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Exploring Multiple Benefits of Urban and Energy Regeneration Projects: A Stakeholder-Centred Methodological Approach

Irene Bertolami [1], Adriano Bisello [1,*], Marco Volpatti [1,2] and Marta Carla Bottero [2]

[1] Eurac Research, Institute for Renewable Energy, Viale Druso 1, 39100 Bolzano, Italy; irene.bertolami@eurac.edu (I.B.); marco.volpatti@polito.it (M.V.)
[2] Interuniversity Department of Urban and Regional Studies and Planning, Polytechnic of Turin, Viale Mattioli 39, 10125 Turin, Italy; marta.bottero@polito.it
* Correspondence: adriano.bisello@eurac.edu

Abstract: An effective way to promote energy transition while tackling climate change involves redefining cities from being part of the problem to integral parts of the solution. Positive energy districts and climate positive circular communities are excellent examples of how this is feasible. But how do we understand which are the multiple benefits that these projects can bring to the local territory and relative community? This article aims to answer this question by developing a specific engagement and evaluation methodology. Our approach involves consulting with project partners to explore the multiple benefits of each case study. Subsequently, it plans to engage the stakeholders through the submission of a questionnaire to gather information regarding the relative importance of different benefits as perceived by each stakeholder. The questionnaire is based on the best–worst scaling method, which is a survey technique for determining people's priorities. The preliminary findings of the study conducted on project partners of two European projects, ARV and ProLight, indicate a strong alignment with current European policy priorities. The involvement of other stakeholders in the study will serve to assess whether bottom-up priorities coincide with broader perspectives or whether adaptations to project strategies and dissemination approaches are needed.

Keywords: multiple benefits; positive energy district; climate positive circular community; smart city; stakeholders' consultation; best–worst scaling; non-financial impact; ESG criteria

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1. Introduction

Climate change is unequivocally one of the most pressing worldwide dilemmas facing humanity in the 21st century. Cities carry a significant portion of responsibility for driving these changes [1]. Nevertheless, our focus should shift towards converting them from being perceived as problematic to being seen as opportunities [2]. Nowadays, the urban population constitutes over half of the global populace [3] and, given the projected escalation of this proportion in the years to come, it becomes fundamental to foster the development of environmentally conscious and sustainable urban areas. Particularly, buildings have a considerable impact on global resource consumption and the environment. Buildings use about 40% of the world's energy, 25% of its water, and 40% of global resources. Moreover, they produce approximately one third of all greenhouse gas emissions (GHG), contributing significantly to global warming [4]. However, by improving the built environment, we can achieve substantial GHG emission reductions, leading to environmental benefits and economic advantages through lower energy costs and a more sustainable infrastructure [5,6].

Nowadays, there are ongoing efforts to especially align with the objectives of the Paris Agreement [7]. Notable initiatives, such as the European Green Deal [8] and the Mission on Climate-neutral and Smart Cities [9], are taking significant steps in this direction. These

initiatives have established ambitious energy and climate targets within Europe, aimed at reducing greenhouse gas (GHG) emissions, enhancing energy security, and promoting greater reuse and recycling of materials [10]. Moreover, the New European Bauhaus initiative extends beyond these objectives, aiming to incorporate the vital principles of inclusivity and aesthetics as well [11].

Within these initiatives, projects are structured to translate ideologies into practical implementation. This involves the creation of sustainable pilot districts to serve as leading examples that inspire transformative change. The sustainable urban models currently considered successful are, for instance, smart cities, positive energy districts, and climate positive circular communities. However, an apparently trivial but crucial question arises: what are the concrete positive impacts of such models on local communities?

One key strategy to address this question is the analysis and assessment of the multiple benefits associated with urban and energy retrofitting projects. By following this approach, all the benefits should be considered without privileging any of them, since they all contribute to the improvement of the community and its territory. This method considers not just the technical enhancements of a project, like increased energy efficiency, but also its associated positive impacts, such as addressing energy poverty or making energy more accessible and affordable for vulnerable communities [12].

Moreover, the task of preparing our cities to effectively tackle the challenges posed by climate change demands active engagement from all individuals, from large corporations to ordinary citizens. A good way to guarantee success is to consider the needs of all the city users as well as to try to make everyone feel part of the community [13].

This article intends to present an innovative way of performing multiple benefit analysis in relation to urban and energy regeneration projects, outlining a precise methodology to be followed by decision makers. What sets this methodology apart is its emphasis on participation, as it actively engages a wide array of people from various backgrounds and interests. In particular, the approach seeks dialogue with stakeholders, who are individuals or groups of people who are or could be affected by organizations' actions [14] or, as in this case, by a project.

The methodological process begins with the identification of expected multiple benefits through a review of the scientific literature and an analysis of recent smart cities and positive energy districts projects. Subsequently, interactive workshops are organised with project partners, using in-person and/or remote interaction to compile a list of expected benefits tailored to each case study. Stakeholders are then invited to participate in a questionnaire based on the best–worst scaling technique, allowing them to identify the most significant benefits based on their professional or individual roles in the project. The workshops facilitate conversations with chosen stakeholders, offering a platform for targeted discussions. Meanwhile, the surveys contribute to a wider understanding by presenting expansive viewpoints and empirical data. This approach is designed to be adaptable and versatile, making it applicable to a range of urban development initiatives.

The methodology for studying multiple benefits, developed in the context of this research, is supported by initial findings from its implementation in two ongoing European urban innovation initiatives, namely ARV and ProLight. At the core of this approach is stakeholder interaction and discourse, facilitated by the use of the best–worst scaling method for assessing individual preferences. Our approach encourages close interaction with stakeholders, facilitating a deeper understanding of their perspectives and priorities within the project. This greater understanding can help stakeholders recognise the potential positive impacts of urban and energy redevelopment, while providing decision makers with an additional opportunity to listen to and consider the voices of those involved. Moreover, this methodology opens new opportunities for making investments in urban energy transition more advantageous, considering the overall impacts. It can be applied to a wide range of urban projects and policies, with tangible benefits in terms of environmental sustainability, social equity, and economic development.

2. Methodological Background

2.1. The "Multiple Benefits" Concept

The concept of multiple benefits refers to any positive impact that can result from a project when it is seen holistically, without assigning it a particular ranking [15].

At its core, the notion of multiple benefits implies that evaluating a project's success should not be limited to a single dimension of assessment. Instead, it encourages an exploration of the multifaceted ways in which the project can bring about positive change, including social, environmental, economic, and governance advantages. Multiple benefits include the following types of advantages:

1. Main goals (expected benefits): these are the positive outcomes that are typically planned for and anticipated during the project's inception and planning stages. They are often aligned with the project's primary objectives and can be usually quantified and measured using specific criteria [16]. Examples of expected benefits could include economic and energy savings, improved efficiency, or reduced fossil fuel dependency.
2. Co-benefits (unexpected and secondary benefits): these are the positive impacts that emerge unexpectedly or collaterally as a result of the project's implementation since they were not initially accounted for in the project's planning or evaluation [17]. These benefits often arise due to the complex interactions between various components of the project and its broader context. The notion of co-benefits is not restricted to any particular realm of society; it can encompass domains such as health and well-being, the environment, economics, and social aspects, among others [16]. Examples of unexpected benefits might include improved quality of life of the inhabitants, enhanced citizen engagement, and increased knowledge exchange. Many of these can be found within the conceptual categories of ESG criteria, which, nowadays, are particularly relevant for every business area.

In other words, multiple benefits are all the expected and unexpected benefits with a horizontal perspective [18], as no single benefit is considered more significant than others nor the main goals compared to the co-benefits [15].

The notion of multiple benefits is a progression from the more commonly recognised concept of co-benefits. Although the definition has experienced slight modifications over time, the notion of co-benefits dates back to the 1990s [19]. Nevertheless, the term gained more comprehensive attention from the Intergovernmental Panel on Climate Change (IPCC) in the third evaluation report of 2001 [4], wherein the concept is employed to signify the non-climatic advantages of policies aimed at mitigating greenhouse gas emissions. The concept of multiple benefits is more recent since it was introduced by the International Energy Agency (IEA) in 2014 [5] to fully harness the investment potential in building energy efficiency. IEA identified 15 multiple benefits, which may originate from the improvement of energy efficiency, and represented them in the so-called "multiple benefits' flower" diagram. The innovation lies in the fact that the identified positive impacts were not limited to the energy sector but extended to social, economic, environmental aspects, and more. Even though nearly a decade has passed since then, its practical implementation remains a challenge today, especially when evaluating complex urban contexts, such as entire neighbourhoods rather than an individual building.

Exploring a variety of benefits is key to maximising the potential of a project or policy. This comprehensive assessment not only aids in understanding the positive outcomes but also in sharing these impacts to increase awareness among investors, end users, and other stakeholders. Notably, Sareen et al. [20] propose that emerging impacts could incentivise stakeholder participation. Furthermore, a technical report by the Joint Research Centre released in 2020 [21] reported that integrating a multiple benefits analysis into the cost-optimality calculation process for an energy district positively influences community involvement. Recognising the significance of studying multiple benefits extends beyond attracting investors; it involves engaging the project's end users in decision making and aiding their comprehension of the project's advantages. Embracing this inclusive approach could gather broader support, acknowledging that stakeholders perceive different benefits

as more significant and engaging based on evolving perspectives while also enhancing the main goals of the project.

2.2. Overview of the Concepts of Smart City, Positive Energy District, and Climate Positive Circular Community

To gain a comprehensive understanding of the practical application of multiple benefits, it is essential to provide an overview of the concepts of smart cities, positive energy districts (PED), and climate positive circular communities (CPCC). These are just some city models, among the most cutting-edge at the moment; however, the methodology can be utilised for any type of urban project.

These concepts have evolved from the broader idea of sustainable and liveable urban settings and are in alignment with the United Nations' sustainable development goals [22]. They receive support and funding from the European Union and various other initiatives.

Smart cities integrate information and communication technologies (ICTs) with sustainability, aiming to enhance the quality of urban life through technology-driven solutions. For example, they may employ sensors to monitor air quality, traffic flow, and energy usage, allowing for real-time adjustments and improvements [23]. Moreover, smart cities are not just about technology but also involve active engagement with the community to create a more comfortable and sustainable urban environment [24].

Positive energy districts (PED) take the sustainability approach further, focusing on creating urban areas that generate more energy than they consume from renewable sources. This excess energy can be shared with other parts of the city, promoting energy efficiency and environmental sustainability [25]. Implementing PEDs may require adjustments to urban planning tools, such as creating variants to general master plans, to optimise mixed-use development while respecting territorial guidelines.

Climate positive circular communities (CPCC) expand on the PED concept, envisioning urban areas that not only produce surplus energy but also emphasise renewable resources, waste reduction, and circular economy principles. These communities aim to integrate social, economic, and environmental sustainability in a balanced way. Achieving a climate-positive status involves actively supporting environmental regeneration and restoration in addition to avoiding harmful environmental consequences. The possibility of generating climate positive circular communities was explored within the framework of the European project ARV.

Each concept mentioned above reflects a commitment to making urban areas more liveable, environmentally friendly, and resilient in the face of evolving challenges like climate change and resource scarcity considering different aspects.

2.3. Best–Worst Scaling

In order to enhance the effectiveness of the multiple benefits analysis and integrate stakeholders' perspectives, a questionnaire was distributed to all individuals directly or indirectly involved in the project. This initiative employed the best–worst scaling (BWS) method, chosen for its efficacy in capturing nuanced stakeholder viewpoints.

BWS, sometimes referred to as MaxDiff [26–28], was developed by Louviere and Woodworth in 1990 and its first application was published in 1992 [29]. This methodology evolved from the desire of creating user-friendly surveys. This methodical approach allows for a more focused and purposeful selection, ensuring the subsequent use and analysis of these benefits would be robust and effective. Its fundament is based on the notion that individuals find it easier to assess extremes rather than rank items, moving away from the approach suggested by other models [30]. Respondents are tasked with selecting the "best" and "worst" elements from a set of options.

BWS aligns with the Random Utility Theory (RUT), which states that people have preferences and make choices based on the utility associated with each alternative [31].

It categorises items into groups or tasks, each consisting of a minimum of three items. Respondents are supposed to identify the "best" and "worst" elements within each task.

Effective implementation of the methodology depends on striking a suitable balance between the number of tasks and the number of items per task.

Initially utilised in the food industry to examine the role of product safety in consumer purchasing decisions [29], this methodology has since then found application across diverse fields, including marketing [32], social sciences [33], and medicine [34].

BWS offers three variations for data collection and preference analysis: object case, profile case, and multi-profile case [35]. This study opted for the first case, known for its simplicity and familiarity. In this scenario, respondents rank items based on subjective scales, providing measures on a known scale [36]. Case 1 proves valuable when the focus is on understanding relative differences between objects rather than obtaining absolute measurements or ratings [37].

In the analysis of best–worst scaling, there are different methods available to calculate results. These methods can be broadly classified into two groups: count-based methods and model-based methods, as outlined by Chrzan et al. in 2019 [27]. The best–worst scaling score was calculated with the Analytical Best–Worst Scoring (ABW) proposed by Lipovetsky & Conklin [38], which follows Equation (1):

$$\mathrm{ABW} = \ln\left(\frac{1+\mathrm{NBW}}{1-\mathrm{NBW}}\right) \quad (1)$$

where NBW is the best–worst score normalised by the unit calculated according to Equation (2):

$$\mathrm{NBW} = \frac{\#\mathrm{Bests} - \#\mathrm{Worsts}}{\mathrm{Total\ times\ shown}} \quad (2)$$

where the distinction between #Bests and #Worsts indicates how often an item is chosen as the best or worst option, respectively. The denominator reflects the total number of times the item is presented for selection.

The creation of the questionnaire was supported by the use of Sawtooth Software Discover® (sawtoothsoftware.com, accessed on 9 January 2023), which is designed to apply the best–worst scaling method.

3. Methodology: PHASES of Evaluation

The present methodology is an evolution of the approach used by Bisello [15] for the investigation of multiple benefits in a Smart and Sustainable Energy-District Project (SSEDP).

While versatile across contexts, this approach has been tested within the framework of the above concepts of smart cities, PEDs, and CPCCs, in particular, where applied to the ARV and ProLight projects.

The ARV project, which spans from 2022 to 2025 and is funded by the H2020 EU program, aims to obtain six pilot CPCCs across Europe. Through initiatives like energy renovation on existing or new buildings, it aims to safeguard threatened heritage while addressing energy poverty and promoting sustainability. In addition to showcasing exemplary models, it intends to create replicable, scalable solutions beyond showcasing exemplary models, fostering knowledge sharing, and best practices dissemination.

The ProLight Project, also funded by H2020 and initiated in late 2022, centres around the PED concept, focusing on small-scale building interventions for energy transition and local urban innovation ecosystems. In line with the principles of the New European Bauhaus, it aims to create sustainable living environments, integrating technologies such as photovoltaic panels and sensors into renovation actions in six case studies in Europe. It seeks to share excess energy across community networks and use innovative digital tools to monitor and address user concerns.

In this context, where projects consist of multiple localised demonstration cases across various European countries, the aim is focused on extracting unique outcomes tailored to each specific local case study within the project. These specific findings hold a pivotal role in executing the project comprehensively, adding significant value to its overall success.

Initially, an extensive literature review was conducted on various online repositories, including ScienceDirect, SCOPUS, Academia, and others. The aim was to delve into diverse topics such as multiple benefits, smart cities, positive energy districts, and best–worst scaling, totalling 122 publications. These readings were instrumental in developing an in-depth understanding of the concepts mentioned.

The procedure for conducting the multiple benefits analysis described in this article will be explained with references to the practical applications and has been subdivided into four steps (Figure 1).

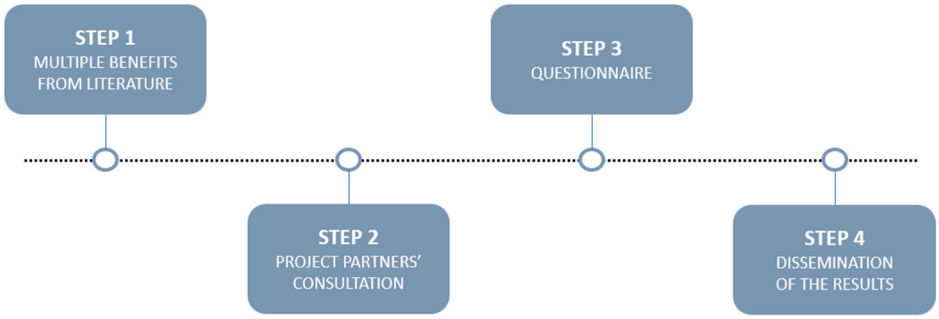

Figure 1. Scheme of the proposed methodology for multiple benefit analysis.

To initiate the multiple benefits analysis, an in-depth literature review of comparable projects to the one under analysis is undertaken (STEP 1). Subsequently, project partners collaborate to curate tailored lists of relevant multiple benefits at both the project and demonstration case levels (STEP 2). Following this, a comprehensive questionnaire is designed and circulated to capture stakeholders' perspectives on the selected multiple benefits' significance (STEP 3). Finally, the results of the questionnaire are disseminated to conclude the process (STEP 4).

3.1. STEP 1: Identify Key Multiple Benefits from the Literature Review

The literature review represents the base of the methodology. It is useful to gain insights into the most frequently cited benefits associated with energy and urban redevelopment projects. This effort is useful for understanding the potential effects and expected results of initiatives similar to the one being considered. The approach is inspired by the ones used by [16,39].

A thorough online screening has been conducted and sixteen projects and four scholarly articles were chosen as references (Table 1). Both theoretical publications and European initiatives (completed or in progress) in the field of city models, such as smart cities, positive energy districts, and climate positive circular communities, were brought into the analytical process. The selection of projects involved an exhaustive review of numerous deliverables and online resources spanning from November to December 2022. These projects have received funding from the European Union and are primarily geared toward introducing innovative solutions to enhance the quality of life for residents and promote environmental well-being. Additionally, we considered articles unrelated to specific projects to explore the concepts of smart cities and positive energy districts in a more theoretical context. This focus was motivated by the recognition that these urban models represent an encompassing and pioneering concept, supported by a substantial body of literature. It is worth noting that the CPCC model is even more recent, and its inception occurred exclusively within the ARV project, which remains ongoing. The analysis extended to include the documentation related to both the ARV and ProLight projects. This deeper examination aimed to fortify the available resources, enhancing the groundwork for subsequent discussions with project partners. The type of partners in these projects is very diverse, ranging from universities and research centres, companies of different sizes (from start-ups or small and medium-sized enterprises to large energy or real estate companies), municipalities and public bodies,

associations, or interest groups. A broad representation of the actors needed to trigger innovation as well was argued in the quadruple helix innovation model [40].

Table 1. Projects and scientific literature consulted to extrapolate multiple benefits.

No.	Title	Type	Urban Model	Description	Main Ref.
1	ARV	EU project	CPCC	ARV seeks to provide and implement appealing, durable, and practical solutions that greatly speed up extensive energy renovations.	[10]
2	SPARCS	EU project	PED	SPARCS aims to encourage the participation of residents in the energy market to transform urban areas into energy prosumers and involve the community. It seeks to introduce innovative solutions in buildings and mobility.	[41]
3	POCITYF	EU project	PEB and PED	POCITYF aims to demonstrate and replicate solutions for improving the energy system in buildings and districts, favouring renewable energies. It will support the transformation of historical cities into greener, smarter, and more liveable communities while maintaining their cultural heritage.	[42]
4	Triangulum	EU project	Smart City	Triangulum aims to show how technologies from the energy, buildings, mobility, and ICT sectors can be used in a single district to significantly reduce energy demand and local GHG emissions while also improving the quality of life and favouring economic growth.	[43]
5	+CityxChange	EU project	PEB and PED	+CityxChange creates positive energy block solutions that lead to positive energy districts and cities. It employs community engagement strategies and decision-support technologies to empower all community stakeholders to make well-informed decisions. It also implements reduction, flexibility, and energy efficiency measures.	[44,45]
6	SINFONIA	EU project	Smart City	SINFONIA aims to implement integrated and scalable energy solutions on a large scale. The target is mid-sized European cities.	[15,46]
7	ATELIER	EU project	PED	ATELIER aims to create and replicate positive energy districts (PEDs). Reducing obstacles to the adoption of clever solutions on a local level will boost the ecology of local innovation.	[47]

Table 1. *Cont.*

No.	Title	Type	Urban Model	Description	Main Ref.
8	SYN.IKIA	EU project	PED	SYN.IKIA aims to provide a model for sustainable plus-energy buildings and neighbourhoods. The goal is to achieve 100% energy savings, 90% of the energy produced from renewable sources, 100% GHG emission reduction, and 10% life cycle cost reduction, compared to Nearly Zero Energy Building (nZEB) levels.	[48]
9	Smart-BEEjS	EU project	PED	Smart-BEEjS aims to train Ph.D. students in policy making, planning, and business model innovation specialised in the energy and efficiency sectors.	[49]
10	MAtchUP	EU project	Smart City	MAtchUP aims to develop and use strategies that can convert urban issues into smart opportunities to create a more liveable urban environment for citizens.	[50,51]
11	GrowSmarter	EU project	Smart City	GrowSmarter aims to create smart city solutions that primarily target the issues of energy, infrastructure, and transportation. It is also intended to generate opportunities for replication in other contexts.	[52]
12	IRIS	EU project	Smart City	IRIS aims to provide energy and mobility systems creating cheaper, better accessible, reliable, and sustainable cities. The project seeks to incentivise citizens to become prosumers and improve their quality of life.	[53]
13	mySMARTLife	EU project	Smart City	mySMARTLife aims to increase the use of renewable sources, focusing on creating inclusive cities. The interventions also comprehend mobility and the use of ICT solutions.	[54,55]
14	smartENCity	EU project	Smart City	SmartEnCity seeks to develop sustainable, smart, and resource-efficient urban environments. Based on the implementation of measures for increasing energy efficiency and the renewable energy supply.	[56]
15	ProLight	EU project	PED	ProLight aims to lower energy consumption per capita and increase the proportion of renewable energy used in the housing sector. By following the European Bauhaus principles, the six demonstration districts should lead to a better quality of life for all targeted end users.	[57]

Table 1. *Cont.*

No.	Title	Type	Urban Model	Description	Main Ref.
16	CITYkeys	EU project	Smart City	CITYkeys seeks to create a set of indicators for the assessment of smart city initiatives. This approach is based on the needs of European cities and citizens and was developed with input from 40 other sustainable systems for smart urban performance.	[58]
17	Environmental sustainability approaches and positive energy districts: A literature review	Article	PED	Analysis of the scientific literature concerning the topic of positive energy district, with particular attention to the sphere of environmental sustainability.	[59]
18	Enabling Positive Energy Districts across Europe: energy efficiency couples renewable energy	Report	PED	Analysis of district-level energy performance objectives. It takes the idea of PEDs into account from a legal and economic perspective and confirms that the minimum energy performance standards on a district scale may be defined using the cost–benefit calculation technique of the EPBD.	[21]
19	Europe Towards Positive Energy Districts	Booklet	PED	Overview of different European projects based on the concept of the positive energy district model.	[60]
20	Positive Energy Districts Solution booklet	Booklet	PED	The booklet contains essential information for decision makers on how to create and manage a PED.	[61]

1. https://greendeal-arv.eu/ (accessed on 10 December 2022), 2. https://sparcs.info/en/ (accessed on 14 December 2022), 3. https://pocityf.eu/ (accessed on 12 December 2022), 4. https://triangulum.no/?lang=en (accessed on 12 December 2022), 5. https://cityxchange.eu/ (accessed on 12 December 2022), 6. http://www.sinfonia-smartcities.eu/en/project (accessed on 12 December 2022), 7. https://smartcity-atelier.eu/ (accessed on 14 December 2022), 8. https://www.synikia.eu/ (accessed on 12 December 2022), 9. https://smart-beejs.eu/ (accessed on 28 December 2022), 10. https://www.matchup-project.eu/ (accessed on 28 December 2022), 11. https://grow-smarter.eu/home/ (accessed on 14 December 2022), 12. https://irissmartcities.eu/ (accessed on 12 December 2022), 13. https://www.mysmartlife.eu/mysmartlife/ (accessed on 4 January 2023), 14. http://smartencitynetwork.eu/ (accessed on 12 December 2022), 15. https://www.prolight-project.eu/ (accessed on 8 February 2023), 16. https://cordis.europa.eu/project/id/646440 (accessed on 4 January 2023).

In the quest to identify multiple benefits, an evaluation of positive impacts was conducted within open-access operational documents through explicit and implicit forms and the examination of Key Performance Indicators (KPIs). The review of the scholarly literature revealed an absence of dedicated sections explicitly addressing multiple benefits. Consequently, the identification of benefits demanded a meticulous examination of the text itself, often requiring a diligent search throughout the material, as they were scattered throughout the documents. As the practice of analysing multiple benefits gains prominence, the expectation is for this information to become more accessible and systematically organised in future research endeavours.

In our case, the benefits derived from the articles were systematically categorised based on their respective articles and a list of 56 benefits has been obtained.

The list was reduced to 18 primary advantages by a careful selection procedure to capture only the most representative benefits. This curation process was guided by several discerning criteria. Firstly, the frequency of citations across multiple articles was considered, ensuring the selected benefits were supported by diverse sources. Secondly, a

preference was given to broader definitions over specific ones, aiming for inclusivity and relevance across varied contexts. Additionally, the perceived significance of each benefit was evaluated through an analytical review. This comprehensive evaluation ensured that the final list of 18 benefits encompassed a diverse range while also being pertinent and impactful.

The decision to settle on 18 benefits was strategic, aiming to strike a balance between comprehensiveness and manageability. This number was considered adequate to avoid overwhelming detail yet comprehensive enough to offer a holistic understanding. Furthermore, this specific count was chosen to facilitate the development of the questionnaires employing the best–worst scaling method.

Table 2 illustrates the multiple benefits selected through the described process. Each benefit is accompanied by a description provided by the authors that represents a broad definition derived from various definitions encountered in the references consulted.

Table 2. Most relevant multiple benefits derived from literature review and project screening.

No.	Multiple Benefits	Description	Ref.
1	Energy savings	Energy saving is given by the renewal of the district and by the use of sustainable actions that increase energy performance. This leads not only to savings from an economic point of view but also to a lower environmental impact. The implementation of measures that favour energy efficiency ensures less waste of energy and therefore a demand related to the real needs of the individual.	smartENCity, GrowSmarter, POCITYF, Triangulum, MAtchUP, mySMARTLife, IRIS, ATELIER, +CityxChange, SPARCS, Smart-BEEjS, ProLight
2	Overcoming energy poverty	By adopting sustainable energy solutions and helping citizens to decrease energy costs and consumption to an affordable level, it is possible to reduce the number of residents considered in an energy poverty situation. Consequently, also the number of deaths related to interior temperature shocks can be decreased.	SINFONIA, CITYkeys, POCITYF, ProLight, MAtchUP, IRIS, SCIS, Smart-BEEjS, SYN.IKIA, ARV
3	Increased energy efficiency	The project ensures an increase in energy efficiency at the district (and city) scale, maximising the share of renewable energies and their intelligent integration into the energy system.	MAtchUP, smartENCity, GrowSmarter, POCITYF, mySMARTLife, SPARCS, Smart-BEEjS, SYN.IKIA, +CityxChange, ProLight
4	Local labour market stimulated	Project-sponsored interventions and activities are expected to result in the creation of new employment and market opportunities, either directly with the initiative's solution providers and partners or indirectly through links with and inducement from the project.	GrowSmarter, CITYkeys, POCITYF, SINFONIA, MAtchUP, Triangulum, IRIS, smartENCity, SPARCS, Smart-BEEjS, +CityxChange, ARV
5	Innovation promotion	The innovations brought about are a benefit for the entire community, as they allow progress in building a more sustainable society. Furthermore, pioneering enterprises will also have a competitive advantage over other enterprises in the market. Innovative solutions may include technological, governance, and legislative improvements.	SINFONIA, smartENCity, MAtchUP, Triangulum, GrowSmarter, POCITYF, mySMARTLife, IRIS, SPARCS, [61]

Table 2. *Cont.*

No.	Multiple Benefits	Description	Ref.
6	Citizens involvement	End users' involvement in the decision-making process for the construction of their own community. Participating citizens will increase the likelihood that the outcome will be supported, and it will better meet the needs of the community.	Triangulum, smartENCity, MAtchUP, GrowSmarter, mySMARTLife, IRIS, CITYkeys, SPARCS, Smart-BEEjS, SYN.IKIA, ProLight, POCITYF, +CityxChange, ARV, [59]
7	Overcoming policy/regulatory barriers	The adoption of new solutions results in the identification of governmental barriers, legal issues, and security/data protection concerns. Therefore, it presents a chance to make useful recommendations for how to overcome them.	smartENCity, IRIS, ATELIER, POCITYF, SPARCS, +CityxChange
8	Knowledge creation and exchange	The collaboration of researchers and experts in the field leads to a fruitful exchange of knowledge, which also favours future developments. It also incentivises capacity-building, training, and awareness-raising opportunities.	Triangulum, smartENCity, MAtchUP, SPARCS, Smart-BEEjS, ATELIER, ARV, ProLight
9	Increased awareness on environmental and energy issues	The introduction of energy-efficiency solutions, combined with an explanation of how to promote energy sustainability, raises user awareness, which may lead to behavioural changes. Greater information is considered to benefit not only the inhabitants of the project's impacted areas but the community as a whole.	SINFONIA, smartENCity, GrowSmarter, Triangulum, MAtchUP, mySMARTLife, IRIS, POCITYF, ATELIER, Smart-BEEjS, SYN.IKIA, +CityxChange, ARV, ProLight, [61]
10	Improved quality of life of the inhabitants	The living and psychological conditions of inhabitants can be improved by greater quality of the buildings, indoor thermal comfort, and reduction in environmental, acoustic, and olfactory pollution.	CITYkeys, martENCity, SINFONIA, Triangulum, MAtchUP, GrowSmarter, mySMARTLife, ATELIER, ARV, SPARCS, SYN.IKIA, POCITYF, ProLight, [59]
11	Improved indoor comfort	A good energy efficiency system leads to the improvement of thermal, humidity, and living comfort.	GrowSmarter, smartENCity, IRIS, Smart-BEEjS, SYN.IKIA, POCITYF, ATELIER, ProLight, [59]
12	Territorial quality and attractiveness increased	An area that is an example of smart and sustainable development might attract tourists who are environmentally conscious as well as institutions, professionals, and researchers.	SINFONIA, MAtchUP, GrowSmarter, POCITYF, SPARCS, [60]
13	Local air quality improved	Utilising renewable energy sources for energy production and consumption instead of fossil fuels will have a lot of significant positive effects on society and the environment. For instance, it will contribute to reducing the amount of pollutants in the air and the urban heat island effect and, as a consequence, the air quality will increase.	SINFONIA, GrowSmarter, Triangulum, MAtchUP, SPARCS, POCITYF, SYN.IKIA, +CityxChange, ARV
14	Reduced fossil fuel dependency and import	Utilising renewable energy sources for energy production and consumption reduces fossil fuel dependency, contributing to increasing the security of the energy supply.	smartENCity, GrowSmarter, SPARCS, Smart-BEEjS, [61]

Table 2. *Cont.*

No.	Multiple Benefits	Description	Ref.
15	Increase in property value	Buildings with attractive and innovative features that are also high performing in terms of energy have a property value premium that is greater than the estimated economic benefit of the energy savings.	SINFONIA, SPARCS, [59]
16	Increased investment prospects and investor confidence	The vision of a project that brings benefits to society, also in economic terms, fosters the confidence of investors who will be more inclined to finance future similar interventions; this will create new economic incentives for promoting energy-efficient districts and sustainable mobility actions.	smartENCity, MAtchUP, SPARCS, Smart-BEEjS, POCITYF, +CityxChange
17	Economic saving	The redevelopment of the area with more cutting-edge and sustainable solutions makes it possible to reduce the prices for energy and heating buildings. The advantages are found in the reduced initial costs, maintenance, and in general of the entire life cycle of the buildings (in fact, proper management of large-scale interventions allows economies of scale). Moreover, the stakeholders and inhabitants can benefit from the increased economic value of real estate, higher performances, and additional revenue from delivering specific energy services.	SINFONIA, CITYkeys, smartENCity, MAtchUP, IRIS, Smart-BEEjS GrowSmarter, Triangulum, MAtchUP, SPARCS, POCITYF, SYN.IKIA, +CityxChange, ARV, ProLight, [61]
18	Increased neighbourhood safety	Thanks to the redevelopment of the place in many aspects, it is expected that the neighbourhood will become safer for citizens.	MAtchUP, CITYkeys, GrowSmarter, SPARCS, ARV

The benefits were then categorised into four broad categories, each encompassing distinct aspects of society: social, governance, environmental, and economic. In turn, there is an almost perfect correspondence between ESG (nonfinancial) and economic criteria.

- Social refers to the impact on individuals and communities, encompassing aspects such as well-being, equity, and social cohesion.
- Governance concerns structures and processes of decision making and regulation within society, including elements such as transparency, collaboration between different levels of government, and long-term planning frameworks.
- Environmental involves the effects on the natural world, including conservation, sustainability, and the preservation of ecosystems and biodiversity.
- Economic relates to the financial implications and prosperity within society, covering factors such as employment, income distribution, and overall economic growth.

As illustrated in Figure 2, numerous identified multiple benefits intersect across multiple categories. This observation is significant as it underscores the interconnected nature of these benefits and emphasises their potential to yield positive impacts across society as a whole. This reveals that improving one area, like the environment, can positively affect others, such as social well-being or economic prosperity. This knowledge is essential for accurate and integrated decision making, since it emphasises the necessity of considering the wider effects and possible synergies that may result from initiatives or projects.

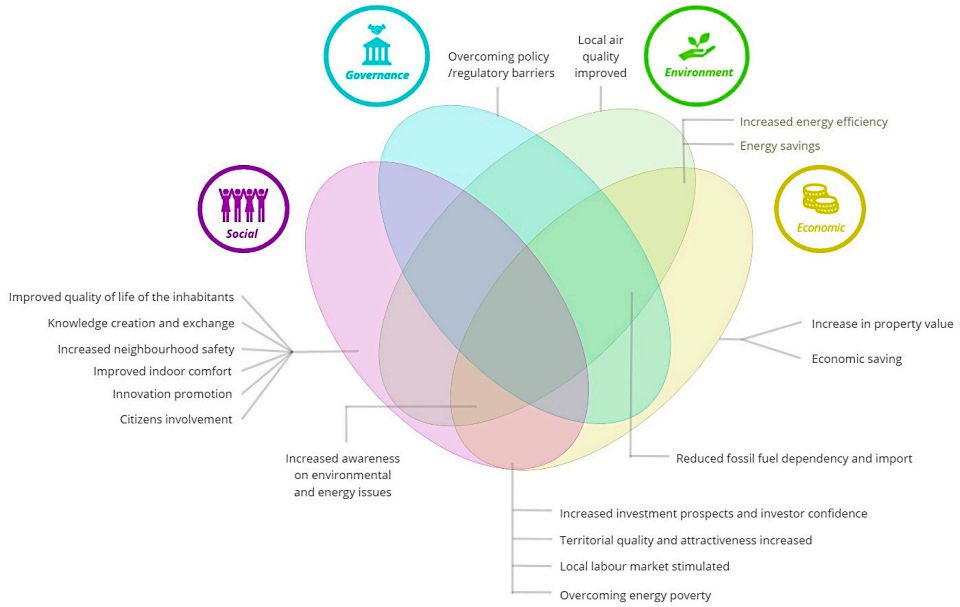

Figure 2. Multiple benefits classified by categories.

3.2. STEP 2: Collaborative Sessions with Project Partners

In this phase, the consultation process involved engaging with project partners closely associated with the targeted initiatives (ARV and ProLight).

Project partners serve as the foundation of project consortia, since they drive the development of the project's implementation. They generally come from a variety of countries particularly those included in the case studies, and they are representative of various sectors. They include research institutes, industrial players, companies, municipalities, and governmental bodies. In addition, the network of partners extends beyond conventional boundaries to include clusters, funding agencies, consulting firms, and professional associations.

Project partners work together to contribute their expertise, resources, and networks to achieve the objectives outlined in the project proposal. Each partner brings a unique set of skills and perspectives to the project, facilitating multidisciplinary collaboration and maximising the project's impact. The main purpose of consulting with them is to comprehensively capture the multiple benefits that could result from implementing such projects within specific areas or contexts.

This stage should be conducted with thoroughness, encompassing two levels of detail to capture a deeper understanding. The initial level focuses on a broad overview, outlining the general benefits and potential impacts of the project. Subsequently, a deeper examination should be carried out, focusing on the single case studies for each project. Although each of the two projects has a general framework, each of their individual case studies undergoes a unique implementation process. Their unique contexts, diverse in cultural, legal, climatic, and geographical aspects, play a significant role in shaping the specific benefits expected from the proposed changes within their respective areas.

The insights and outcomes generated during these workshops would be instrumental in refining the survey materials and aligning them with the perspectives and priorities of the project stakeholders.

3.2.1. Collaborative Sessions with All Project Partners

A dedicated workshop should be conducted for each project, aimed at gathering insights and discussions from project partners. The purpose of this initial phase is to serve as a preliminary step to understand the multiple benefits of the entire projects before engaging separately local partners in the survey process to tailor the list of positive impacts. Through this collaborative approach, knowledge exchange can be fostered, allowing for the identification of both shared and unique benefits. This can significantly contribute to a more

comprehensive understanding of the varied advantages resulting from the implementation of these projects.

For both the ARV and ProLight projects, workshop participants, approximately 30 per project, were instructed to utilise the collaborative online platform known as Miro (https://miro.com/it/, accessed on 10 March 2023). This platform served as a virtual workspace for conducting workshop activities seamlessly. Miro was chosen for its ability to accommodate multiple users at the same time, facilitating continuous interaction and simultaneous online viewing. Once accessed, participants encountered a workshop-tailored board on the platform, ensuring parity in brainstorming and engagement for both in-person and remote attendees. The Miro board also incorporated findings from the literature review, serving as a reference and inspiration for participants to identify and document the benefits linked to implementing each analysed project.

The participants actively contributed by sharing their insights during a joint brainstorming session. Each person listed at least 10 benefits from the project considered, even if these were mentioned before, ensuring all advantages were captured. This emphasis on inclusivity aimed to compile a concise and comprehensive final list based on both individual significance and the frequency of occurrence noted by participants. To embrace the various dimensions through which the project's multiple benefits might manifest, workshop participants were asked to classify these advantages using a four-set Venn diagram. This diagram integrated the four principal categories: Social, Governance, Economic, and Environmental, offering a holistic representation of the potential scopes of project benefits. This approach facilitated a visual representation illustrating how the benefits intersected and converged within different categories.

Once the participants contributed to filling out the diagram during the workshop, similar-meaning benefits were grouped to prevent redundancy. Subsequently, a selection of 18 elements was made to create a finalised list, which underwent review and agreement by the participants. This selection process considered the perceived importance and impact of the multiple benefits, as well as the frequency of repetition for each concept.

3.2.2. Collaborative Sessions with Local Partners

Once the general multiple benefits of the project have been identified, the next step involves examining the specific benefits that each case study can offer to its respective area. This phase necessitates collaboration with local-level case study partners. As the benefits may differ slightly from those of the entire project, it is crucial to conduct separate sessions for each case study. Furthermore, this approach aims to prevent the influence of different case study partners on each other's benefit choices.

Given the likely smaller number of local partners participating in these workshops, usually two or three at a time, the recommended brainstorming method involves presenting a range of multiple benefits from similar projects (see Section 3.1), previous workshops involving all partners (see Section 3.2.1), and existing preliminary studies and project deliverables related to the specific case studies. Participants are then tasked with selecting the most pertinent multiple benefits for their case study and suggesting additional ones as needed. This process can be facilitated through the Miro online platform. Participants are not only encouraged to write down the benefits but are also asked to actively participate in discussions regarding the pertinence of each identified benefit concerning the specific case study.

The workshop's tangible outcome comprises once more an inventory of 18 multiple benefits. These lists are crucial in formulating a questionnaire intended for circulation among stakeholders engaged in each project's case study, as detailed in the following section.

3.3. STEP 3: Questionnaire on the Most Relevant Multiple Benefits

At this point, project stakeholders are invited to complete a questionnaire that aims to identify the most significant benefits associated with each project's case study. Participants are asked to rank these benefits based on their respective roles in the project. The goal

is to establish a priority ranking of the most relevant benefits, providing insights into the preferences of different stakeholder groups. This process helps in comprehending the objectives of each demonstration case and contributes to implementing changes that align with the needs and aspirations of its residents. Additionally, it facilitates the phase of communication of improvements resulting from the project's implementation. The analysis can thus clarify the different perceptions, which arise from the different needs of the various stakeholder groups. Understanding that an element may be perceived as a significant benefit by one stakeholder group but less beneficial by another underlines the importance of assessing perspectives comprehensively.

Since the intention is to study the multiple benefits as a result of project implementation on the territory, a questionnaire has to be created for each case study. In the case of both ProLight and ARV, six questionnaires should be created. The use of the best–worst scaling technique in this questionnaire ensures reliable outcomes with minimal effort required from the respondents. In alignment with the theory outlined in Section 2.3, the questionnaire is designed to force respondents to select a benefit they consider most relevant and one they consider less relevant from a set of six items. In the examples of ARV and ProLight, 18 previously chosen elements are considered, necessitating the repetition of this process nine times. In the end, each benefit will have been presented to the respondent three times, in comparison with different benefits (Table 3).

Table 3. Examples of task sets used in the BWS survey addressed to ARV project partners.

The Most Relevant	Task 1	The Least Relevant
○	Increased energy efficiency	○
○	Reduced energy fossil fuels	○
○	Increased in property value	○
○	Citizen involvement	○
○	Improved quality of life of the inhabitants	○
○	Climate change awareness	○
The Most Relevant	**Task 3**	**The Least Relevant**
○	Respect of human rights	○
○	Increased energy efficiency	○
○	Citizen involvement	○
○	Innovation in governance processes	○
○	Energy costs reduction	○
○	Energy poverty reduction	○
The Most Relevant	**Task 9**	**The Least Relevant**
○	Territorial quality and attractiveness	○
○	Increase in property value	○
○	Increased comfort levels	○
○	Climate change awareness	○
○	Economic savings	○
○	Fostering technological innovation	○

To refine the study of multiple benefits, the questionnaire was enriched with questions related to gender, age, and participants' role in the project case study. Additionally, a

question was introduced asking participants to express their opinion on the aspect that should be given the highest consideration in an urban redevelopment project, choosing from economic, social, environmental, or governance aspects. Including the latter question in the survey seeks to identify respondents' primary sensitivity among these categories and validate the consistency of their responses. This is crucial, because each benefit could align with one or more of these categories and, therefore, it could be noticed if there was a consistency or otherwise between the final ranking of multiple benefits and the importance attributed to each category in the separate question.

The questionnaire proposes a list of possible roles of each respondent within the case study defined based on a preliminary stakeholder mapping study, which generally is already conducted within the framework of these kinds of projects.

Therefore, this question was constructed to be slightly different for diverse case studies, since the stakeholders who have implications in practice are not always the same. An example of stakeholders' categories may be the following: Cultural Promoter (neighbourhood committee, student association, and cultural foundation), Non-resident urban user (commuter, tourist, and co-worker), Financial Actor (Chamber of Commerce, construction sector association, and Confindustria), Local Authority (district, municipality, and province), Citizen (owner and-tenant), Researcher (research-institutes and-universities).

Due to the variety of stakeholders, methods of reaching potential respondents are diverse. They encompass participation in local events, direct engagement based on existing connections, and outreach through online platforms and websites. To be more effective, the questionnaires should be translated into the local language.

3.4. STEP 4: Elaboration and Dissemination of the Results

Effective dissemination of the results is crucial, especially to comprehensively analyse the multiple benefits that contribute to the success of the project. Dissemination takes place through various means, including project results, articles published in journals, and the organisation of local public events. These events serve as platforms to present and learn more about the specific project, promoting broader understanding and engagement with the community. This proactive approach enhances the overall impact and success of the initiative, ensuring that the project results and benefits are communicated widely and transparently.

4. Preliminary Results

Although the application of the methodology on the ARV and ProLight projects has not yet been fully concluded, it is possible to outline some preliminary observations and results.

Despite differing methods in multiple benefits identification, the study revealed a significant overlap between the benefits identified in workshops and those found in the literature review (Figure 3). These shared benefits underscore the consistent positive impacts achievable through these models of urban and energy requalification projects.

The social category emerged as highly significant in both initiatives, indicating its massive importance. Moreover, it is essential to highlight the numerous connections identified within these categories, suggesting that the benefits identified during the workshops could positively influence various societal aspects beyond the social domain alone. Participants' recognition of these interconnections emphasises their comprehensive understanding and consideration of the broader societal implications of the projects.

The activity of disseminating questionnaires and collecting data at the local level is still ongoing, but the procedure was initially tested on project partners, considering the multiple benefits of the entire project. Following the scheduled workshops, the questionnaires were distributed and completed; 20 replies were obtained for ProLight and 21 for ARV. Although the responses to the questionnaire may seem limited, they are in line with expectations, considering that the target group is the project partners, who represent a relatively small group.

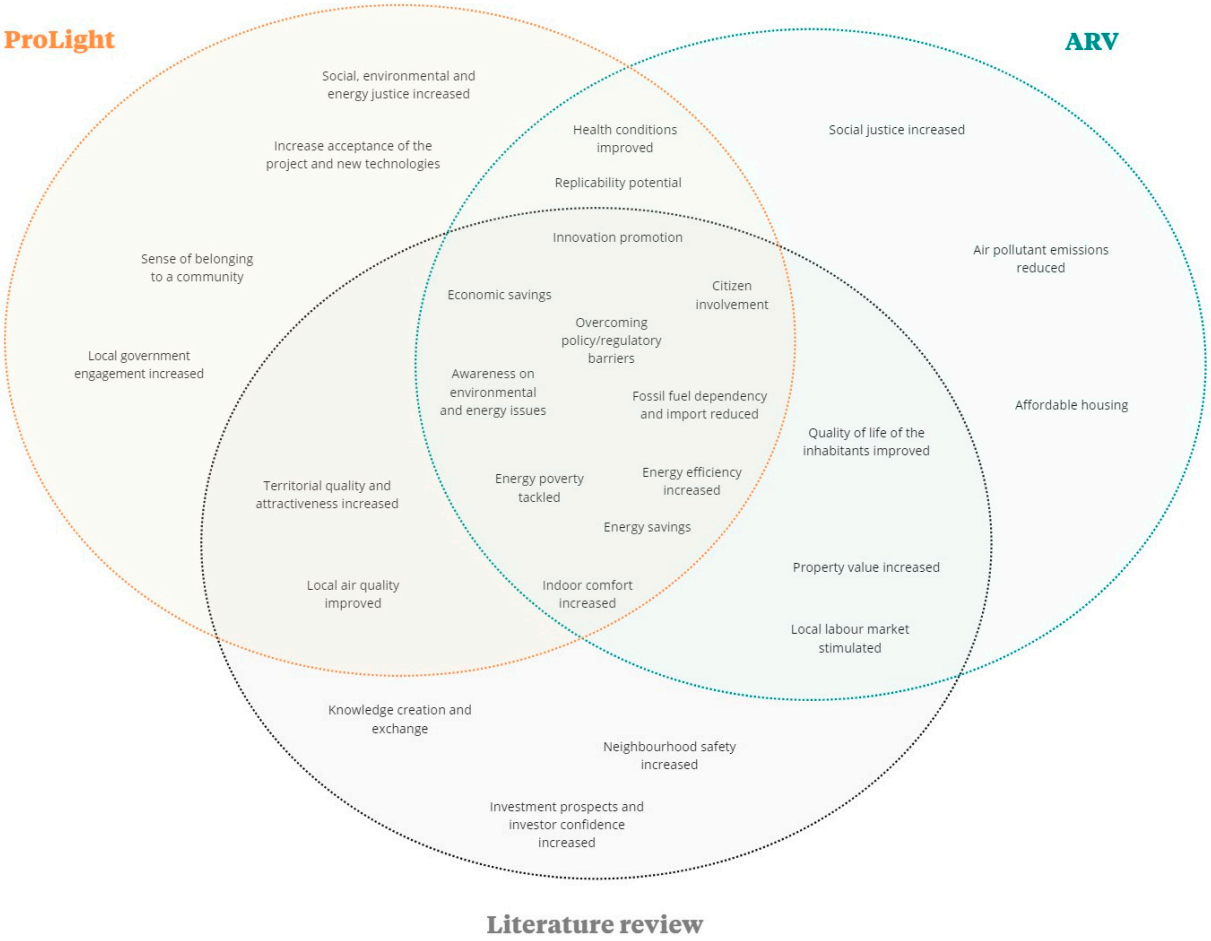

Figure 3. Linkages of multiple benefits between the two projects and the literature review.

Similar trends have been observed across different projects (Table 4).

Table 4. Ranking of multiple benefits according to the perception of ARV and ProLight project partners.

Predominant Category	Multiple Benefits	ARV	ProLight
Environmental	Increased energy efficiency	1	1
Environmental	Reduced energy fossil fuels	4	/
Environmental	Reduced air pollutants	15	/
Environmental	Energy savings	/	4
Environmental	Reduce CO_2 emissions	/	6
Environmental	Local air quality improved	/	16
Social	Improved quality of life of the inhabitants	2	/
Social	Energy and environmental consciousness	3	/
Social	Citizen involvement	5	9
Social	Energy poverty reduction	6	5
Social	Territorial quality and attractiveness increased	9	15
Social	Climate change awareness	11	/
Social	Increased comfort levels	12	/
Social	Respect of human rights	14	/
Social	Investing in architectural training	16	/

Table 4. *Cont.*

Predominant Category	Multiple Benefits	ARV	ProLight
Social	Increased awareness on environmental and energy issues	/	2
Social	Adaptation of personal behaviours for limiting climate change	/	3
Social	Energy and social justice	/	7
Social	Creation of energy communities	/	8
Social	Social cohesion	/	10
Social	Improved indoor comfort	/	11
Social	Sense of belonging	/	17
Economic	Energy cost reduction	8	/
Economic	Economic savings	10	/
Economic	Off-site construction market improved	13	/
Economic	Increased in property value	17	/
Economic	Resilience to energy price fluctuation	/	13
Governance	Fostering technological innovation	7	/
Governance	Innovation in governance processes	18	/
Governance	Local governance improved	/	12
Governance	Overcoming policy/regulatory barriers	/	14
Governance	Innovation promotion	/	18

The aspect deemed most important in both projects is the focus on increasing energy efficiency, followed by benefits related to raising awareness of environmental issues. Although the lists of benefits were customised for each project by different individuals, the significance of the environmental issue and its educational aspect is recognised as a priority over other benefits by the project partners. This aligns perfectly with the priorities outlined in recent guidelines, such as those of the New European Bauhaus. Another similarity lies in the positioning of economic benefits, which are predominantly ranked in the second half of the list. This suggests that economic aspects, although important, are considered less pivotal than other benefits by the samples of project partners in the context of urban and energy redevelopment. A similar observation can be extended to the governance category. Upon reviewing the two rankings, it becomes evident that the project partners of ARV and ProLight are closely aligned.

Interestingly, despite respondents not having access to benefit lists compiled by other project partners, the lists from different cases showed similar percentages of benefits within each macro-category across the list of multiple benefits of the projects, with a predominance of the social and environmental categories (Table 5). This observation is relevant because it denotes further confirmation of the consolidation of a common direction, and thus of the main benefits, in current urban and energy regeneration projects.

Table 5. Occurrence in the percentage of multiple benefits by their prevalent category in ARV and ProLight projects.

Category	ARV	ProLight
Economic	16.67%	5.56%
Social	55.56%	61.11%
Environmental	22.22%	22.22%
Governance	5.56%	11.11%

Since the questionnaire testing phase was conducted within the project consortium, the sample is very different from the one that we could obtain delivering the questionnaire to the overall stakeholders of each demonstration case. The background and the perspectives of the sample of the project partners are expected to be more homogeneous than the one of the stakeholders. In any case, this test provided valuable insights into the perspectives of

the project partners. Through this process, a deeper understanding of their perspectives was gained, which informed decision-making and collaboration strategies for the future.

For what concerns the local level, the distribution of the questionnaire is ongoing to expand its reach through dissemination at community meetings, various remote communication platforms, and personal contacts. This strategy aims to foster broad involvement and participation.

During the interactive sessions with demo leaders, which lasted approximately half an hour each, various discussion points and pertinent details regarding the demos emerged. This moment provided a valuable opportunity to assess the current status of the projects, clarify the direction of each demo, and identify both strengths and areas for improvement.

Although still in progress, the questionnaire began to be disseminated in Trento, starting with an event open to the citizenship, where the project's progress was discussed. On this occasion, the multiple benefits of the project were presented, which were useful to make all the positive impacts of the project understood, especially by the citizenship.

5. Discussion

To successfully promote energy transition, it is essential to adopt more sustainable territorial planning, transforming urban spaces into smart neighbourhoods and cities. The analysis and communication of the advantages arising from such projects constitute an effective approach to garnering support from communities, often resistant to change, and from investors.

This article introduces an innovative methodology for the multiple benefits analysis in relation to urban and energy redevelopment projects, emphasising stakeholder involvement and employing the Best–Worst Scaling method for constructing questionnaires. This approach enhances decision-making procedures and guarantees conformity with community requirements, helping to redefine strategies for a greater urban energy transition.

In addition to theoretical explanation, the discourse is enriched with practical insights from European projects, namely ARV and ProLight, to demonstrate the methodology's efficacy and its potential to capture the broad range of perspectives of different stakeholders that these initiatives can provide. The results of both projects emphasise a common emphasis on environmental improvements and greater citizen involvement. Comparing these findings with a 2020 study on SINFONIA's co-benefits [15], a change in priorities emerges, with SINFONIA emphasising economic and individual health co-benefits. This discrepancy may be an indication, together with variations in stakeholder sensitivity and contextual differences, of potential changes in societal values and trends. The approach described in the article aims to capture the diverse perspectives of stakeholders, suggesting its applicability in different cultural contexts and indicating whether perceived benefits are universal or specific.

The study's engagement with stakeholders via the best–worst scaling methodology revealed both strengths and weaknesses. While the approach facilitated stakeholder involvement, concerns arose regarding its length and potential for stakeholder fatigue. Future research could mitigate these issues by streamlining the selection process and incorporating open-ended questions to capture additional stakeholder perspectives.

Another next development is to integrate multiple benefits with key performance indicators (KPIs) and quantify them in a more objective and quantitative way. This facilitates the association of benefits with corresponding KPIs and economic value, improving the rigor of the evaluation process and providing a structured framework for understanding economic impact. In fact, this method heavily relies on stakeholders' perceptions rather than quantitative data, which can be limiting. Therefore, further analysis quantifying aspects such as willingness to pay would enhance the significance of this study and allow decision makers to prioritise and allocate resources effectively, maximising the positive outcomes of urban projects.

Moreover, further research could explore proactive strategies to mitigate potential negative impacts and examine the applicability of the methodology outside European contexts.

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