gardening parcel, kiosk shopper as well as people attending and paying for courses and educational activities.

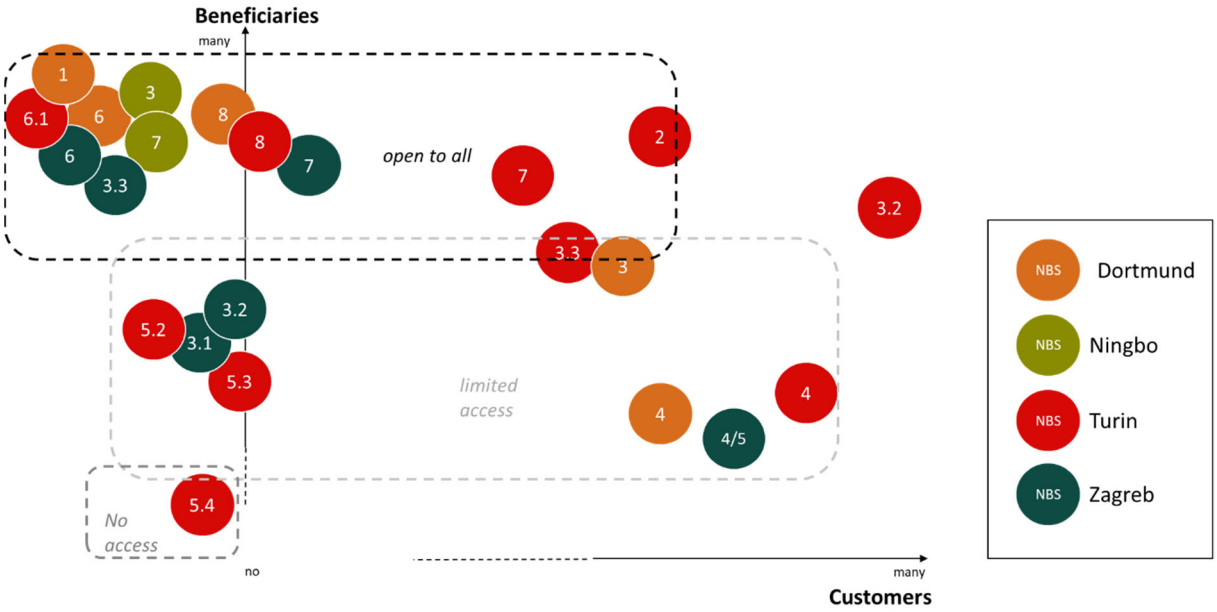

Figure 43: Who are the main target groups of the NBS? Customers and beneficiaries

6.4. Financial benefits: revenues vs. cost reduction approaches

Since several implemented NBS are not aiming any profit, a significant number of proGIreg case studies create no or only low revenue streams and at the same time no or only indirect cost reduction measures (see Figure 44). At the same time it becomes obvious that the revenue-oriented NBS also look for ways and options to reduce costs.

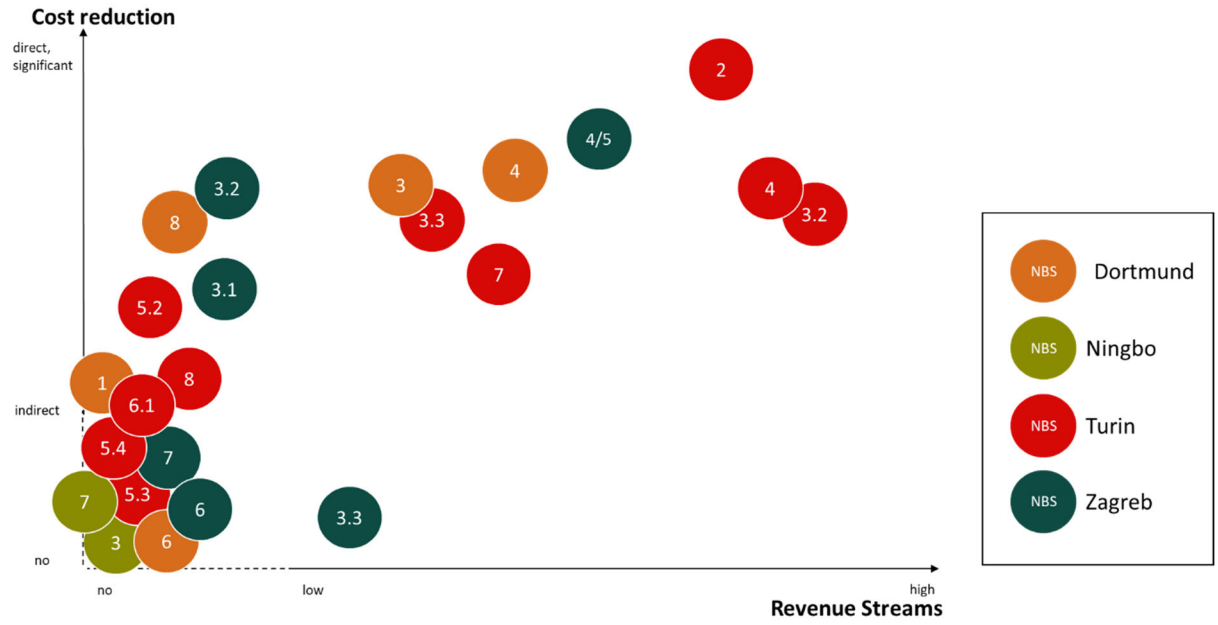

Figure 44: NBS allow to create revenues or reduce costs; or even both

Cost reduction measures are exploited by all stakeholder groups involved in the NBS implementations (see Figure 45). Thus, this economic dimension is not only of relevance for the market-oriented private sector (bottom right part of the Pestoff triangle), but likewise also for the centrally positioned third sector NBS as well as public entities implementing NBS.

Figure 45: Position of NBS implementations taking cost reduction measures into consideration.

7. Conclusions

The newly developed nature-based solution Business Model Canvas presented in this report tested 23 NBS implementations in the four FRCs of Dortmund, Ningbo, Turin, and Zagreb of the proGIreg project. The output shows the applicability of the tool (NBS BMC), which is building on earlier modifications of the original BMC from Osterwalder and Pigneur towards sustainability and NBS. Since the new NBS BMC was able to be used methodologically for a wide range of NBS implemented in the project, the applicability can be confirmed. Given the limited number of 23 implementations, further use of the new tool beyond the proGIreg Front Runner Cities should be carried out to further validate the suitability for the heterogeneity of NBS and contexts. The Follower Cities, which are in the phase of implementing an increasing number of NBS, might serve as a good starting point for this in the coming time. An increasing number of cases substantiates the testing and might reveal demand for adaptations or fine-tuning of the tool. This reports presents not only the 14 building blocks but also the guiding questions per building block. This allows all interest people or entities to use and test the tool as well as their NBS business models.

With regard to the findings on the business models of NBS, four main analysis approaches were used. The Pestoff triangle builds the core classification grid for the Business Model Catalogue and its iBMCat. Firstly, it allows to position NBS business models based on their organisational governance between state, market, and community. Additionally, the triangle

approach differentiates between formal vs. informal, non-profit vs. profit, and public vs. private activities. Most NBS are within the public and/or third sector domains. However, some NBS are also positioned in the market corner for profit or at least on the edge between for profit and non-profit including public-private-partnership constellations. By using the Pestoff triangle it is possible to cluster types of business models. The main types are public provision, sales, and diversified business models, which can be further detailed including public-private partnership or sponsorship/donation models bridging public and private as well as diversified approaches relying on services or rental concepts. It is encouraged to promote a stronger involvement (and lead) of NBS implementations from community and private sector including private-community-public cooperation. Nonetheless, public entities, especially municipalities, will also play a pivotal role in the future mainstreaming plan of NBS implementations in urban areas.

Due to shortage of public budgets, new approaches are required. The analysis reveals that it is suitable to integrate entrepreneurial thinking from early on in the process of NBS implementations. While this is inherently integrated in private, business-oriented actor groups, this is partly out of the box for public and community actors. Entrepreneurial thinking goes beyond exploiting promising revenue streams, but also utilizing financing models and measures to reduce costs, especially in the maintenance and evolution phase of NBS. To do so, the cooperation of different stakeholder groups is deemed a suitable way towards the mainstreaming of NBS. By matching public, private, and third sector new alliances can be developed in order to result in mutual trust, higher levels of acceptance as well as creating more flexible and innovative milieus. Overall, it is important to highlight that NBSs have an economic dimension by offering jobs, revenue paths, new NBS entrepreneurship, but also by allowing cost reduction measures for public entities and beyond. The likelihood of longer lasting sustainability and evolution of NBS implementations can be increased when integrating revenue streams and/or cost reduction measures in order to reduce dependency from insecure (public) financing.

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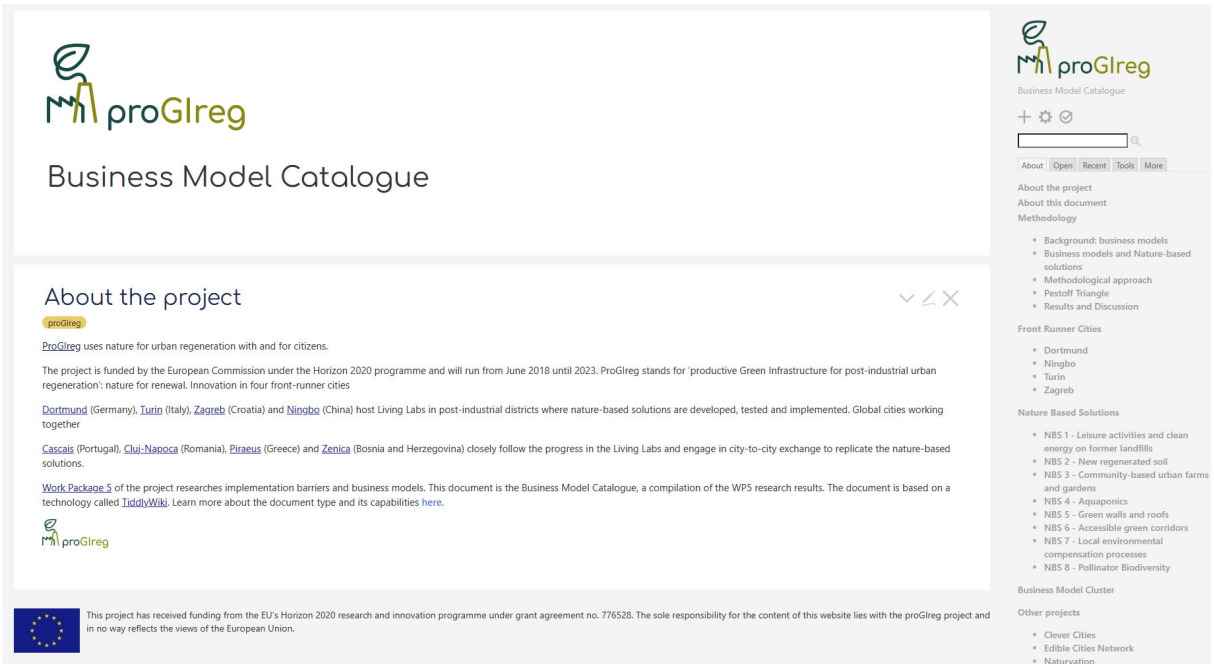
Annex 1: iBMCat

The research results on the business model task of WP5 have been compiled into an interactive Business Model Catalogue (iBMCat). The iBMCat is based on a document format called TiddlyWiki. The document format is interactive, yet self-contained in one single file, which can be displayed and used on all major web browsers and major operating systems without installing anything. The document can be loaded from a website, but it can also be used in an offline fashion from a local file system.

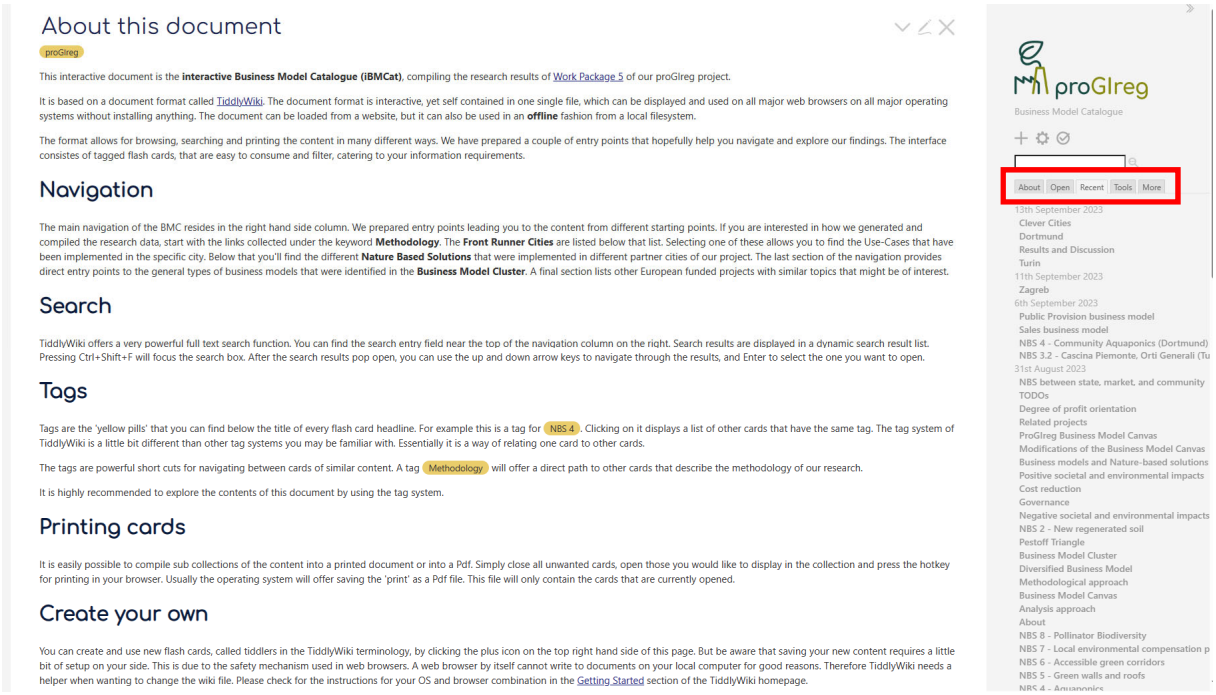
The format allows for browsing, searching and printing the content in many different ways. A couple of entry points are prepared that help to navigate and explore the Business Model Catalogue in a tailored and user specific manner. The interface consists of tagged flash cards, that are easy to consume and filter, catering to the information requirements of the users. This link allows access to the iBMCat:

https://fh-swf.sciebo.de/s/XAhpEa0u7Ud4XQb.

Please note that the iBMCat does not work from within the online storage system sciebo. Please download the file (top right corner) and open in your favourite web browser. Some insights are presented here. The right bar provides an easy to use navigation and search function.



Furthermore, the open and recent cards are presented as overview lists under the corresponding sheets.



The search function allows to filter content based on the search term, e.g. the NBS 2 implemented in Turin, New Soil. This search results for instance in ten matches, whereof two include the search term “New Soil” in the title, while another eight include the New Soil NBS elsewhere.