



D7.3: Monitoring and Evaluation Handbook

VARCITIES | Work Package 7, Task 7.3

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Abbreviation list

Term	Description
KPI	Key Performance Indicator
VS	Visionary Solution
M&E	Monitoring & Evaluation
TFII	Task Force 2
UTCI	Universal Thermal Climate Index
SROI	Social Return on Investment
NDVI	Normalised Difference Vegetation Index
GIS	Geographic Information System
AQI	Air Quality Index
PET	Physiological Equivalent Temperature
NBS	Nature Based Solutions
UGI	Urban Green Infrastructure



Executive Summary

This report presents the final Monitoring and Evaluation (M&E) Handbook of the VARCITIES project, which implemented Visionary Solutions (VS) to enhance health, well-being, and resilience in seven pilot cities across Europe. Building on the preliminary results of D7.2, this deliverable consolidates the Key Performance Indicator (KPI) data collected between 2022 and 2025 and evaluates the impacts of VS implementation.

The Handbook establishes a comprehensive evaluation framework grounded in the EKLIPSE challenges and Task Force II guidelines. Over 150 KPIs were monitored across environmental, social, cultural, digital, economic, physical, and psychological dimensions. Data was gathered through a mix of field measurements, digital sensors, surveys, and participatory evaluation processes, ensuring both quantitative robustness and qualitative insights. The pilots adapted their KPIs throughout implementation to respond to political, social, and environmental shifts, highlighting the importance of flexible, context-sensitive M&E design.

Results show that VARCITIES interventions delivered significant multi-dimensional impacts. Environmental value includes (among others) added data on air and noise pollution, micro-climatic conditions and vegetation data. Social and cultural benefits emerged through enhanced accessibility to green spaces, higher citizen participation in co-creation, and strengthened inclusivity for vulnerable groups. Health and well-being improvements were demonstrated in increased outdoor activity, better perceived quality of life, and reductions in anxiety and loneliness. Economically, pilots reported the creation of jobs, new cultural and business opportunities, and projected healthcare cost savings.

Cross-site comparisons reveal both common strengths and context-specific challenges. Shared success factors include strong participatory governance, integration of digital monitoring tools, and visible enhancement of public spaces. Challenges included data collection delays due to construction works, vandalism of sensors, and difficulties in sustaining engagement across transient populations. Nonetheless, the final KPI evaluations confirm the high replication potential of several VS, which were rated positively by follower cities and external stakeholders.

This Handbook when used also in conjunction with D7.2 provides not only a record of VARCITIES achievements but also a methodological blueprint for cities seeking to adopt similar approaches. The KPI methodologies have already been presented in



D7.2. In this Deliverable, the methodologies are consolidated with the new KPIs. It demonstrates how robust M&E can capture the multiple co-benefits of nature-based and socio-cultural urban interventions, strengthening the evidence base for sustainable urban policy and planning. The lessons learnt and best practices distilled here will be expanded in Deliverable D7.4, supporting the replication and scaling of Visionary Solutions beyond the project's lifetime.

1 Introduction and scope

The scope of D7.3 is to outline the key outcomes emerging from the key performance indicator (KPI) measurements that were taken during the project to measure the impact of Visionary Solutions (VS) from the various health and wellbeing perspectives; the social, environmental, digital, economic, cultural, physical and psychological. These perspectives are included in the following section (see Table 1) as the topics attributed to each KPI, and furthermore as criteria for the evaluation of VSs. In D7.3, results from the KPI evaluation are included in Annex II to avoid cluttering the core document. Cross-comparisons between the pilot case-studies in instances where the same methods have been applied are also presented.

This deliverable expands on the preliminary findings reported in D7.2 as well as the KPI methodologies. The final KPI results collected by the pilots and their analysis within the context of the VSs are also provided. The document serves as a handbook for the monitoring and evaluation (M&E) of their implementation. The monitoring methods, documentation of the data collection procedure and evaluation strategies are outlined in Annex I to avoid cluttering the core document. These methodologies are to be used in conjunction with those already presented in D7.2 as a final consolidation of the full list of KPIs. The KPI results are shown in Annex I, once again to maintain the core document readability. The assessment of the VS implementation and performance are also provided. The scope of the document is therefore to have a city M&E handbook with data sets, metrics, KPIs, collection methods, monitoring framework, lessons learnt from pilot activities, improvements in health achieved, evaluation strategies and tools utilised and conditions of each pilot.

This document provides a basis on the lessons learnt, multiple benefits and best practices will be developed and reported in D7.4 as a follow up of these outcomes. The various data specifications, such as units of measurements, data collection sources, data collection tools, types of data and expected impact or outcome, are also being included in Annex II. The main task associated with the work reported in D7.3 is T7.3 - Evaluation of results and lessons learnt [M12-M60], involving the work of all pilot representatives and their experts. This task synthesised the data related to the pilots' implementation process through a diversity of evaluation methods to extract findings that assess the effectiveness of VS for future implementation. It also communicates the final evaluation results and develops these recommendations for implementation based on these findings - to be reported in D7.4.



2 Guidelines for choosing Indicators

2.1 Changes in KPIs

This section presents the latest KPIs that have been measured across all the pilot sites and serves as a reference point for the following sections. Throughout the implementation and stakeholder engagement process, the need to make changes to adapt to the political, social and environmental situation, mitigate risks and include measures for improvement has come up organically in every pilot case-study. It was therefore crucial to make necessary changes to the KPIs being measured to reflect these changes. A consolidated list can be found in Table 1.

The EKLIPSE Framework Challenges were used as reference for the development of the KPIs. Some of the KPIs are following the recommendations in this framework and the Task Force 2 (TFII) Handbook, while others were created in addition to measure specific aspects of the VS that have been implemented in the pilot sites. The expected impact of each KPI is also delineated in Table 1. In general, the M&E process requires measuring KPIs from multiple challenges to understand if they have reached their expected impact or outcome. This process enabled WP7 to identify the main aspects where the implementation of the VSs has been successful. More details about the KPI evaluation strategy are included in Section 3.3. Lastly, the topic section links the KPIs to the health and wellbeing perspectives and criteria mentioned above, which serves as a reference to understand which of the criteria have been most impacted through the implementation. Once the KPI results have been collected, the evaluation phase commenced to assess the impact using various methods explained in the next section. Each KPI has a specific scope, and its own method that was applied. In general, and where possible, similar methods were recommended to the pilots by WP7 to enable cross-comparisons between the data collected in the sites. Inevitably there were cases where the KPI measurements and methods being carried out could not be applied in the same way, mainly due to the diverse nature of their VSs. While some pilots focused more on taking direct measurements of the infrastructural implementation process, others sought to add value through the increase of scientific data on various local sites.

In WP6, some VS have been grouped and presented as a whole. Based on the data collected, the performance of each VS group is analysed to understand which topics and challenges have been most affected or unaffected by the VARCITIES implementation and co-creation process. Successful KPIs will be identified and promoted as best practices that should be adopted when these solutions are implemented in other cities. This information is further detailed in D7.4.

2.2 Holistic guidelines for choosing KPIs

Since this document is intended to provide overall guidance on monitoring, Figure 1 shows the approach that can be used where the KPIs can be chosen from some framework (in this case the EKLIPSE framework) and then, depending on the visionary solutions as well as the various health and well-being perspectives that are considered and their respective expected outcomes one can optimise and redefine the KPIs. In a way this is a feedback loop to refine KPIs that can then later on be monitored and eventually evaluated.

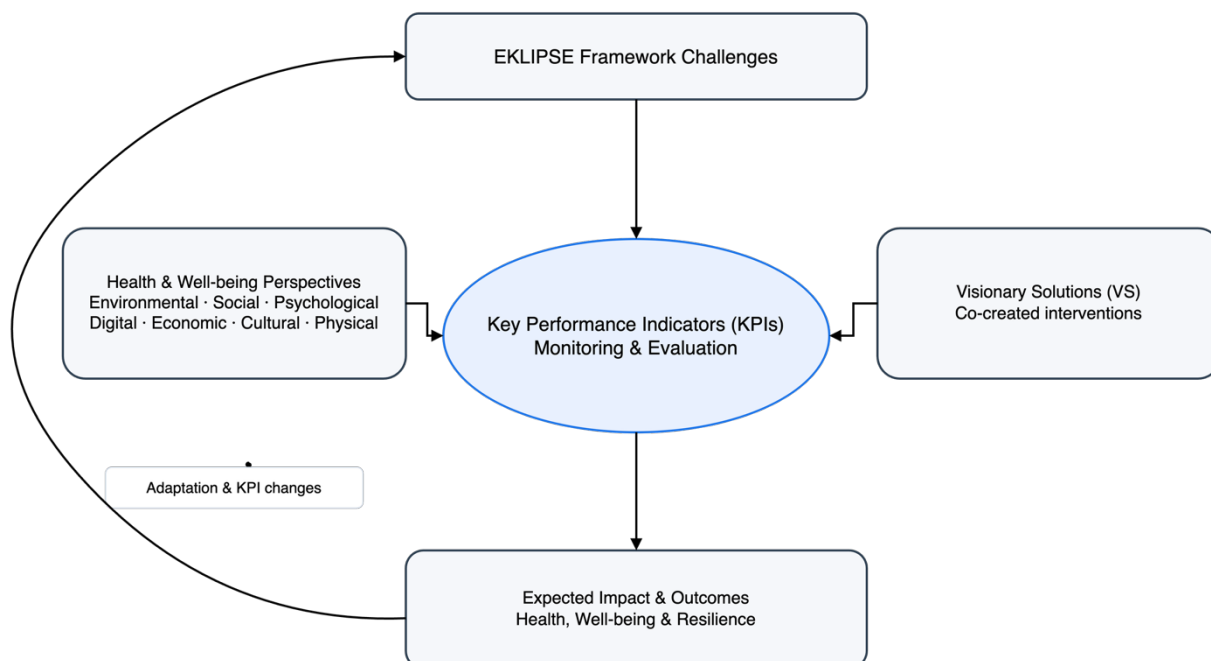


Figure 1 - Holistic framework for choosing Key Performance Indicators (KPIs) in VARCITIES, linking EKLIPSE framework challenges, health and well-being perspectives, Visionary Solutions and expected impacts.

ID	EKLIPSE CHALLENGE	INDICATOR	Expected Impact	Topic	SE (Skellefteå)	IE (Dundalk)	IT (Castelfranco)	SI (NovoMesto)	MT (Gżira)	GR (Chania)	BE (Leuven)
1.1	1. Climate Mitigation and Adaptation	C removed/stored by vegetation	Increased carbon sequestration data	Digital				x	x	x	
1.2		Decrease in mean or peak daytime local temperatures	Increased temperature data	Environmental						x	x
1.3		Measures of human comfort	Increased temperature data on human comfort	Environmental			x	x		x	x
1.4		Energy	Energy savings from lighting upgrades and improvements	Environmental	x	x					
1.5		Local energy production from renewable energy sources	Increased energy savings	Environmental		x				x	
1.6		TXx, Monthly mean value of daily maximum temperature	Increased temperature data	Digital						x	
1.7		Cooling of ambient air	Increased temperature data	Digital						x	
1.8		No. of temperature and humidity data	Number of temperature and humidity data added	Digital			x			x	x

2.2	2. Water Management	Water retention capacity by vegetation and soil	Increased water retention capacity by vegetation and soil	Environmental	x						
2.3		Water quality physical parameters: temperature, odour, taste, turbidity, transparency, colour	Increased water quality data	Digital							x
2.4		Reduction in water routed to urban sewerage system	Reduction in water routed to drainage network	Environmental		x					
2.6		Water quality indicators (chemical, biological)	Increased water quality data	Digital	x						x
2.7		Economic benefit of reduced stormwater to be treated in public sewerage system	Reduction in water routed to drainage network / Reduced costs for sewerage treatment	Social	x						
2.8		Avoided runoff	Increased data about reduced water runoff due to vegetation	Digital						x	
4.1	4. Green Space Management	Surface of public GS per capita	Increased public green space surface per capita	Social					x		
4.2		Accessibility of urban GS for population	Increased accessibility of urban green spaces	Social		x		x	x		x

4.3	4.3.a Recreational (number of visitors) value of GS	Increased recreational value of green spaces	Social	x	x	x	x	x	x	x
	4.3.b Cultural (number of cultural events) value of GS.	Increased cultural value of green spaces	Social	x	x	x	x	x	x	x
4.4	Weighted recreation opportunities provided by UGI	Increased weighted recreation opportunities provided by Urban Green Infrastructure	Social				x			
4.5	Nature based recreation opportunities	Increased Nature Based recreation opportunities	Social				x			
4.6	Proximity of GI to green travel routes	Increased accessibility of urban green spaces	Social		x					
4.7	Green-related social service provided to population	Increased Green-related social service provided to population	Social				x		x	
4.9	Effectiveness of seating locations	Increased use of green public space facilities	Social		x	x				

4.11	Species richness and composition with respect to indigenous vegetation and local/national biodiversity targets	Increased urban biodiversity	Environmental	x	x			x		
4.12	Total area of designated sites of local biodiversity importance within the city (habitat/species management areas)	Increased urban biodiversity	Environmental	x						
4.13	Sustainability of green areas	Big savings in operational cost	Social	x						
4.14 a	Increased connectivity to green infrastructure	Increased connectivity to green infrastructure	Social				x			x
4.14 b	Increased connectivity to sports facilities	Increased connectivity to sports facilities	Social							
4.15	Pollinator species increase	Increased urban biodiversity / Increased pollinator species	Environmental	x						
4.19	Increased data on singing birds in green zones	Increased data on singing birds in green zones	Digital			x				
4.21	No. of Sensory Elements	Increased data from sensors	Digital			x				

4.22	5 Air/Ambient Quality	Total vegetation cover (total leaf area)	Increased data on total vegetation cover	Digital						x	
4.23		Tree species composition in the GS and percent of live tree population by area of native origin	Increased data on tree species composition	Digital						x	
4.24		No. of vegetation data	No. of vegetation data added	Digital						x	
5.5		Physical air quality indicators: temperature, humidity, etc.	Increased (physical) air quality data	Digital			x	x		x	x
5.6		Chemical air quality indicators (Concentration of particulate matter (PM10 and PM2.5), NO2, SO2, CO, NH3, CL, CO2 and O3 in ambient air)	Increased (chemical) air quality data	Digital		x	x	x	x	x	x
5.7		Air pollution episodes	Increase of air pollution data	Digital					x		
5.10		Modelled O3, SO2, NO2 and CO capture/removal by vegetation	Increased air quality data (air chemical capture/removal by vegetation)	Digital						x	

5.11		Total particulate matter removed by vegetation	Increased air quality data (on total particulate matter removed by vegetation)	Digital						x	
5.12		Oxygen production	Increased air quality data (on oxygen production)	Digital						x	
5.13		European Air Quality Index	Increased air quality data (European Air Quality Index)	Digital, Environmental						x	
5.14		No of days during which air quality parameters exceed threshold values	Increased air quality data (exceeding threshold values)	Digital, Environmental						x	
5.15		No. of air quality data	Increased number of air quality data added	Digital, Environmental						x	
6.4	6. Urban Regeneration	Reclamation of contaminated land	Increased reclamation of contaminated land	Environmental	x				x		
6.5		Annual trend in vegetation cover in urban green	Increased data on NDVI	Environmental						x	
6.6		Use reclaimed/recycled building materials	Increased reclamation of building materials	Environmental		x					

6.7		Road surface dedicated to pedestrians	Increased share of pedestrian areas	Social		x	x				
6.8		Access of residents/employees by foot to open space: sports centre, recreation area, or GS	Increased accessibility of sport and recreation facilities	Social, Cultural				x		x	x
6.9		Access of residents to cultural facilities on foot	Increased accessibility of cultural facilities	Social, Cultural		x				x	x
6.10		Perceived quality of urban GS	Increased data on perceived quality of urban green spaces	Digital, Environmental						x	
7.1	7. Participatory planning and governance	Openness of participatory processes	Increased and improved participation	Social			x				x
7.3		Social learning concerning urban ecosystems and their functions/services	Increased awareness of urban ecosystems	Social	x		x	x			
7.4		Perceptions of citizens on urban nature	Increased awareness of urban ecosystems	Social	x		x	x		x	
7.5		Social values for urban ecosystems and biodiversity	Increased awareness of urban ecosystems	Social	x		x	x			

7.6	Inter-departmental collaboration leading to NBS designs for multi-functionality	Increased governance coordination for NBS	Social			x	x			
7.7	Improved coordination of NBS strategies within and across levels of governance	Increased governance coordination for NBS	Social				x			
7.8	Citizen participation in and co-creation of the design, implementation and evaluation of project interventions	Increased improved participation and	Social, Cultural	x	x	x	x	x	x	x
7.9	Institutional learning concerning acquisition of knowledge and understanding	Increased institutional capacity	Social			x	x			
7.11	Number of individuals that is aware of the project's objectives, content and processes	Increased improved participation and	Social	x	x	x	x	x	x	x
7.12	No of initiatives proposed & implemented by the public in the project's framework	Increased institutional capacity	Social		x					

7.13		No of new information channels generated between public institutions & citizenship	Increased institutional capacity	Social		x		x			
7.14		No civil society entities that have participated in the execution of the project in relation to the total of entities with presence in the neighbourhood	Increased and improved participation	Social, Cultural				x			
7.16		No of persons involved (on average) in the project activities	Increased and improved participation	Social, Cultural		x			x		x
7.17		No of activities involving children	Increased and improved participation	Social, Cultural							x
7.18		No. of participants in citizen science activities	Increased participation in citizen science activities	Social, Cultural					x		
8.1	8. Social justice and social cohesion	The availability and distribution of parks (different types) or ecosystem services with respect to specific individual or household	Fair availability of green spaces and ecosystem services	Social					x		

		socioeconomic profiles landscape design									
8.5		Personal and social background of people who participated in the project's activities	Fair participation to project activities	Social Justice	x	x	x	x	x	x	x
8.7		Participation of entities representing groups of persons with functional disabilities	Greater inclusion of people with functional disabilities	Social Cohesion				x			
8.8		Participation of individuals with functional disabilities	Greater inclusion of people with functional disabilities	Social Cohesion		x	x	x			
8.9		Participation of immigrants	Greater inclusion of immigrants	Social Cohesion					x		
8.10		Accessibility of open public spaces and buildings for families with baby carriages and individuals with restricted mobility	Greater inclusion of families with babies and individuals with restricted mobility	Social Cohesion			x	x			x
9.4	9 - Public Health and Wellbeing	Noise reduction rates (or exposure to noise pollution)	Increased data on noise pollution exposure	Psychological		x	x		x	x	x

9.5	No of hours spent outdoors, time people spend in the facility	Increased (data on) outdoor presence	Psychological		x			x		x
9.6	Perceived well-being before and after the visit of GS. Can also measure metrics from health centres and hospitals to determine level of health conditions and support needed	Increased health and well being	Psychological		x	x				x
9.7	Assessment of the personal satisfaction about life, emotional competences (ability to understand one's own and other's emotions) and coping strategies regarding everyday problems in healthy older adults	Increased data on health and wellbeing	Psychological			x				
9.8	Feeling of improving the quality of life (the Quality-of-Life questionnaire)	Improved quality of life/ Increased data on health and wellbeing	Psychological		x	x	x	x	x	x
9.9	Social and emotional loneliness perception	Increased data on health and wellbeing	Psychological			x				
9.10	Cognitive Abilities	Improved cognitive abilities	Psychological			x				

9.12	Sense of place and received restorativeness	Enhanced sense of place and restorativeness	Psychological			x				
9.13	Residential attachment and satisfaction	Increased residential attachment and satisfaction/ Increased data on health and wellbeing	Psychological			x		x		x
9.14	Increased data on behavioural and psychological symptoms in dementia	Increased data on behavioural and psychological symptoms in dementia	Psychological			x				
9.16	Number / share of people being physically active (min. 30 min 3 times per week)	Increased outdoor physical activity (increased of data gathering of data of people being physical active)/ Increased data on health and wellbeing	Indicators related to physical activity				x		x	x
9.19	Increase in walking and cycling in and around areas of interventions	Increased outdoor physical activity / Increased of data gathering of data of people being physical active/ Increased data on health and wellbeing	Social	x	x		x	x	x	x

9.20	Smoke cessation due to sports activities in green areas	Reduced smoking/ Increased data on health and wellbeing	Social						x	
9.21	Level of physical activity in distances covered and average calories burned	Increased (physical) data on health and wellbeing	Social			x				
9.22	Improved motor skills among the youth	Improved motor skills among the youth	Psychological				x			
9.27	Anxiety levels	Reduction in anxiety levels	Psychological	x		x				
9.28	Affective status	Increased psychological well-being and/or quality of life: improved positive emotions; reduced negative emotions	Psychological	x		x				
9.29	Association between Quality of life and Human performance and well-being	Improved quality of life based on the human performance and wellbeing/ Increased data on health and wellbeing	Psychological						x	
9.30	Association between Quality of life and Physical Health	Improved quality of life based on physical health/ Increased data on health and wellbeing	Social						x	

9.31	Association between Quality of life and Psychological Health	Improved quality of life based on psychological health / Increased data on health and wellbeing	Social, Psychological						x	
9.32	Association between Quality of life and Social Relations	Improved quality of life based on social relations / Increased data on health and wellbeing	Social, Environmental						x	
9.33	Association between Quality of life and Residential Environment	Improved quality of life based on Residential Environment / Increased data on health and wellbeing	Social, Environmental						x	
9.34	Association between Quality of life and neighbourhood environment	Improved quality of life based on neighbourhood environment / Increased data on health and wellbeing	Social						x	
9.35	Association between Quality of life and Infrastructure/Services in the humans' living environment	Improved quality of life based on Infrastructure/Services in the humans' living environment / Increased data on health and wellbeing	Social, Environmental						x	

9.36		No. of noise data	Increased number of noise data added	Digital, Environmental				x		x	
9.37		No. of health and lifestyle data	Increased number of health and lifestyle data	Social, Digital				x		x	
10.1	10. Potential for new economic opportunities and green jobs	No. of jobs created; gross value added	Increased job opportunities	Economic, Social		x		x		x	x
10.2		New businesses attracted & additional business rates. Increase in start-up funding attracted by businesses in the area	Increased business opportunities	Economic					x		
10.3		Resource efficiency in the urban system	Increased resource efficiency	Economic, Environmental		x					
10.4		Increased footfall and spend in the areas of interventions	Increased footfall and spend in the areas of interventions	Economic, Social		x					

10.5	Definition of parameters for (re)designing of green public spaces based on the well-being of users	Increased parameters for (re)designing green public spaces	Social	x	x	x	x	x	x	x
10.6	Replication solutions	High replication potential of Visionary Solutions	Economic	x	x	x	x	x	x	x
10.7	Number of elderly health care institutions involved in 5 years	Increased impact of the project	Economic, Social			x				
10.8	Saved healthcare spending	Savings in healthcare spending	Economic	x	x			x	x	x
10.9	Public / Private Investments in the 5 years of the project	Increased public & private investments	Economic	x	x	x	x	x	x	x

Table 1: KPI Pilot Mapping carried out for the VARCITIES project

3 Monitoring & Evaluation Methods

This section includes the VARCITIES monitoring process, detailed information about the pilot's methodologies to collect KPI data and a description of the main evaluation methods being proposed in VARCITIES to assess the performance of the VS. Each pilot site has developed co-created and context-specific interventions that address the challenges of their city, both directly and indirectly. The KPIs correspond to one or more VS that they are being measured in, to generate data that will assess the impact of VSs from a health and wellbeing perspective. After the pilot site leaders had organised the co-identification and co-design stakeholder workshops, some aspects to the VSs had been changed in order to improve their implementation by integrating the feedback received from the participants. This process led to some changes in KPIs to reflect the components of the revised VSs.

3.1 Pilot methodologies

The full methodologies are provided in D7.2 and are not repeated here. Also, some KPI methodologies have also been updated since the submission of D7.2 to reflect these latest updates. These are included as Annex I in this document and are not included here to ensure that the core part of this document remains easily accessible.

3.2 VARCITIES Monitoring Process

Since the VARCITIES project is highly emphasised on collecting data for a vast number of KPIs from 9 EKLISE Challenges, it was important to have a well-coordinated structure. The general process involved the setting up of 10 Monitoring Periods before the start of the implementation phase up until the post-implementation period for a total for 30 months; from November 2022 until March 2025. Some pilot teams have started taking their measurements even earlier than the start of the first Monitoring Period to allow more time for the data collection. Detailed methodology reports are included in Annex I for each KPI by pilot experts, who have been in constant contact with the pilot leaders to provide support in the KPI data collection, data management and impact framing at every stage of the project. These supplement the methodology reports found in D7.2 given that new KPIs have been added.

A Gantt chart was prepared for the pilot leaders to have a timeline when each KPI measurement should be taken, allocated into the different monitoring periods. A risk register was also provided to keep a track record of the risks and mitigations associated with the data collection of some KPIs. Additionally, an internal database was created for the pilots to upload KPI data, visual information and related material. Figure 2 shows the structure of the monitoring process. This can be adopted in other projects, also a project management approach.

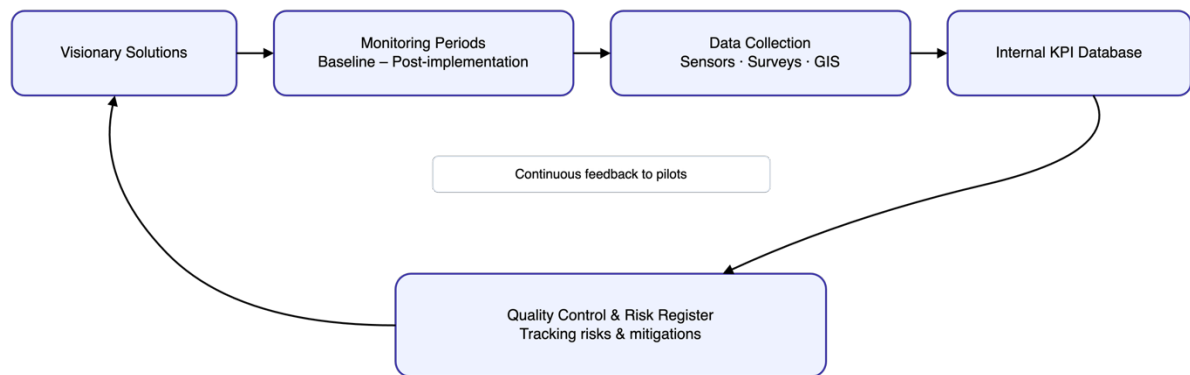


Figure 2 - Monitoring process used throughout VARCITIES.

3.3 Evaluation Methods

This subsection describes the main evaluation methods that have been followed in order to assess the impact of each KPI. These include; (1) comparing pre-implementation or baseline with post-implementation data, (2) assessing results based on available benchmarks, standards and EU targets, and (3) co-evaluation with stakeholders. Each assessment method is described hereunder;

- 1) Pre-implementation and post-implementation comparisons enable the pilots to measure any changes during these project periods. With this method, any H&WB improvements are scrutinised to assess the impact of the Visionary Solutions. Any external changes are also taken into account during evaluation wherever possible.

- 2) Benchmarking is an assessment tool being used to measure if VARCITIES Visionary Solutions outcomes have contributed in any way to achieving local, national and international targets or provide scientific evidence about existing spaces in comparison to existing EU targets, standards and specific recommendations.
- 3) The VARCITIES project provided stakeholders with the opportunity to engage in the evaluation process. Various stakeholders with different social backgrounds and expertise were selected in each site, depending on the evaluation topic needs of the KPIs being measured within the pilot sites. Results were presented, and feedback was collected regarding the perceived impact of the Visionary Solutions and co-creation process thereof by external project members.

KPIs are being evaluated differently across the pilot sites, depending on the specific needs of the pilot site. Some sites have considered the direct impact from the implementation of infrastructural changes or increase of sociocultural activity, while others have focused more on the added value of evidence being generated through data collection, which includes; processed sensor data, questionnaires with citizens and stakeholders, GIS mapping and others. A combination of these impact evaluation methods was recommended to the pilot site managers to increase validity in the assessment of results. Figure 3 provides a flowchart showing how the various evaluation methods feed into the KPI results obtained. This allows us to assess impact as will be shown in the next sections.

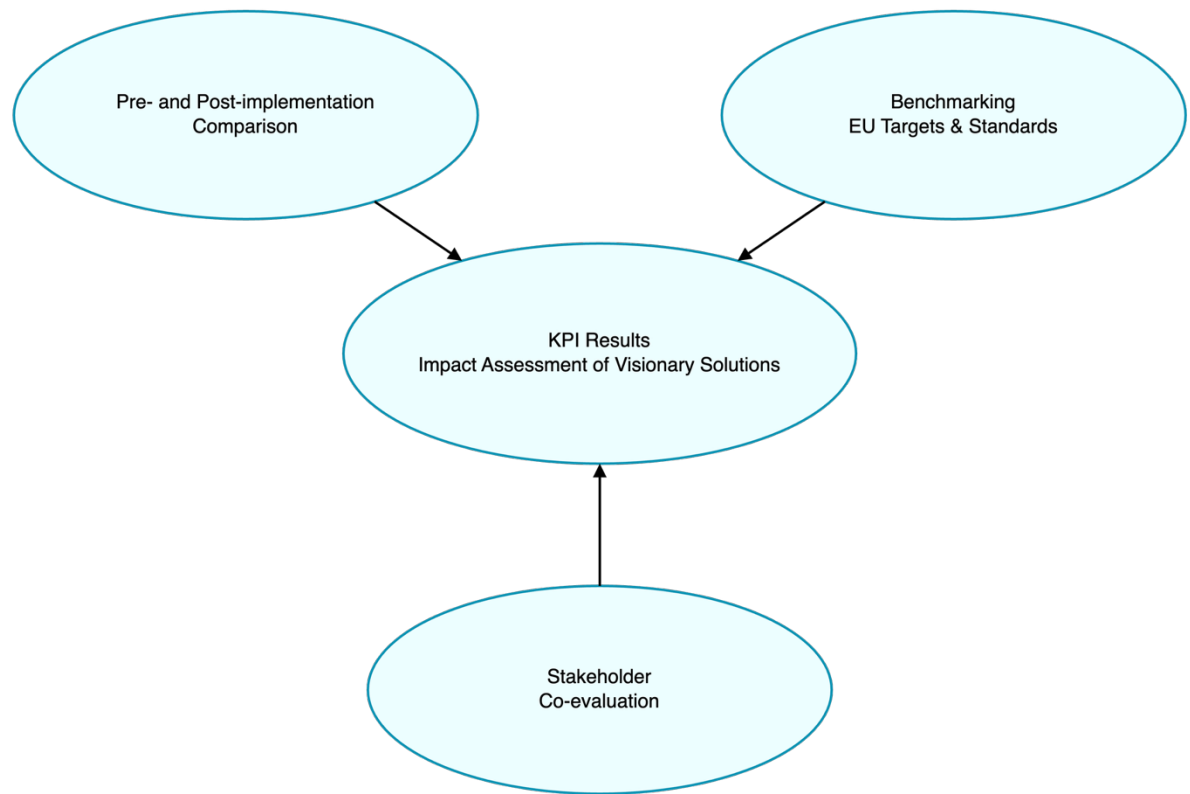


Figure 3 - Evaluation methods used in VARCITIES.

4 KPI Evaluation Outcomes of the Visionary Solutions

This section evaluates each pilot's Visionary Solution based on the objectives defined for that specific solution. For each objective, the expected impacts are listed, along with a general assessment of whether the objective has been met.

As a basis for this section, the pilot results are provided in Annex II. This is a voluminous representation and visualisation of the results obtained for each KPI and is not part of the core document sections to maintain readability. The reader is referred to this Annex to support the reading of these evaluation outcomes as required. The following evaluation of each pilot provides an overview of the key evaluation outcomes per visionary solution, allowing readers to assess these outcomes in light of possibly similar visionary solutions that are planned for their city.

4.1 Castelfranco

VS1: Creation of garden access routes to ensure an improved access according to the needs of the garden users

VS1 involves renovating the existing access route and internal paths to improve accessibility for pedestrians, cyclists, and individuals with special mobility needs. Enhancements include upgraded pavement for safer and more comfortable access. These improvements will benefit visitors, particularly the elderly and those with mobility challenges.

Objective 1.1: Increase in number of visitors

- Increased recreational and cultural value of green spaces (4.3)

This indicator is divided into two sections. Section 4.3a highlights a significant increase in visitors following the events held in the intervention area over a two-year period. Between 2020 and 2022, the number of visitors rose by approximately 86.42%, nearly doubling the use of the space. It is important to note that Villa Bolasco is not a publicly

accessible site, and tours are usually booked during weekends for visitors due to high security and protection of the gardens and Villa itself.

Objective 1.2: Improvement of accessibility on existing routes

- Increased share of pedestrian areas (6.7)
- Accessibility of open public spaces and buildings for families with baby carriages and individuals with restricted mobility (8.10)

The measurement of objective 1.2 shows a remarkable progress in the related indicators: from 0% to 72% of the road surfaces were renovated to be dedicated to pedestrians (6.7), as well as a remarkable improvement in accessibility, reaching 5,000 m² of adapted areas compared to the previous 0m² (8.10). The measurements indicate a substantial transformation of existing routes and the creation of new pathways, thereby demonstrating robust achievement of the target.

Objective 1.3: Improved beneficial experience of the visit

- Increased recreational and cultural value of green spaces (4.3)

The indicator is divided into two sections, 4.3b monitors the number of activities carried out within the VARCITIES Framework. A total of nine (9) activities were carried out: these not only brought value per se to the space by giving it added meaning at the time, but also had a reflective nature giving a long-term usefulness and engendering reconsideration of the spatial use within the community.

VS2: Analysis and monitoring of psychological and physiological well-being for elderly & people affected by Alzheimer

The overall aim of VS2 is to provide information on how the effects of natural environments affect the well-being, behaviour and physiological states of people, with a special focus on elderly people and people with dementia.

Objective 2.1: Provide data on the positive effects of natural environments on well-being, behaviour and physiological states (with a focus on elderly and people with disabilities)

- Increased data on human comfort (1.3)
- Increased number of temperature and humidity data (1.8)
- Increased use of green public space facilities (4.9)
- Fair participation to project activities (8.5)

- Greater inclusion of people with functional disabilities (8.8)
- Improved quality of life (9.8)
- Improved cognitive abilities (9.10)
- Enhanced sense of place and restorativeness (9.12)
- Increased residential attachment and satisfaction (9.13)
- Increased data on behavioural and psychological symptoms in dementia (9.14)
- Increased health and wellbeing data (9.21)
- Reduction in anxiety levels (9.9, 9.27)
- Increased psychological well-being and/or quality of life: improved positive emotions; reduced negative emotions (9.28)

The evaluation of VS2 confirms substantial progress toward achieving Objective 2.1, with data collected across a wide range of indicators providing evidence of the benefits of natural environments for both physiological and psychological well-being, particularly among vulnerable populations such as the elderly and individuals with disabilities.

The inclusion of people with functional disabilities was a key target, and Indicator 8.8 reflects significant progress in this regard. In 2022, 7% of the participants had dementia (5 out of 81), and by 2023, the pilot achieved full inclusion of individuals with dementia in the targeted activities. This demonstrates both quantitative and qualitative improvements in inclusive engagement, aligned with the expected outcome of greater inclusion of people with functional disabilities (8.8).

Complementing this, Indicator 9.14 showed enhanced data on behavioural and psychological symptoms in dementia, revealing the positive effects of nature exposure on psychophysiological well-being. Sensor-based monitoring recorded a lower number of visual fixations, which is interpreted as a sign of improved attention and concentration, supporting the expected outcome of improved cognitive abilities (9.10).

Additional data collected also showed improvement in psychological well-being and overall quality of life (9.28). There is clear evidence of reduced anxiety levels (9.9, 9.27) and an enhanced sense of place and restorativeness (9.12) among participants, all of which indicate that exposure to green spaces had a measurable impact on emotional states. Furthermore, residential attachment and satisfaction (9.13) were positively influenced by the intervention, suggesting an improved perception of the local environment.

In terms of physiological measures, the project successfully gathered temperature and humidity data (1.8) as well as enhanced human comfort metrics (1.3). These support the environmental dimension of well-being and further demonstrate the role of nature in regulating comfort conditions.

From a behavioural perspective, the project observed an increased use of green public space facilities (4.9) and ensured fair participation in project activities (8.5), contributing to a broader engagement of citizens with their environment.

While the expected outcomes have been largely met, and the evaluation confirms the effectiveness of nature-based interventions, it is acknowledged that larger sample sizes would strengthen the representativeness of the findings and allow for broader generalisation across target populations.

The insights generated through this objective are expected to support urban planners, public health authorities, and care professionals in designing inclusive, health-supportive green environments. In summary, the implementation of VS2 has provided robust, empirical evidence that immersive engagement with natural environments can significantly enhance both the mental and physical well-being of elderly and vulnerable groups, fulfilling the aims of Objective 2.1 and informing future replication and upscaling efforts.

VS3: Full monitoring of microclimatic conditions in the different areas of the garden (forest area, open area, lake area)

Monitoring of the microclimatic and environmental conditions in the different areas of the garden (forest area, open area, lake area) in order to assess to which extent, the environmental and site-related variables influence the health and wellbeing of users in the garden.

Objective 3.1: Monitoring of the microclimatic and environmental conditions

- Reduced urban temperature / Improved human comfort / Increased number of data (1.3)
- Increased number of temperature and humidity data (1.8)
- Increased data on singing birds in green zones (4.19)
- Increased air quality data (5.5, 5.6)
- Reduced noise level (mapping of green and urban areas)/ increased number of data (9.4)

Objective 3.1 has been successfully achieved through the systematic collection of environmental data across key indicators. Extensive measurements related to temperature and human comfort (1.3) revealed that 38.23% of recorded PET values fell within the optimal comfort range (24°C–29°C), with only 0.57% exceeding 29°C, indicating limited heat stress and improved thermal conditions.

Over 74,000 temperature and 39,000 humidity and pressure readings (1.8) were collected at high frequency, providing detailed insight into microclimatic variations. This robust dataset supports long-term climate monitoring and adaptation planning.

Noise mapping data (9.4) was gathered to assess sound levels in green and urban areas, contributing to improved understanding of acoustic comfort. In parallel, the inclusion of bioacoustic indices (4.19)—including ACI, BI, and NDSI—enabled the monitoring of avian activity and biodiversity in green spaces, offering indicators of ecological quality.

Additionally, air quality data (5.5, 5.6) was collected to monitor pollutants and support assessments of environmental health in the intervention area.

Overall, the results confirm that Objective 3.1 has been met. The data collected provides a strong basis for evaluating the impact of nature-based solutions on urban microclimates and ecological conditions and supports evidence-based upscaling in similar urban contexts.

Objective 3.2: Implementation of a hybrid system, consisting in a network of wireless devices (IoT) and other instruments

- Increased data from sensors (4.21)

A hybrid system, consisting of a network of 21 wireless (IoT) devices and other instruments, has been successfully installed. This has not only enabled current data collection, but also opens up the possibility of future monitoring and adds value for future studies.

VS4: Development of a green public spaces (re)design toolbox and establishment of the “Local observatory on therapeutic effects of the landscape”

The main aims are to develop and conserve a healthy urban environment, to promote initiatives and actions to protect and manage the landscape according to such principle, to raise awareness about the therapeutic value of blue and green areas, foster the participation of local stakeholders, and to promote a unique and shared approach among the municipalities of the territory for the management of the urban natural and semi-natural areas.

Objective 4.1: Development of a best-practices manual

- Increased governance coordination for NBS (7.6)
- Increased parameters for (re)designing green public spaces (10.5)
- High replication potential of Visionary Solutions (10.6)
- Increased elderly health care institutions involved (10.7)

The development of the good practice manual has partially progressed. The increase in the number of parameters applicable to the (re)design of green public spaces (10.5) demonstrates that the project has generated relevant and transferable technical learning. Furthermore, a high potential for replicability of the developed solutions has been recognised (10.6), which reinforces the strategic value of the manual as a tool for future VS implementation.

However, institutional impact is still limited. Only seven institutions have participated so far, and only one has maintained its involvement for more than a year (10.7). This low continuity compromises the consolidation of strong governance around the NBS (7.6) and weakens the project's capacity to generate structural change beyond its duration. Although the collection of good practices is progressing, their effective implementation depends on greater inter-institutional articulation, which seems to be yet to be fully consolidated. Further collaborations can be explored to build on existing work.

Objective 4.2: To ensure the involvement of the population in the activities for the protection and management of the environment

- Openness of participatory processes (7.1)
- Increased awareness of urban ecosystems (7.3)
- Social values for urban ecosystems and biodiversity (7.4, 7.5)
- Increased and improved participation (7.8, 7.11)

- Fair participation to project activities (8.5)
- Greater inclusion of people with functional disabilities (8.8)

The participation of the population has been one of the strongest dimensions of the project, with more than 730 people participating in different activities and a sustained effort to open participatory processes (7.1), and increase awareness of urban ecosystems (7.3, 7.4).

The inclusion of specific groups has been notable in the case of people with dementia, whose participation increased from 7% in 2022 to 100% in 2023 (8.8), which evidences a significant improvement both quantitatively and qualitatively. However, challenges persist in terms of social and sexual diversity (8.5).

Awareness and attribution of social values to urban biodiversity has reached 51 people (7.5), which while indicating progress, could be expanded to achieve a broader cultural transformation. Elderly institutional participation remains limited and fragmented (10.7), which restricts the structural scope of these actions. However, the VS implementation was successful in integrating perspectives and collecting data from vulnerable groups to support others with similar physical or psychological impairments.

VS5: Implementation of virtual and ICT tools to ensure a rewarding experience of garden users and for the assistance of visitors with disabilities with the goal of increasing safety while visiting the garden

The main goal is to use technology (i.e., sensors, smartphones and apps) to ensure an increased safety and enjoyability of the visitors in the garden. The VS consists of monitoring visitors' behaviour via sensors and Android devices that also provide the means for improved safety interactions like calls to specific emergency numbers.

Objective 5.1: Make the garden more accessible to any category of visitors, including also people with a certain level of disability.

- Greater inclusion of families with babies and individuals with restricted mobility (8.8)
- Fair participation to project activities (8.5)

The implementation of Objective 5.1 has resulted in tangible improvements in the accessibility and inclusiveness of the garden space. Actions taken have enabled greater inclusion of families with babies and individuals with restricted mobility (8.8), ensuring that the space is more welcoming and usable by a broader range of users, including those with physical or cognitive limitations.

Participation in project activities was balanced and representative (8.5), further demonstrating the project's commitment to equitable access and engagement. The design interventions and inclusive programming collectively supported fair use of the garden by diverse social groups, in line with the objective.

Moreover, the garden served as a living lab for evaluating the therapeutic benefits of natural environments. Evidence gathered through the project demonstrated positive effects of nature on psychological well-being, cognitive function, and anxiety reduction, benefiting both vulnerable groups (e.g., individuals with dementia) and the general public.

In conclusion, Objective 5.1 has been effectively addressed through improvements in physical accessibility and inclusive engagement, supported by empirical evidence of the garden's positive impact on health and well-being.

Objective 5.2: Data collection towards ensuring an increased safety and enjoyability of the visitors in the garden

- Increased use of green public space facilities (4.9)
- Increased data from sensors (4.21)
- Increased health and wellbeing (9.9)

The implementation of Objective 5.2 has effectively leveraged digital tools to improve both the safety and user experience of garden visitors. Through the deployment of sensors and mobile applications (4.21), the project enabled real-time monitoring of visitor presence and behaviours, as well as the facilitation of emergency alerts and safety responses.

The increased use of green public space facilities (4.9) reflects higher engagement and comfort levels among visitors, indicating that technological enhancements contributed positively to the usability and attractiveness of the space. Furthermore, improvements in self-reported health and well-being (9.9) suggest that the environment not only became safer but also more supportive of physical and psychological health.

The data collected supports a comprehensive evaluation of the space's functionality, safety, and inclusivity, demonstrating that the integration of ICT in urban green areas

can promote active use while ensuring a secure and enjoyable experience for all visitors.

In summary, VS5 has met Objective 5.2 by combining digital innovation with environmental design to enhance both the quality and safety of interactions within the green space.

VS6: Adaptive and intelligent lighting systems / energy data management

Objective 6.1: Install intelligent lighting systems to improve energy efficiency

- Increased awareness of urban ecosystems (7.3)

The adaptive and intelligent information system was constituted by a digital (interactive) screen, also referred to as a Totem, located outside the walls of the garden, which displays interactive information about the historical garden and its environmental conditions, to stimulate the curiosity of citizens and visitors, and allow them to perceive the benefits provided by nature. The questionnaire completed by participants has also generated significant information about the functionality and user-experience of the Totem in relation to its affordances and capabilities.

4.2 Chania

VS1: Mobile Urban Living Room

The visionary solution aims to revitalize urban green spaces by encouraging citizen engagement and data collection, ultimately improving the social, environmental, and economic landscape of cities. The Mobile Urban Living Room (MULaR) project has set forth a visionary agenda focused on data-driven urban enhancements, community empowerment, environmental stewardship, cultural enrichment, and economic revival. Evaluating the project based on these objectives reveals the depth and breadth of its impact:

Objective 1.1: Gather environmental, biodiversity & health data

- Increased data on carbon storage and sequestration in vegetation (1.1)
- Increased temperature and humidity data (1.8)
- Increased data on avoided run-off (2.8)
- Increased data on total vegetation cover and tree species composition (4.22)

- Increased data on air quality (5.10, 5.12, 5.15)
- Increased number of vegetation data (4.24)
- Increased data on health and wellbeing (9.8)

MULaR has been designed as a sophisticated data collection platform where a selection of sensors continuously monitoring vital environmental parameters like air pollution and microclimatic conditions. In addition to the technological data collection, citizen surveys have been seamlessly integrated into the process, capturing self-reported health and well-being insights; this dual approach not only provides a robust dataset on urban green spaces and their ecological contributions but also informs future strategies for enhancing and preserving these areas. The wealth of data includes detailed records of air quality, carbon storage in vegetation, temperature fluctuations, and humidity levels, all of which form the structure of subsequent urban planning and green space redesign initiatives in Chania. Considering the vast amounts of environmental datasets collected, this objective is considered to be achieved.

Objective 1.2: Increase citizens' productivity

- Increased Green-related social service provided to population (4.7)
- Recreational or cultural value of green spaces (4.3)
- Increased accessibility to cultural and recreational facilities (6.8, 6.9)

MULaR aims to transform the urban experience by interweaving facilities into daily life, creating a setting that fosters productivity. By providing a dynamic space where work, relaxation and social interaction converge, MULaR encourages citizens to think outside conventional environments, thereby stimulating innovative ways of working and collaborating in various environments while collecting meaningful data about the pilot site. This integration of natural elements not only boosts energy efficiency but also translates into tangible outcomes such as energy savings and the creation of new job opportunities, fuelling both social interaction and broader economic productivity, increasing recreational value of respective green spaces.

Objective 1.3: Increase community engagement and social interaction

- Increased Green-related social service provided to population (4.7)
- Increased and improved participation (7.8, 7.11)
- Fair participation to project activities (8.5)

Central to the project is the aim of enhancing social cohesion by drawing citizens together in shared, easily accessible public spaces. As a mobile meeting point, MULaR has successfully turned parks, urban forests, and schoolyards into vibrant hubs of community life where educational, cultural, and social events bring together diverse groups. This intentional design has fostered deeper levels of public engagement, enabling fair and broader participation in local initiatives while making cultural and recreational activities more accessible – thereby reinforcing a stronger sense of community among members within targeted spaces.

Objective 1.4: Increase citizens' environmental awareness

- Increased data on perceived quality of urban green spaces (6.10)
- Increased awareness of urban ecosystems (7.4)

MULaR plays a significant role in educating and raising environmental consciousness by offering interactive activities and showcasing real-time environmental data. Through engaging hands-on workshops, discussions, and demonstrations, the project has effectively elevated public understanding of crucial environmental and climate change issues. This educational approach not only informs but also inspires sustainable behavior, making environmental stewardship an integral part of the process while indirectly enhancing community resilience in the face of ecological challenges.

Objective 1.5: Increase citizens' creativity, strengthen identity, and build connections

- Recreational or cultural value of green spaces (4.3a/b)
- Increased accessibility to cultural and recreational facilities (6.9)

The project serves as a creative platform that empowers citizens to express themselves through a blend of cultural and community-driven initiatives. By hosting diverse cultural events and educational programs in an inviting green setting, MULaR has enabled individuals to express their creativity and helped build a shared urban experience - creating connections among residents. This focus on cultural participation enriches the urban fabric, reinforcing community ties and celebrating local heritage while also paving the way for innovative cultural possibilities.

Objective 1.6: Strengthen the local economy

- Increased energy savings (1.5)
- Increased job opportunities (10.1)

- Definition of parameters for (re)designing green public spaces based on the well-being of users (10.5)
- High replication potential of Visionary Solutions (10.6)
- Increased data on healthcare spending (10.8)
- Increased public/private investments (10.9)

By attracting citizens into underutilized urban green spaces and stimulating engagement through local activities, MULaR has contributed to the economic vitality of neighbourhoods. The initiative has not only provided the setting for economic and social possibilities, but has also generated new data about its added value. This economic stimulation, coupled with the creation of job opportunities and projected healthcare savings derived from improved well-being, has reinforced public and private investments, demonstrating that sustainable urban innovations can indeed be a catalyst for economic growth and resilience.

The evaluation of MULaR clearly demonstrates that the project's interdisciplinary objectives have been successfully met through a mix of technological innovation, community engagement, and cultural activation. The integration of detailed environmental monitoring with active citizen participation has resulted in measurable improvements in Chania, while its innovative and inclusive approach has strengthened community interaction and boosted local economies at a micro-scale. In essence, as a majority of stakeholders also expressed, MULaR serves as a replicable model for reimagining urban spaces, one where data, innovation, and community engagement converge to create healthier and vibrant cities.

VS2: Sensor kits on bikes and bike stations

The main components and measures implemented in VS2 were sensor installations on public and private bicycles and bike stations, which have been collecting environmental and health data in Chania. The data obtained was combined with weather station data and prediction models, bike sharing systems usage data, questionnaires, apps and data from statistical services and observatories. Indications and warnings about the environmental conditions were made available to citizens and visitors locally.

Objective 2.1: Increase citizens' environmental awareness to support them in improving Health and Wellbeing

- Increased awareness of urban ecosystems (7.4)

The solution has been designed to empower citizens with timely information regarding local air quality and noise levels, thereby directly enhancing environmental awareness. By deploying sensor-kits on both bicycles and fixed stations, the system gathers real-time measurements of various pollutants, temperature, humidity, and noise. These datasets are processed and transformed into actionable air quality and environmental condition alerts through predictive models. As a result, Chania residents and visitors are provided with warnings and recommendations, enabling them to make informed decisions to protect their own health and wellbeing. This heightened awareness is reflected in the increased urban ecosystem data and supports broader public engagement in health-related activities. This objective was also reached through the data being transmitted to local accessible databases.

Objective 2.2: Gather environmental, biodiversity & health data

- Increased temperature and humidity data (1.8)
- Increased number of air quality data (5.5, 5.6, 5.10, 5.11, 5.12, 5.15)
- Increased data on noise pollution exposure (9.4)
- Increased number of noise data (9.36)

Visionary Solution 2 systematically collects a comprehensive range of data by integrating sensor-kit measurements from public and private bicycles with fixed station data. The bicycle sensor-kits capture localized information such as PM1, PM2.5, PM10, noise levels, temperature, and humidity, while the station-mounted kits extend this dataset to include pollutants like SO₂, NO_x, and O₃ among others (refer to KPI 1.8 in Section 4). Furthermore, by combining these readings with weather station data, bike usage statistics, questionnaires, and additional external data sources from observatories and statistical services, the project creates a robust, multidimensional repository. This extensive data collection effort is expected to yield increased temperature, humidity, and air quality data, which is essential for monitoring environmental conditions and validating further predictive analysis.

Objective 2.3: Reduce healthcare spending

- Increased awareness of urban ecosystems (7.4)
- Increased data on outdoor physical activity (9.16)
- Savings in healthcare spending (10.8)

By offering citizens a reliable method of receiving real-time alerts and recommendations about air quality and noise levels, the solution aims to pre-empt adverse health impacts and thereby potentially lower healthcare demands. When inhabitants are informed about which areas and times to avoid, particularly those prone to high levels of air pollutants or noise exposure, they can take steps to reduce their risk of developing related health issues. The continuous accumulation of health and environmental data aids in correlating high-risk exposures with potential health outcomes, creating a foundation for future studies that could quantify reductions in healthcare spending. Although direct cost-saving metrics are not detailed, the underlying indicators related to enhanced data on outdoor physical activity and the generation of financial projections of healthcare suggest that preventative measures and exposure to green spaces may contribute to long-term savings in expenditures.

Objective 2.4: Reduce “environmental disparities” by providing vulnerable social groups with information about certain pollutants. Protecting them from exposure to hazardous environmental conditions

- Increased awareness of urban ecosystems (7.4)
- Increased data on noise pollution exposure (9.4)
- Increased number of noise data (9.36)

This objective specifically targets vulnerable social groups—cyclists, pedestrians, children, and the elderly—by ensuring that they receive accurate, localized information about pollutant levels in their environments. The dual approach of utilizing mobile sensors on bicycles and fixed stations ensures a hyper-local measurement of pollutants that can affect these groups - each in their own way. The data on pollutants that are most relevant to their immediate surroundings, including both fine particulate matter and noise pollution, enable timely alerts and guidance on safer practices. Consequently, the system works to mitigate the exposure of these vulnerable populations to hazardous conditions, contributing to a safer and more equitable urban environment.

Objective 2.5: Improve social inequality

- Increased and improved participation (7.8, 7.11)
- Fair participation to project activities (8.5)

Through its inclusive approach and commitment to transparent information sharing, the solution addresses social inequality by ensuring that all community segments have

access to critical environmental data. The deployment of sensor systems across widely used public spaces—combined with the integration of data from diverse sources—has facilitated increased and improved participation, as well as fair participation in project activities. By making data available to everyone, regardless of socioeconomic status and cultural background. The initiative fosters a more informed and engaged public, thus reducing social disparities and promoting equal access to environmental and health resources.

4.3 Dundalk

VS1: Creation of Outdoor Learning Pod between Dundalk Library & Museum Quarter to showcase the newest technologies and host shared functions

VS1 provides a sheltered outdoor learning space to host events for a wide range of visitors to engage and educate on improved biodiversity and NbS in urban areas and Health and Well-being.

Sensors are installed to measure the number of visitors, monitoring improvements to the use of the space. The software for the existing solar panels enables the energy generated to be seen by the visitors, encouraging the use of sustainable energy solutions in the area.

Objective 1.1: Engage and educate on improved biodiversity and NbS in urban areas and Health and Well-being.

- Increased recreational and cultural value of green spaces (4.3)
- Increased accessibility of cultural facilities (6.9)
- Increased and improved participation (7.11 & 7.16)
- Increased institutional capacity (7.12, 7.13)
- Greater inclusion of people with functional disabilities (8.8)
- Increased health and wellbeing (9.6)
- Improved quality of life (9.8)
- Increased job opportunities (10.1)
- High replication potential of Visionary Solutions (10.6)
- Savings in healthcare spending (10.8)
- Increased public & private investments (10.9)

The project successfully boosted engagement and well-being, most notably through the "Cubbie" sensory hub, which delivered 1,215 sessions for 886 participants with functional disabilities and achieved an 88% self-reported improvement in well-being. The company that implemented the facility is increasingly doing so in other places. Moreover, the creation of the Outdoor Learning Pod has attracted a wide range of users who gather for various purposes. It regularly hosts numerous community groups, offering diverse programming and consistently high—and growing—attendance. The area's recreational value grew, with organised activities increasing from one to eight, drawing a total of 421 participants. This engagement fostered two new public-led initiatives, including the Mural Seek Festival. Co-evaluation surveys confirmed the success, with solutions like the Sensory Garden rated as having "high" or "very high" replication potential by 36 respondents.

Objective 1.2: Measure the number of visitors, monitoring improvements to the use of the space.

- Increased use of green public space facilities (4.9)
- Increased institutional capacity (7.12, 7.13)
- Increased outdoor presence (9.5)
- Increased job opportunities (10.1)
- Increased footfall and spend in the areas of intervention (10.4, 10.5)
- High replication potential of Visionary Solutions (10.6)
- Increased public & private investments (10.9)

The project improved the physical amenities of the space by installing eight new benches, creating seating for 18 people where none existed before. However, a quantitative assessment of the impact on overall visitor numbers was not possible. The data for indicators measuring footfall (KPI 10.4) and the number of hours spent outdoors (KPI 9.5) is unavailable. While the significant increase in event participation suggests higher visitor numbers on specific days, the lack of general footfall data prevents a comprehensive analysis of day-to-day use. Increased participation throughout was reported through events that maximised engagement of various social groups, enabling participation.

VS2: Outdoor Urban Green Learning and Sensory Garden for health and well-being

Enhanced biodiversity to the existing garden and improved ways for the public to appreciate, to ensure visitors have all available means to experience the green spaces and feel the benefit of them.

The objective of the outdoor Urban Green Learning and Sensory Garden is the Enhancement of Health and Wellbeing. This will be achieved through increased sense of safety, recreation relaxation, reduction of stress for the visitors

Objective 2.1: Enhance biodiversity

- Increased urban biodiversity (4.11)
- Increased health and wellbeing (9.6)
- High replication potential of Visionary Solutions (10.6)
- Increased public & private investments (10.9)

The perceived value and future potential of this solution are high. Co-evaluation surveys show strong support for its replication potential (KPI 10.6), with 36 respondents rating it as "high" or "very high," suggesting it is a successful model for replication. The project is also integrated into wider public and private investment strategies (KPI 10.9), ensuring its sustainability. However, the evaluation is missing specific data to quantify any increase in urban biodiversity (KPI 4.11), which is the core indicator for this objective. Similarly, while the garden is intended to improve well-being, there is no specific data measuring the direct impact on health and wellbeing (KPI 9.6) for this VS, making a full assessment of its primary goals difficult.

Objective 2.2: Improve public value and engagement with facilities

- Energy savings from lighting upgrades and improvements (1.4)
- Increased energy savings (1.5)
- Reduction in water routed to drainage network (2.4)
- Increased recreational and cultural value of green spaces (4.3)
- Increased use of green public space facilities (4.9)
- Increased reclamation of building materials (6.6)
- Increased accessibility of cultural facilities (6.9)
- Increased and improved participation (7.8)

- Increased and improved participation (7.11)
- Greater inclusion of people with functional disabilities (8.8)
- Increased outdoor presence (9.5)
- Increased job opportunities (10.1)
- High replication potential of Visionary Solutions (10.6)
- Increased public & private investments (10.9)

The project successfully improved facilities and drove significant community engagement. Energy savings (KPI 1.4 & 1.5) were achieved by upgrading floodlights, and the recreational value (KPI 4.3b) was boosted by increasing activities from one to eight. Critically, the project demonstrated strong participation and inclusion. Co-creation workshops engaged 18-21 citizens each (KPI 7.8), and project awareness (KPI 7.11) was high, with 633 event attendees and dissemination reaching over 2,000 people. The project excelled in inclusion of people with functional disabilities (KPI 8.8), with the Cubbie sensory hub engaging 886 participants. This strong community involvement was validated in the final stakeholder event, where the project's effectiveness in increasing participation was rated as "very effective" by the majority of respondents.

Objective 2.3: Ensure visitors have all available means to experience the green spaces and feel their benefit

- Increased accessibility of urban green spaces (4.2)
- Increased health and wellbeing (9.6)
- Improved quality of life (9.8)
- Increased outdoor physical activity (increased of data gathering of data of people being physical active) (9.19)
- Increased job opportunities (10.1)
- Increased resource efficiency (10.3)
- Increased footfall and spend in the areas of intervention (10.4, 10.5)
- High replication potential of Visionary Solutions (10.6)
- Increased public & private investments (10.9)

The project significantly increased the physical accessibility of urban green spaces (KPI 4.2). Post-intervention, the average walking time to these spaces was reduced by 32.96%, bringing both the North (10 min) and West (9 min) zones below the 15-minute EEA benchmark for accessibility. This represents a major improvement in providing the means for residents to reach green areas. However, while accessibility was improved, the

evaluation lacks data to measure the resulting change in visitor behaviour, with no information on quality of life (KPI 9.8), physical activity (KPI 9.19), or footfall (KPI 10.4, 10.5).

VS3: Sensor-equipped bike-stations

The Visionary Solution provides a new car-free area for pedestrians and cyclists with improved cycling infrastructure for visitors. Its aim is to encourage active travel, reduce air pollution, and foster urban regeneration.

Objective 3.1: Provide a new car free area for pedestrians and cyclists

- Increased share of pedestrian areas (6.7)
- Increased data on outdoor presence (9.5)
- High replication potential of Visionary Solutions (10.6)

This solution is viewed as a highly successful model for other cities. Co-evaluation surveys show its replication potential (KPI 10.6) is considered "high" or "very high" by 36 respondents, confirming its value. However, the evaluation cannot confirm the achievement of the objective's primary outcome. There is no quantitative data to measure the increased share of pedestrian areas (KPI 6.7), which was the main goal. Furthermore, with no data on outdoor presence (KPI 9.5), it is impossible to determine if the new infrastructure successfully attracted more people to use the car-free space, making it difficult to assess its impact on public activity.

Objective 3.2: Encourage active travel and urban regeneration

- Increased use of green public space facilities (4.9)
- Increased and improved participation (7.8, 7.11)
- Increased of data gathering of data of people being physical active (9.16)
- Increased job opportunities (10.1)
- Increased footfall and spend in the areas of intervention (10.4)
- Increased public & private investments (10.9)

The project successfully delivered significant new infrastructure to encourage active travel. The use of public space facilities (KPI 4.9) was greatly enhanced by installing 14 new bicycle racks, a water filling station, a bike repair station, and charging points where none existed before. This investment provides the community with the necessary tools

to adopt more active lifestyles. However, the evaluation does not measure the behavioural impact of these new facilities. Data on participation in related activities (KPI 7.8, 7.11), actual changes in physical activity levels (KPI 9.16), and footfall (KPI 10.4) is missing.

Objective 3.3: Reduce air pollution

- Chemical air quality indicators (5.6)
- Reduced noise level (mapping of green and urban areas)/ increased number of data (9.4)
- Increased health and wellbeing (9.8)
- Improved quality of life (9.8)
- Savings in healthcare spending (10.8)

The data confirms that the intervention area maintains a healthy environment. Monitoring of chemical air quality indicators (KPI 5.6) shows that PM2.5 levels remained consistently below the WHO guideline of 5 µg/m³. The area also benefits from reduced noise levels (KPI 9.4), with measurements (40-60 dB) comparable to a quiet library. While these conditions are positive, the data represents a snapshot rather than a measured reduction due to the project. The evaluation is missing data to link this healthy environment to direct community benefits, such as improved health and wellbeing (KPI 9.8) or savings in healthcare spending (KPI 10.8).

4.4 Gżira

VS1: Rue D'Argens: Micro-greening Interventions through a Participatory Design Process

VS1 aims to revitalise Rue D'Argens through a participatory process where residents are active agents in the decision-making process and revitalisation of their area. The objectives are as follows:

Objective 1.1: Gathering of environmental & health and wellbeing data

- Increased carbon sequestration data (1.1)
- Increased data on outdoor presence (9.5)
- Increased outdoor physical activity (9.19)
- Increased data about business opportunities in the pilot site (10.2)
- Definition of parameters for (re)designing green public spaces (10.5)

- High replication potential of Visionary Solutions (10.6)
- Increased data on healthcare spending (10.8)

In environmental terms, progress was made through the creation of the Gżira tree inventory and the use of the i-Tree Eco model (KPI 1.1), which estimated 878 tons of carbon stored, led by species such as Aleppo pine and Australian pine. This effort provides a solid basis for assessing local ecological benefits.

Pre- and post-intervention surveys provided data on outdoor presence, physical activity, residential satisfaction, and quality of life. Time spent outdoors remained largely stable, with only minor fluctuations across hour ranges (KPI 9.5). Quality of life, measured using WHOQOL-BREF, showed slight improvements in physical health and social relationships, while perceptions of the environment slightly declined (KPI 9.19). Moreover, while an increase in active mobility (KPI 9.19) was expected, the data show a decrease in the number of people walking (from 108 to 88 responses) and a significant drop in bus use (from 77 to 29 responses). Regarding economic activity in the intervention area (KPI 10.2), the business mapping indicated stability: there were no relevant increases in the number of establishments between 2022 and 2024. This could be due to several factors, not all of them positive, such as the gentrification of the space, the abandonment of homes by people with lower incomes, etc.

Objective 1.2: Boost community engagement and sense of belonging

- Increased public green space surface per capita (4.1)
- Increased recreational and cultural value of green spaces (4.3)
- Increased and improved participation (7.8, 7.11, 7.16)
- Increased participation in citizen science activities (7.18)
- Fair participation to project activities (8.5)
- Greater inclusion of immigrants (8.9)
- Improved quality of life (9.8)
- Increased residential attachment and satisfaction (9.13)

The objective of strengthening community engagement and increasing a sense of belonging shows mixed results when assessed through various indicators.

In terms of quality of life, participants show a modest improvement in the perception of their physical health and social relationships according to the WHOQOL-BREF scale (KPI

9.8). Physical health scores increased slightly (from 3.608 to 3.652), and social relationships remained stable with a slight improvement (from 3.979 to 3.984). However, there was a worrisome decrease in perception of the environment (from 3.277 to 3.157), suggesting that participants perceive a deterioration in their physical and social environment. This result is consistent with qualitative comments mentioning overbuilding, pollution, noise and loss of green spaces as main sources of dissatisfaction.

Regarding residential attachment and life satisfaction (KPI 9.13), participants reported a slight increase in overall life satisfaction (from 5.0 to 5.2 on the life satisfaction scale), as well as a slight decrease in the desire to change aspects of their life if they could, indicating an increase in overall satisfaction.

The social cohesion indicators present a more complex picture, which, even with a slight change, does not show positive aspects of the effectiveness of interventions to strengthen social ties. Perceived availability of help in the neighbourhood showed a shift towards neutral responses, suggesting a less polarized support network.

The scope of the intervention may not have been sufficient to generate significant changes, which precludes establishing a direct causal relationship between the observed changes and the intervention. External factors may have influenced the results, limiting the ability to directly attribute changes to the intervention.

VS2: Citizen Science on Air quality to increase H&WB awareness

This Visionary Solution centres on the use of distributed sensor technologies, enabling citizen-led science through installations in public spaces and outdoor areas of private homes. Sensors were deployed across various locations in Gżira to measure air pollutants and conduct pre- and post-intervention noise assessments.

The primary aim is to raise environmental awareness and democratize knowledge, empowering citizens to improve their health and wellbeing through greater understanding of local air quality. By collecting and comparing data from different geographical points, the project generated publicly accessible datasets on air and noise pollution. This co-monitoring approach also fosters civic engagement by equipping communities with the knowledge and tools needed to take sustainable action.

Objective 2.1: To gather air quality and noise data

- Increased data from sensors (4.21)
- Increased number of air quality data (5.6, 5.7)
- Increased data on noise (9.4)

By using 24 sensors at different locations and measuring parameters related to air quality and noise, a data set of approximate data entries has been generated, with records from year 2023 to year 2025. Even with the objective achieved, there is some room for improvement in the consistency of the data, giving measurements during different periods depending on the location of the sensor. The added value in this objective is to create a knowledge-base about the pilot site which was previously nonexistent, and collecting baseline measurements for future implementation or comparisons

Objective 2.2: Provide democratization of knowledge and awareness on the air quality of Gżira

- Increased and improved participation (7.8, 7.11, 7.16)
- Increased participation in citizen science activities (7.18)
- Fair participation to project activities (8.5)
- Greater inclusion of immigrants (8.9)

The reach of the activities was measured in the evaluation workshops in very positive terms, reaching more than 5,000 people, both online and in-person, and more than 1,000 in the face-to-face activities. Furthermore, we must understand that the democratisation of knowledge implies not extending it to the population as if it were a homogeneous subject, but to do so with a special interest in those groups that usually present greater difficulties in accessing it, thus seeking to avoid the systematisation of inequalities. KPI 8.9 and 8.5 measurements are used for this purpose, showing representative demographic distributions. Even so, KPI 8.9 shows a certain weakness in the participation of migrants.

VS3: Urban Biodiversity, Education and Engagement through a Co-Created Community Garden Project

The aim of this Visionary Solution was to provide a green public space in Gżira, increased biodiversity and environmental education to school children and the local community to improve health and well-being of both children and adults through the development of a mixed use ecological playscape and school garden.

Objective 3.1: Embedding a greener perspective into our educational institutions and cultural context

- Increased recreational and cultural value of green spaces (4.3)
- Definition of parameters for (re)designing green public spaces (10.5)

The holding of 18 events over 4 years, including both closed events and others open to the public, help to establish this greener mindset. The public events had more than 200 visitors, and the closed events worked with institutions. In addition, and although not taken into account for this objective, the scope of the project is wider (as shown in Objective 2.2). A number of parameters have been developed that facilitate interventions by institutions to redesign green spaces based on the well-being of users (10.5). This does not imply a direct effect on embedding a greener perspective, but it allows to facilitate it. Although a change of perspective in culture and institutions cannot be affirmed, steps towards it have been made, as pointed out in some of the co-evaluative workshops.

Objective 3.2: To bring nature closer to our urban environments and instil ecological awareness into our younger generations

- Increased public green space surface per capita (4.1)
- Increased accessibility of urban green spaces (4.2)
- Increased urban biodiversity (4.11)
- Fair availability of green spaces and ecosystem services (8.1)

Given the relatively small scale of the interventions at the two schools, there has been limited impact on the KPIs measuring broader urban metrics such as increased public green space surface per capita (4.1), increased accessibility of urban green spaces (4.2), and the fair availability of green spaces and ecosystem services to the wider community (8.1). However, these interventions have contributed positively to urban biodiversity (4.11). A total of 252 plants—including a diverse mix of tree species, herbs, vegetable plants, and indigenous Maltese shrubs—have been introduced within the school grounds, enriching the ecological value of these sites. Situated in a highly dense urban setting, these green soft areas provide students and educators with direct contact with nature. They are actively being used for outdoor environmental education and ecological awareness activities, thus supporting the objective of fostering a deeper ecological consciousness among younger generations.

Objective 3.3: To explore and promote a co-creative attitude towards local planning and development

- Increased and improved participation (7.8, 7.11, 7.16)
- Increased participation in citizen science activities (7.18)
- Fair participation to project activities (8.5)
- Greater inclusion of immigrants (8.9)
- Definition of parameters for (re)designing green public spaces (10.5)

The introduction of co-creation methodologies and participatory processes in the development of the outdoor ecological playscape and soft area at St Clare Gżira, as well as the community garden at Stella Maris, was considered to be a novel approach—particularly in the inclusion of children in planning activities. These efforts extended beyond formal co-creation workshops and were also tested through the implementation of pop-up parks around Gżira, introducing a new model of civic participation in a context where such practices are scarce.

Despite the traditionally low levels of public involvement in local planning in Malta—this pilot successfully engaged 78 citizens in the co-creation and implementation phases, with a further 14 participating in the co-evaluation of the interventions. While higher participation levels would have been ideal, this initiative represents a significant step forward in testing and showcasing co-creative and participatory methodologies (7.8). This achievement was recognized during the co-evaluation workshop, where both stakeholders and residents reflected positively on the pilot.

During the co-evaluation feedback session, several participants highlighted challenges in engaging the broader public, particularly in areas like Rue D'Argens, where the transient nature of residents—including short-term renters—presents barriers to sustained engagement. Feedback suggested that more frequent and visible community activities could enhance future participation. Nonetheless, the interventions were commended for their inclusive and multi-faceted communication strategies, with participants during the co-evaluation workshop also highlighting the range of stakeholders reached during the project activities and diversity of engagement methods used (7.11, 7.16, 7.18, 8.5). Importantly, co-creation has now been formally embedded as a parameter in the framework for (re)designing green public spaces based on user well-being (10.5).

4.5 Leuven

VS1/3: (Mobile) Urban Living Room & data collection as part of an integrated re-development intervention

An ephemeral construction was co-designed and co-implemented together with vulnerable young adults using the construction materials of the existing city's Velodroom (deconstructed to give its place to the new project). It can host various cultural, social and sports activities designed for different age groups. In an integrated approach, a health trail (as part of VS3) was created in the surrounding area along which data is being collected on environmental conditions, water quality and mobility, helping to create a solid knowledge base on the effects of the wider implemented intervention.

Objective 1.1: Co-create and integrate architectural elements into a vibrant new public space

- Increased and improved participation (7.1, 7.8, 7.11, 7.16, 7.17)
- Increased reclamation of building materials (6.6)

The creation and the programming of the Olevodroom is estimated to have engaged over 25,000 participants through cultural events, construction camps, and neighborhood gatherings. Additionally, more than 850 citizens (KPI 7.8) took part in hands-on co-creation activities, confirming a strong participatory approach. Moreover, the impact of the activities is visible in the growth of collective knowledge about the VARCITIES project, with an estimated 85,000 people reached through various media articles and dissemination activities.

From a sustainability perspective, the intervention demonstrated a high level of material reuse: 80% of the wood and 90% of the steel from the Velodroom were reclaimed, supporting an increase in reclamation of building materials (KPI 6.6). Spare and unused materials were also repurposed creatively by artists and retained for future maintenance. Overall, the solution effectively met its objective by integrating sustainable architectural elements into a vibrant public space through co-design and circular construction practices.

Objective 1.2: Stimulate and facilitate social contact and promote physical activity for all users

- Increased accessibility of urban green spaces (4.2)
- Increased recreational and cultural value of green spaces (4.3)
- Increased connectivity to green infrastructure (4.14a)
- Increased accessibility of sport and recreation facilities (6.8)
- Increased accessibility of cultural facilities (6.9)
- Greater inclusion of families with babies and individuals with restricted mobility (8.10)
- Fair participation to project activities (8.5)

The Olevodroom, located in the Hertogensite, successfully functioned as a multifunctional space for sports, recreation, and cultural events, fostering social interaction and promoting physical activity among diverse user groups. With the upcoming development of the new urban green park in the area, further improvements in accessibility and connectivity to surrounding green infrastructure are expected (KPI 6.8).

In terms of inclusion and accessibility (KPI 8.10), GIS tools were used to compare the footprint of the Olevodroom with that of the former Velodroom. Both featured open-plan designs with generally accessible layouts, apart from small areas affected by slope. The Olevodroom maintained a high level of accessibility, particularly for families with young children and individuals with limited mobility.

Regarding social participation and use (KPIs 4.3 and 8.5), the Olevodroom recorded strong community engagement. Between March and October 2024, 24,846 people attended events, with May alone drawing over 12,000 visitors. A total of 89 activities were held, ranging from music and circus performances to sports, children's workshops, and even urban camping.

In summary, the VS met its objective by creating an inclusive, vibrant, and accessible public space that supported both physical activity and social interaction, with strong levels of participation from various community groups and consistent use across its first season.

Objective 1.3: Gathering of health and lifestyle data

- Increased (data on) outdoor presence (9.5)
- Improved health and wellbeing (9.6)
- Improved quality of life / Increased data on health and wellbeing (9.8)
- Increased residential attachment and satisfaction / Increased data on health and wellbeing (9.13)
- Number of health and lifestyle data (9.37)
- Increased job opportunities (10.1)
- Increased parameters for (re)designing green public spaces (10.5)
- Increased data on healthcare spending (10.8)
- Increased public & private investments (10.9)

Objective 1.3 focused on building a rich evidence base on health, lifestyle, and well-being in the city of Leuven through structured data collection across multiple indicators. The data was gathered using targeted surveys covering themes such as physical activity, quality of life, neighbourhood satisfaction, and general health.

A total of 1,373 individual data entries were collected across six key indicators (ID 9.5, 9.6, 9.8, 9.13, 9.16, and 9.19), comprising questions on outdoor presence, physical activity, mental and general health, neighbourhood environment, social connections, and lifestyle habits. The collected information provides valuable insight into:

- Physical activity patterns (duration, type, frequency)
- Health and well-being metrics (including mental health and sleep satisfaction)
- Perceptions of neighbourhood environment and social cohesion
- Quality of life indicators and willingness to stay in the area
- Use of mobility modes and time spent in green spaces

Moreover, a targeted survey was conducted among residents of Leuven to examine the relationship between access to green environments and health outcomes. This survey focused on general green space usage, perceived health impacts, and specific experiences with the Olevodroom, both in its current location and its anticipated future placement within the new urban park (KPI 10.8).

The gathered data serves as a baseline for evaluating changes in health and well-being outcomes over time. Overall, this objective was effectively met, with the collected data offering strong potential to guide evidence-based urban policy and planning in Leuven.

VS2: Sensors for health and water quality measurements

The aim of this VS is to understand the impact that the general revitalization project of the Hertogensite under way will have on the living quality of this area by measuring the water quality and the climatic conditions through sensors, measurement of surrounding factors.

Objective 2.1: Measuring impact of revitalization project through water quality

- Increased data on water quality physical parameters (2.3)
- Increased data on water chemical parameters (2.6)

Progress has been made in meeting the objective through the collection of water quality data. KPIs show both physical and chemical values (ph, chlorophyll, temperature, odour, etc.) that allow a reliable technical baseline to be established. Although the long-term impact is still to be determined, the necessary inputs are available for future benchmarking. The improved monitoring system represents a key step towards measuring the effects of similar solutions on water quality.

Objective 2.2: Monitoring of comfort conditions through microclimatic factors

- Increased temperature data (1.2)
- Increased temperature data on human comfort (1.3)
- Number of temperature and humidity data added (1.8)
- Increased (physical) air quality data (5.5)
- Increased (chemical) air quality data (5.6)
- Number of air quality data added (5.15)

This VS has allowed the establishment of a solid basis for the continuous monitoring of environmental conditions in the neighbourhood, in particular air quality and climatic variables. This monitoring has been possible thanks to the installation of high-frequency sensors, which have generated a significant volume of data. Continuous record keeping of temperature, humidity, solar radiation, atmospheric pressure and air quality were obtained, allowing a detailed view of microclimatic variations over time.

The data cover the whole year for maximum temperatures, and more than a year for daily averages, with tens of thousands of records generated by multiple sensors. Thermal

comfort index (UTCI) measurements, being fundamental in understanding the impact of thermal conditions on people, were also incorporated.

In addition, the project has taken an important step towards a deeper understanding of air quality, both in terms of chemistry and total data volume. More than 219,000 records have been collected in one year across multiple sensors (KPI 5.15), providing an extensive basis for assessing the environmental impact of urban interventions and being able to identify times of highest concentration, useful for detecting critical patterns and guiding future actions (KPI 5.6).

VS4: IoT infrastructure for smart lighting and noise measurements

The aim of this VS is to provide smart infrastructure to the city over the years to integrate sensors in lighting poles for noise management. VS4 aims to mitigate noise-related challenges in the city of Leuven, where popular places often create nuisance for inhabitants.

Objective 4.1: Data collection of noise pollution during day and night

- Increased data on noise pollution exposure (9.4)
- Number of noise data added (9.36)

VS4 has successfully initiated the deployment of smart lighting poles equipped with integrated noise sensors to address noise pollution in Leuven. As of June 2025, one of the two planned smart poles has been installed and is actively collecting noise data. Monitoring began on 24 April 2025 and is ongoing.

Initial data from Hertogenpark shows average Lden values of 56.3 dB(A), slightly exceeding the EU benchmark of 55 dB(A), with measurements ranging from 47.3 to 70.4 dB(A) over a 48-day period. These values reflect elevated daytime readings, partly influenced by ongoing construction activities. The collection of high-frequency (15-minute interval) noise data is steadily building a robust environmental dataset to support future noise management strategies.

VS5: Mobility sensors to measure pedestrian and bike flows

To gain a deeper understanding of how small-scale mobility interventions affect pedestrian and cyclist movement patterns, traffic trajectories, and exposure to air

pollutants. By monitoring the use of parks and "slow network connections," the solution aims to provide insights into the number of users, their types of activities, and movement trajectories, thereby illustrating the overall effectiveness of the project in promoting sustainable and healthier mobility.

Objective 5.1: Measure the impact of the project on sustainable mobility via gathering data on the flow of pedestrians and bikers visiting the park

- Increased health and wellbeing (9.6)
- Increased outdoor physical activity (increased data gathering of data of people being physical active) / Increased data on health and wellbeing (9.19)

The project has had a significant impact on the promotion of active mobility and physical well-being as evidenced by the data collected. An increase in outdoor physical activity is observed, with more people reporting walking 10-15 hours per week than before the intervention (KPI 9.19). Similarly, KPI 9.16 suggests that the improved environment has stimulated a more active lifestyle among visitors. In addition to the physical component, emotional health benefits have also been identified, improving the emotional state of visitors to the intervention (KPI 9.6). This VS successfully monitored the data in question, contributing to a creation of a shared knowledge-base about the pilot site.

4.6 Novo Mesto

VS1: Brownfield remediation and greening with plant species indigenous to the nearby Natura 2000 areas

This Visionary Solution aims to regenerate a degraded area through landscaping and monitoring activities. Its goal is to create conditions that enable other stakeholder initiatives to take place within the park. Additionally, it serves an educational purpose by informing visitors about the local plant and animal species in the surrounding environment.

Objective 1.1: Provide landscaping and monitoring activities to the degraded area

- Increased data on carbon storage in and sequestration by vegetation (1.1)
- Increased Nature Based recreation opportunities (4.5)
- Increased air quality data (5.5, 5.6)
- Increased reclamation of contaminated land (6.4)

Through the reclamation of 6,660 m² of contaminated brownfield land, the Novo Mesto pilot facilitated the development of a motor skills park for children and a sensory park for the visually impaired (KPI 6.4). As part of the broader regeneration effort, indigenous trees were also planted in the area. The carbon capture and storage capacity of this newly introduced vegetation has been assessed, showing consistent levels of annual CO₂ sequestration post-intervention—113.8 tonnes in 2024—which represents a positive contribution to landscape improvement and climate regulation (KPI 1.1).

In addition, environmental sensors have been installed for constant monitoring of air quality and microclimatic conditions. (see figures KPI 5.5 & 5.6) The data only pertains to the post-implementation period, not being able to make a comparison of the values and therefore the measurement of the intervention, yet they will be particularly useful to observe the seasonal improvement in environmental conditions and the evolution over time (KPIs 5.5 and 5.6). Beyond the ecological benefits, the project has also enhanced the social use of the space through the development of nature-based recreational opportunities (KPI 4.5).

Objective 1.2: Enable activities of stakeholders to commence in the park

- Increased jobs opportunities (10.1)
- Increased public & private investments (10.9)

The project has helped local public and private actors start and strengthen their activities in the park, leading to increased local employment (KPI 10.1).

The recovery of the space has promoted new job opportunities, especially in sectors related to sports, recreation and community revitalization. The incorporation of swimming instructors, who represent about 47.5% of the new jobs created, reflects how improvements in infrastructure and service offerings have enabled the activation of new sustainable economic functions. Further investment is also possible and projected for the coming years to build on existing infrastructure, while also rendering economic benefits.

VS2: Creating sustainable forest trails

Sustainable trails in the surrounding mixed forest will be created in order to connect the facilities. Public awareness, educational events and information campaigns will be

initiated to promote and facilitate the creation of sustainable forest trails. The trim track will be equipped with information stations providing visitors with information on healthy lifestyle. The route will also be equipped with sensors for tracking and detecting the movement of visitors.

Objective 2.1: To facilitate the creation of sustainable forest trails and the connection of sports and recreational facilities

- Increased temperature data on human comfort (1.3)
- Increased accessibility of urban green spaces (4.2)
- Increased recreational and cultural value of green spaces (4.3)
- Increased weighted recreation opportunities provided by Urban Green Infrastructure (4.4)
- Increased Nature Based recreation opportunities (4.5)
- Increased job opportunities (10.1)
- Increased public & private investments (10.9)

Beyond their ecological value, the trails have been designed as active green infrastructure, generating multidimensional benefits. One of the essential aspects has been the improvement of thermal comfort for trail users (KPI 1.3), ensuring that climatic conditions in the intervention area remained in an acceptable range for outdoor activity throughout most of the year.

In addition, the creation of the trails has contributed to an improvement in accessibility to the urban green area (KPI 4.2). Thanks to the reconfiguration of the environment, pedestrian access time from the urban centre has been significantly reduced, facilitating the integration of the park into the daily life of the population and eliminating physical barriers to its use.

The increase in the diversity and frequency of recreational and cultural activities organized in these spaces (KPI 4.3b) demonstrates that the trails also fulfil a social function, with peaks in both visitors and the number of events organized, and a progressive appropriation of the space by the community.

The infrastructure has also strengthened the recreational opportunities offered by the urban green infrastructure (KPI 4.4) and, in particular, has promoted nature-based

recreation activities (KPI 4.5). Along with it is the contribution to the economy (KPI 10.1) (KPI 10.9).

VS3: Interconnectedness of sports, recreational and therapeutic facilities

This Visionary Solution enhances the interconnection of facilities by focusing on programmatic, communication, and technical integration. Key measures include the development of integrated business and environmental programs, improved accessibility, installation of information and WiFi infrastructure, and the organization of social and educational events. A self-sustaining program was established to promote healthy leisure for all age groups, with tailored activities for specific target groups such as children (motor development) and the elderly (health promotion). Facilities are managed as a unified entity, creating synergies between recreational and therapeutic services to improve visitor experience and wellbeing.

Objective 3.1: Development of integrated business and environmental programs

- Increased governance coordination for NBS (7.6, 7.7)
- Increased institutional capacity (7.9)
- Increased job opportunities (10.1)
- Increased public & private investments (10.9)

Although steps have been taken towards the creation of environmental and business programmes, progress in coordinated governance (KPI 7.6) is limited: only 24.5% of participants in co-creation workshops came from government institutions, which is evidence of low interdepartmental articulation to design NBS with a multifunctional approach. In parallel, the associated economic development (KPI 10.1) has generated jobs, mainly in operational functions such as sports instruction, but these do not yet form a solid environmental entrepreneurial ecosystem. Further investment in the pilot area will provide a stepping stone for the establishment of the aforementioned programs. Finally, the workshops reflect a good level of learning (KPI 7.9), with an average satisfaction rating of 4/5.

Objective 3.2: Enhance the experience and H&WB of visitors and encourage interactions between the various user groups

- Increased Green-related social service provided to population (4.7)
- Increased and improved participation (7.8, 7.11)

- Fair participation to project activities (7.13, 7.14, 8.5)
- Greater inclusion of families with babies and individuals with restricted mobility (8.10)
- Improved quality of life (9.8)

The objective has had positive results, particularly in expanding access to and inclusive use of green spaces. For example, the increase of 15,730 m² accessible for families with pushchairs and people with reduced mobility (KPI 8.10) is a clear achievement in terms of inclusive infrastructure.

Citizen participation has shown remarkable progress - from just 16 people in 2023 to 199 in 2024 - with a cumulative total of 245 participants. This positive trend suggests a greater appropriation of the space and an environment more conducive to social interaction.

However, when analysing the profile of the participants, a lack of diversity is evident, which restricts the true scope of the objective. Most of the participants belong to a privileged socio-economic group, with stable employment, higher education and between 31 and 65 years of age. Young people, older people, those in situations of economic vulnerability or with disabilities are clearly under-represented, which limits the inclusive and spontaneous nature of the interactions promoted (KPI 7.8). This information calls for a more rigorous co-creation process, or alternatively, a more varied engagement strategy to entice other communities.

On the other hand, significant advances in accessibility, such as having participants with impaired mobility at events, represents a concrete step towards inclusion, removing physical barriers that previously prevented certain groups from participating. This improvement contributes directly to the goal of broadening the spectrum of users and facilitating more diverse interactions. The majority of respondents perceive tangible benefits following the interventions, suggesting a real improvement in visitor experience, in line with the purpose of the objective (KPI 9.8).

VS4: Integrated management of the facilities

This Visionary Solution focuses on the integrated management of sports and recreational facilities at ŠRC Češča through a unified ICT platform. VS4 specifically aims to implement a system that combines facility booking with IoT sensor data to monitor visitor flows and enhance operational efficiency. A Customer Relationship Management (CRM) system will

support data collection and analysis, enabling better service delivery and user experience.

Objective 4.1: Implement a customer Relationship Manager (CRM) system to collect and manage data from IoT sensors deployed at the park.

- Increased governance coordination for NBS (7.6,7.7)
- Increased institutional capacity (7.9)
- Increased and improved participation (7.8, 7.11)
- Increased public & private investments (10.9)

Although the associated KPIs do not directly measure the deployment and specific functionality of the CRM system, they provide indirect indications of its existence and impact. For example, the increase in co-creation processes (7.8) and inter-departmental coordination (7.6) suggests a stronger organisational framework, potentially enabled by digital tools such as a CRM. Similarly, the ability to collect and use data may have facilitated greater citizen participation or a more strategic allocation of investments (10.9).

However, the lack of direct indicators assessing the use, reach, interoperability or effectiveness of the CRM system in data management limits the possibility of assessing the degree to which the objective has been met, and more specifically, how functional the system is.

VS5: IoT solutions for measuring the health and well-being of users and visitors

This Visionary Solution supports the acquisition of wearables to actively track the activities and directly monitor the H&WB of visitors. Additionally, visitor tracking sensors are placed at the pilot site to more accurately track the movement of visitors.

Objective 5.1: Track the activities and directly monitor the H&WB of visitors

- Increased air quality data (5.5, 5.6)
- Increased data on quality of life (9.8)
- Increased data on outdoor physical activity (9.16, 9.19)

Although some of the KPIs do not directly measure the impact of health or wellbeing monitoring, they provide valuable indirect information on improving the quality of the environment and physical activity in the park.

The thermal comfort indicators (KPI 5.5 and 5.6) provide key data on the air quality and physical conditions of the environment, which directly impacts on the well-being of users. Although these data do not directly reflect the health conditions of individuals, they do provide critical information about the environment that can influence users' experience and willingness to participate in outdoor activities.

On the other hand, the data on outdoor physical activity (KPI 9.16 and 9.19) show an increase in the number of active people, albeit with a slight decrease in the number of visitors between 2023 and 2024. These KPIs show a correlation between the controlled environment and the promotion of physical activity.

Finally, the quality-of-life indicators (KPI 9.8) reflect an improvement perceived by users, with an average score of 3.9 in the 2024 surveys. This data suggests that, despite variations in active participation, the implemented solutions have had a moderate positive impact on users' quality of life. More specific data on how improvements in park conditions and physical activity directly impact the health and well-being of visitors would be useful.

4.7 Skellefteå

VS1: Build natural infrastructure to create urban resilience

This VS focuses on improving park waterways to attract visitors and nearby residents, encouraging longer stays. Enhancements to the riverbank green boost biodiversity and offer educational value. Water flow and quality are monitored. The improvements benefit park visitors through better accessibility and aesthetics, while nearby residents gain protection from property flooding.

Objective 1.1: Making the waterways in the park more attractive to visitors and residents, encouraging people to spend more time in the park.

- Reduction in water routed to drainage network / Reduced costs for sewerage treatment (2.7)
- Increased recreational and cultural value of green spaces (4.3)
- Increased reclamation of contaminated land (6.4)
- Increased public & private investments (10.9)

Economically, a key benefit has been the reduction of stormwater routed to the public sewerage system, resulting in estimated cost savings between 550,000 kr (€47,103) and 1,100,000 kr (€94,207), directly addressing KPI 2.7. Due to GDPR restrictions, KPI 4.3 could not be fully assessed; the installed visitor sensor monitors only one pathway and does not provide representative data for overall park usage. However, notable environmental progress has been made under KPI 6.4, with 75% of contaminated land in Skellefteå (12,225 m² out of 16,300 m²) successfully reclaimed as of November 2023, primarily due to the implementation of VSs.

Objective 1.2: Measure water flow and quality

- Increased water retention capacity by vegetation and soil (2.2)
- Improved surface water quality (2.6)
- Reduction in water routed to drainage network / Reduced costs for sewerage treatment (2.7)
- Increased recreational and cultural value of green spaces (4.3)
- Big savings in operational cost (4.13)
- Increased reclamation of contaminated land (6.4)
- Increased parameters for (re)designing green public spaces (10.5)
- High replication potential of Visionary Solutions (10.6)
- Increased public & private investments (10.9)

To support Objective 1.2, several initiatives were undertaken to monitor water flow and quality. Water retention capacity—an important indicator of ecosystem resilience and flood mitigation—rose from 3,600 m³ to 4,000 m³ after the implementation of VSs. In terms of water quality (KPI 2.6), three measurement rounds were conducted at four sampling sites along the Skellefteälven River, analysing chemical (Copper concentrations) and biological indicators (E. coli and Coliform Index). These efforts mark a systematic step forward in tracking and improving surface water quality. Consistent with KPI 2.7, reduced stormwater load to the public sewerage network translated into estimated economic savings of 550,000–1,100,000 kr (€47,103–€94,207).

However, it is worth noting that high grass management—used in parts of the area to support biodiversity and retention—currently incurs higher maintenance costs (€0.80/m²/year) compared to traditional grass management (€0.18/m²/year). These

higher costs are largely attributed to the novelty of the approach and limited equipment scaling, which may decrease over time

VS2: Creation of a wetland bed to increase biodiversity

VS 2 aimed to use stormwater to create a wetland bed by allowing the new green space area to be partially flooded and to foster planting of indigenous species on the wetland bed.

Objective 2.1: Halt habitat loss for local species, enhance biodiversity

- Increased urban biodiversity (4.11, 4.12)

The total number of recorded species in the pilot area more than doubled—from 48 species before implementation to 99 after—indicating a significant positive impact on local biodiversity, in line with KPIs 4.11 and 4.12. In addition, approximately 1,372 acres (5.55 km²) of land within the city of Skellefteå have been identified as areas of high biodiversity value. These outcomes reflect the success of habitat restoration and diversification measures and support long-term ecological resilience.

Objective 2.2: Increase recreational value for users

- Increased recreational and cultural value of green spaces (4.3)

Since the park is open-access and visitor counting sensors could not be installed due to GDPR, there are no records on how many visitors frequent the green spaces in Skellefteå. However, the pilot notes that several schools have been invited to Klockardalsparken and are actively using the outdoor classroom and participating in environmental education activities.

Objectives 2.3: Enables the trial of different green area management for a sustainable and rational management of biodiverse areas in the future

- Increased water retention capacity by vegetation and soil (2.2)
- Reduction in water routed to drainage network / Reduced costs for sewerage treatment (2.7)
- Big savings in operational cost (4.13)
- Increased parameters for (re)designing green public spaces (10.5)
- High replication potential of Visionary Solutions (10.6)

- Savings in healthcare spending (10.8)
- Increased public & private investments (10.9)

The KPIs linked to this objective focus on testing innovative approaches for the sustainable and rational management of biodiverse urban areas. Key trials included the creation of a wetland bed to assess improvements in water retention (KPI 2.2) and reductions in water routed to the sewage system (KPI 2.7). These interventions serve as practical experiments to inform future biodiversity-friendly maintenance strategies. Additionally, the municipality is developing long-term plans to strengthen biodiversity management, supporting broader design and planning improvements (KPI 10.5). Looking ahead, the Skellefteå pilot has identified a future funding opportunity of approximately €75,000 through Local Sustainability Grants, which could support the replication and scaling of green infrastructure (KPIs 10.6 and 10.9).

VS3: Installation of smart lightning to contribute to an inviting environment and encourage activities in the park

VS 3 involves the installation of smart lighting to contribute to an inviting environment and encourage activities in the park. As of 2024, the sensors for the lamp posts and the cables for the lamp posts have been installed.

Objective 3.1: Enhance the park environment to provide a safe, inviting, and engaging space for visitors—encouraging outdoor activity, improving well-being, and contributing to placemaking—while also reducing light pollution through energy-efficient lighting solutions.

- Energy savings from lighting upgrades and improvements (1.4)
- Increased recreational and cultural value of green spaces (4.3)
- Increased outdoor physical activity (increased of data gathering of data of people being physical active) (9.19)
- Increased psychological well-being and/or quality of life: improved positive emotions; reduced negative emotions (9.28)

In terms of energy savings, seven 22Wh luminaires were replaced, resulting in a total reduction of 154Wh. Beyond energy efficiency, the smart lighting fixtures also contribute to a more welcoming atmosphere—particularly valuable during the darker months of the

year. While various activities were reported in the park, data collection was not sufficient to determine whether there was a measurable increase in outdoor physical activity or improvements in psychological well-being and quality of life.

VS4: Educating and engaging citizens in the area to level up their awareness of climate change and the importance of biodiversity

The goal of this VS is to provide clear information, educational content, and interactive tools to help citizens understand and engage with the park's nature-based solutions (NBS). This includes updates on project progress and insights into the pilot's goals.

Information signs were installed to explain the solutions and highlight their role in addressing climate change, the water cycle, and biodiversity. Using the park as a living example, the initiative promotes awareness of sustainable urban design and encourages time in green spaces—supporting both environmental education and mental well-being. As a Child-Friendly City, it is also important that children can access information and interact with the solutions in meaningful ways.

Objective 4.1: Provide information, educational material and interactive solutions to educate and engage citizens in order to understand and interact with the solutions in the park

- Increased recreational and cultural value of green spaces (4.3)
- Increased awareness of urban ecosystems (7.3, 7.4, 7.5)
- Increased and improved participation (7.8, 7.11)
- Increased parameters for (re)designing green public spaces (10.5)

While a number of educational activities were carried out in collaboration with schools and science centres—contributing qualitatively to increased awareness of urban ecosystems (KPIs 7.3, 7.4, 7.5)—these efforts were not formally evaluated, and no quantitative data was collected to assess the level of awareness achieved. The park's open-access nature posed challenges for engaging visitors directly, and survey efforts to assess perceptions and awareness yielded limited responses. This also impacted the ability to measure progress on KPI 4.3 (recreational and cultural value).

Due to the park's open-access nature, directly engaging visitors for feedback through surveys was challenging. Nonetheless, co-creation workshops offered a more targeted form of citizen engagement. The number of local citizens and stakeholders participating

in co-creation activities in the Skellefteå pilot had steadily increased since the first workshop in 2021, reaching a total of 23 participants to date (KPIs 7.8, 7.11). Public awareness was also supported through broader communication channels: the project received coverage in a local newspaper with a reach of 19,000 people, while other activities directly engaged over 300 individuals.

VS5: Creation of space in the park with bee hotels/insect habitats, permanent school-material

VS5 provided the deployment of open-air classrooms for young students so that educational activities can be organised in a natural setting. It included the creation of a specific space in the park with bee hotels/insect habitats, as well as building material at the disposal of the students to use to create further hotels/habitats, and permanent educational material such as signs about different species.

Objective 5.1: Provide open-air educational infrastructure for young students so that they may experience learning in natural settings

- Increased awareness of urban ecosystems (7.3, 7.5)
- Increased and improved participation (7.8)
- Fair participation to project activities (8.5)
- Increased parameters for (re)designing green public spaces (10.5)

While a number of educational activities were carried out in collaboration with schools and science centres—contributing qualitatively to increased awareness of urban ecosystems (KPIs 7.3, 7.5). These efforts were not formally evaluated, and no quantitative data was collected to assess the level of awareness achieved.

Objective 5.2: Creation of space in the park with bee hotels/insect habitats

- Increased urban biodiversity / Increased pollinator species (4.15)

The total number of recorded species in the pilot area more than doubled—from 48 species before implementation to 99 after—indicating a significant positive impact on local biodiversity and pollinator species.

5 Pilot Cross-Comparative Metrics and Impacts

5.1 Cross-comparative metrics

Following the thorough reporting of KPI results in Annex II and VS evaluations, this section outlines the commonalities in the pilot site KPI measurements, and draws parallels between the sites' performance to highlight best practices and successful outcomes emerging from the VARCITIES project. Several sessions were held by the WP7 leaders to coordinate data collection between the various pilot site representatives and pilot experts in VARCITIES to align these common aspects where possible. The possibility of comparisons was based on similar methodologies, sample characteristics, types of data collected and impacts. The comparisons are made on the basis of the various challenges that were addressed under VARCITIES.

In the coming subsections, the comparisons are made by means of tables, highlighting each KPI and the Pilots that measured the KPIs. As will be described in section 5.2, The usefulness of these cross-comparisons allows stakeholders such as urban designers, city managers and others to draw parallels on what can be expected for their own city in case a particular KPI is being addressed. As will be highlighted, despite the fact that different pilots, as outlined in D7.2, might use slightly different methodologies, the outcomes tend to be aligned and still provide a good indicator that can be used to evaluate outcomes.

Challenge 1

1.1 - C removed/stored by vegetation

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Chania	C tons year-1	i-Tree Eco	Land Use, Strata/Area, Trees Species, Tree's Latitude-Longitude, Total Tree Height (m), Live Tree Height (m), Height to Crown Base (m), Diameter at Breast Height (DBH) (cm), Crown Size (m), Crown Width N-S (m), Crown Width E-W (m), Percent of Crown Missing (%), Crown Health (Dieback) (%), Crown Light Exposure	Field measurements		Increased carbon sequestration data
Gżira	C tons year-1	i-Tree Eco	Height (m), Width (m), Trunk CIR, Foliage length, Canopy area	Field measurements (tree survey + GIS data)		Increased carbon sequestration data
Novo Mesto	C tons year-1	EcoMatcher: $CO_2 = 0.1083 \times D^2 \times H$	(DBH) (cm), Height (m)	Field measurements		Increased carbon sequestration data

Table 2: Common KPI 1.1

This table presents the methods used by Chania, Gzira, and Novo Mesto to quantify carbon sequestration by vegetation. Chania and Gzira applied the i-Tree Eco model using different sets of tree parameters gathered through field measurements. Novo Mesto relied on a mathematical equation from EcoMatcher ($CO_2 = 0.1083 \times D^2 \times H$) based on tree diameter and height. All three pilots aimed to quantify carbon storage in tons per year, using locally collected data from tree surveys and GIS tools. The data enables assessment of the contribution of urban greening to climate mitigation.

1.2 - Decrease in mean or peak daytime local temperatures

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Chania	°C	1) Calculation of mean and peak daytime local temperature within two Green Spaces 2) Calculation of mean and peak daytime local temperature in corresponding urban spaces 3) Calculation of differences (green vs urban space)	Temperature	Sensor data		Increased temperature and humidity data
	°C	Calculation of mean daytime temperature in the city, divided per clusters.	Temperature	Sensor data - Temperature Data is collected through two main sources: 1. Bike stations and 2. Bicycle usage data.		Evaluation of Environmental pollution in the city of Chania
Leuven	°C	1. Calculation of daily maximum temperatures. 2. Calculation of monthly mean value of daily maximum temperature	Temperature	Data from weather stations and sensors in: 1) a green space and 2) an urban space		Increased temperature and humidity data

Table 3: Common KPI 1.2

The table outlines how Chania and Leuven measured temperature differences across green and urban areas. Chania calculated mean and peak temperatures using sensors and data from bike stations, offering both micro and city-wide scales. Leuven focused on daily maximum temperatures and monthly averages from fixed weather stations. Both pilots use °C as the unit and aim to track the cooling effect of green spaces. The added value lies in identifying urban heat island effects and supporting urban design decisions to enhance climate resilience through extensive data collection.

1.3 - Measures of human comfort

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Castelfranco	°C	Calculation of PET	of air temperature, wind velocity, barometric pressure, and humidity	Sensor data, data from weather stations		Increased temperature data on human comfort
Novo Mesto	°C	Calculation of PET	of air temperature, air pressure, humidity	Sensor data, data from weather stations		Increased temperature data on human comfort
Chania	°C	Calculation of UTCI.	Temperature (°C), Relevant Humidity (%RH) liquid thermometer temperature (°C), thermal radiation (°C)	Sensor data, data from weather stations, Portable sensor		Increased temperature data on human comfort
Leuven	°C	Calculation of UTCI	Air Temperature (°C), Relevant Humidity (%RH) Dew point temperature (°C), Mean Radiant Temperature, Air speed (m/sec)	Data from weather stations and sensors in: 1) a green space and 2) an urban space		Increased temperature data

						on human comfort
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Table 4: Common KPI 1.3

Castelfranco, Novo Mesto, Chania, and Leuven calculated human thermal comfort using PET or UTCI indices - as shown in the table above respectively. Data was collected from weather stations or portable sensors and includes temperature, humidity, wind velocity, and radiant temperature. PET is used by Castelfranco and Novo Mesto, while Chania and Leuven apply UTCI. The pilots aim to assess the comfort levels of citizens in green spaces, with potential benefits for planning inclusive and pleasant urban environments.

1.4 - Energy

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Skellefteå	kWh year	Calculation of kWh year	power consumption (measured in watts, kWh/year)	Meter data	Energy savings from lighting upgrades and improvements	
Dundalk	kWh year	Calculation of kWh year	power consumption (measured in watts, kWh/year)	Meter data	Energy savings from lighting upgrades and improvements	

Table 5: Common KPI 1.4

Skellefteå and Dundalk measured power consumption in kilowatt-hours per year to evaluate energy savings due to infrastructure upgrades, particularly lighting systems. The method involves direct meter readings. The pilots aim to reduce

energy use and demonstrate the impact of sustainable infrastructure investments. This data contributes to environmental and cost-saving evaluations.

1.5 - Local energy production from renewable energy sources

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Dundalk	kWh year	Three-phase meter to measure solar electricity from the PV system	Solar electricity generation in kilowatt-hours (kWh)	Meter data	Increased energy savings	
Chania	kWh year	Direct measurements from victronenergy MultiPlus-II 48/5000/70-48.	Solar electricity generation in kilowatt-hours (kWh)	sensor-PV Meter	Increased energy savings	

Table 6: Common KPI 1.5

Dundalk and Chania monitor solar energy generation using advanced meters. Dundalk uses a three-phase meter, while Chania applied a Victron Energy MultiPlus-II system. Both track energy output in kWh per year. The data enables assessment of renewable energy integration and helps quantify energy savings.

1.8 - Number of temperature and humidity data

Pilots	Units		Type of Data	Sources of Data	Expected Outcome/Impact
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		Method/Tools			Direct Impact	Added Value
Chania	No. of temperature and humidity data	Field measurements	Temperature, Humidity	Sensor data, data from weather stations	Increased temperature and humidity data	
Leuven	No. of temperature and humidity data	Field measurements	Temperature, Humidity	Sensor data, data from weather stations	Increased temperature and humidity data	
Castelfranco	No. of temperature and humidity data	Field measurements	Temperature, Humidity	Sensor data, data from weather stations		Increased temperature and humidity data

Table 7: Common KPI 1.8

Chania, Leuven, and Castelfranco collected temperature and humidity readings through field measurements and weather stations. This indicator reflects the volume of environmental data gathered for monitoring purposes. The consistent data acquisition improves the pilots' ability to assess microclimatic changes, evaluate intervention performance, and support future modelling work.

Challenge 2

2.6 - Water Quality Indicators

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value

Skellefteå	various (e.g., microgram/l)	Water sampling	Metals (Cu), E-coli and Coliform index	Lab analysis of water samples		Increased data on water quality
Leuven	various (e.g., microgram/l)	Water sampling	Dissolved oxygen, pH, ions, total nitrogen, total phosphorus, suspended matter, BOD (Biological oxygen demand), COD (chemical oxygen demand).	Lab analysis of water samples		Increased data on water quality

Table 8: Common KPI 2.6

Water quality was assessed in Skellefteå and Leuven through field sampling and laboratory analysis. Skellefteå focused on metals and bacteria (e.g., Cu, E. coli), while Leuven measured a broader range of parameters including dissolved oxygen, pH, nitrogen, phosphorus, BOD, and COD.

Challenge 4

4.2 - Accessibility of urban green spaces for population

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Dundalk	km / min (on foot, by bus)	Walking distance and walking time calculated by means of GIS	Distance, time	Google Maps	Increased accessibility of urban green spaces	
Novo Mesto	km / min (on foot, by bus)	Walking distance and walking time calculated by means of GIS	Distance, time	GIS Maps	Increased accessibility of urban green spaces	

Gżira	km / min (on foot, by bus)	Walking distance and walking time calculated by means of Google maps tool	Distance, time	Google Maps	Increased accessibility of urban green spaces	
Leuven	km / min (on foot, by bus)	Walking distance and walking time calculated by means of Google maps tool	Distance, time	Google Maps		Increased data on accessibility of urban green spaces

Table 9: Common KPI 4.2

Accessibility to green spaces in Dundalk, Novo Mesto, Gżira, and Leuven was analysed using GIS or Google Maps to calculate walking distances and travel times. This indicator reflects spatial equity and helps determine how well green areas are integrated into urban settings for all citizens using relevant benchmarks for distance and travel time respectively.

4.3a - Recreational or cultural value of green spaces (number of visitors)

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Skellefteå	No. of visitors/year	Record keeping	No. of visitors	Record keeping	Increased recreational or cultural value of green spaces	
Dundalk	No. of visitors/year	Record keeping	No. of visitors	Cubbie monthly reports, LCCs booking system for the Learning pod	Increased recreational or cultural value of green spaces	
Castelfranco	No. of visitors/year	Record keeping	No. of visitors	Record keeping	Increased recreational or cultural value of green spaces	

Novo Mesto	No. of visitors/year	Record keeping, People Counting Sensor	No. of visitors	Record keeping, People Counting sensors	Increased recreational or cultural value of green spaces	
Gżira	No. of visitors/year	Registrations in events	No. of visitors	Record keeping	Increased recreational or cultural value of green spaces	
Chania	No. of visitors/year	Record keeping	No. of visitors	Record keeping	Increased Recreational or Cultural Value	
Leuven	No. of visitors/year	Record keeping	No. of visitors	Record keeping, People Counting sensors	Increased recreational or cultural value of public spaces	

Table 10: Common KPI 4.3a

Visitor counts were recorded through people counting sensors, registration logs, or event attendance. The data helps quantify green space use and assess their value for recreation and community engagement. Increased visitation reflects positive social impact.

4.3b - Recreational or cultural value of green spaces (activities in green space)

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value

Skellefteå	No. of activities in green spaces/ year	Record keeping	number of events/activities held	Record keeping	Increased recreational or cultural value of green spaces	
Dundalk	No. of activities in green spaces/ year	Record keeping	number of events/activities held	Record keeping	Increased recreational or cultural value of green spaces	
Castelfranco	No. of activities in green spaces/ year	Record keeping	number of events/activities held	Record keeping	Increased recreational or cultural value of green spaces	
Novo Mesto	No. of activities in green spaces/ year	Record keeping	number of events/activities held	Record keeping		Increased data about recreational or cultural value of green spaces
Gżira	No. of activities in green spaces/ year	Record keeping	number of events/activities held	Record keeping	Increased recreational or cultural value of green spaces	
Chania	No. of activities in green spaces/year	Record keeping	number of events/activities held	Record keeping	Increased recreational or cultural value of green spaces	
Leuven	No. of activities in green spaces/year	Record keeping	number of events/activities held	Record keeping	Increased recreational or cultural value of public spaces	

Table 11: Common KPI 4.3b

All pilots recorded the number of recreational or cultural activities held in green spaces. The data was gathered via manual record keeping. Gżira, Castelfranco, Skellefteå, Chania, Dundalk and Leuven focused on measuring activities that have been organised as part of VARCITIES, while Novo Mesto collected data related to activities in green spaces occurring at the pilot site in general. High activity levels indicate strong community engagement and cultural use of the space, which supports urban well-being and social inclusion. It also reflects how multifunctional and adaptable these spaces are.

4.9 - Effectiveness of seating locations

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Dundalk	No. of benches	No. of occupancy of bench	No. of occupancy of bench	No. of occupancy of bench	Increased green public space facilities	
Castelfranco	No. of people using benches	Measurement of no. of people sitting from sensors affixed to the benches and through GPS app on smartphones (V55)	No. of people using benches	Data through GPS app on smartphones, motion sensors	Increased use of green public space facilities	

Table 12: Common KPI 4.9

Castelfranco Veneto evaluated bench use through sensors and GPS tracking. They complemented this with smartphone GPS data. This indicator highlights how often green space amenities are used, informing the design of accessible and user-friendly public areas. Increased use of benches implies successful placemaking and comfort. On the other hand, the Dundalk pilot has increased the number of benches, while taking measurements regarding their use by the public was not possible.

4.11 - Species richness and composition with respect to indigenous vegetation and local/national biodiversity targets

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Skellefteå	No of indigenous vegetation	Manual count of species	Number of species	Manual count of species	Increased urban biodiversity	
Dundalk	No of indigenous vegetation	Manual count of species	Number of species	Manual count of species	Increased urban biodiversity	
Gżira	No of indigenous vegetation	Manual count of species	Number of species	Manual count of species	Increased urban biodiversity	

Table 13: Common KPI 4.11

Skellefteå, Dundalk and Gżira counted indigenous plant species to assess biodiversity levels. The unit of measure is the number of native species present. These counts help understand the ecological quality of urban green spaces and how well they align with biodiversity targets.

4.14 - Increased connectivity to existing GI/ socio-cultural spaces

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Novo Mesto	m and/or %	Measurement of distances using GIS, Calculation of Percentage Connectivity	Walking distance, percentage connectivity	GIS Maps	Increased connectivity to existing Green Infrastructure	

Leuven	m	Measurement of distances using Google Maps	Walking distance	Google Maps	Increased connectivity to existing Green Infrastructure	
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Table 14: Common KPI 4.14

Novo Mesto and Leuven evaluated connectivity using distance and percentage metrics derived from GIS or Google Maps. Novo Mesto focused on calculating walking distances and connectivity percentages between new and existing green infrastructure, while Leuven relied on distance alone. This indicator helps assess the integration of interventions into broader ecological and social networks.

Challenge 5

5.5 - Physical air quality indicators: temperature, humidity, etc...

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Castelfranco	% (air vapour), °C	Measurement of physical air quality indicators	Humidity, air temperature, air pressure	Sensors		Increased number of air quality data
Novo Mesto	% (air vapour), PA	Measurement of physical air quality indicators	Humidity, air pressure	Sensors		Increased number of air quality data
Chania	%, °C	Calculation of hourly & daily values of temperature and relative humidity.	Air Temperature (oC), Relative Humidity (%)	Sensors		Increased number of air quality data, Evaluation of Environmental pollution in the city of Chania
Leuven	% (air vapour), PA	Measurement of physical air quality indicators	Humidity, air temperature, air pressure, wind speed, wind	Sensors		Increased number of air quality data

	°C, °, mm, m/s		direction, wind gust, rain, solar radiation			
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Table 15: Common KPI 5.5

Castelfranco, Novo Mesto, Chania, and Leuven used sensors to measure physical air quality parameters such as humidity, temperature, pressure, wind speed, and solar radiation. Leuven collected the broadest range of variables. These measurements provide real-time data on environmental conditions and support evaluations of comfort, health risks, and climate adaptation performance.

5.6 - Chemical air quality indicators (Concentration of particulate matter (PM10 and PM2.5), NO2, SO2, CO, NH3,CL,CO2 and O3 in ambient air)

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Dundalk	µg/m3	Measurement of chemical air quality indicators	CO2, O2, PM1, PM2.5, PM10	Sensors		Increased number of air quality data
Castelfranco	µg/m3	Measurement of chemical air quality indicators	CO2, O3, PM1, PM2.5, PM10	Sensors		Increased number of air quality data
Novo Mesto	µg/m3	Measurement of chemical air quality indicators	CAQI24, PM1, PM2.5, PM10	Sensors		Increased number of air quality data
Gżira	µg/m3	Measurement of chemical air quality indicators	CO2, SO2, O3, PM1, PM2.5, PM10	Sensors		Increased number of air quality data
Chania	µg/m3	Measurement of chemical air quality indicators	PM1, PM2.5, PM10, CO, CO2, NO2, SO2, O3	Sensors		Increased number of air quality data, Evaluation of Environmental

						pollution in the city of Chania: Air Quality Index and Air quality maps
Leuven	µg/m3	Measurement of chemical air quality indicators	PM1, PM2.5, PM10	Sensors		Increased number of air quality data

Table 16: Common KPI 5.6

All listed pilots (Dundalk, Castelfranco, Novo Mesto, Gżira, Chania, Leuven) monitored concentrations of pollutants such as CO₂, PM₁, PM_{2.5}, PM₁₀, NO₂, and O₃ using air quality sensors. The data supports environmental policy decisions and helps raise public awareness of urban air pollution trends.

5.15 - No. of air quality data

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Chania	No. of added data (per year)	Based on the summarized data collected from the Air Quality indicators (ID5.6) for both Visionary Solutions (VSs), ArcGIS is employed to map the data and identify clusters within the city. This mapping highlights urban areas where data has been gathered, providing a spatial overview of the city.	PM1, PM2.5, PM10, CO, CO ₂ , NO ₂ , SO ₂	Sensors	Increased number of air quality data	
Leuven	No. of added data (per year)	Summary of relevant indicators (5.5 & 5.6)	Number of entries	Weather stations, Senstick, Air quality sensor	Increased number of air quality data	

Table 17: Common KPI 5.15

Chania and Leuven collected and summarised air quality data using a combination of indicators. Chania used GIS to identify pollutant clusters, while Leuven aggregated data from various sensors. These efforts aim to visualise and quantify air quality for targeted environmental improvements and policymaking.

Challenge 6

6.4 - Reclamation of contaminated land

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Skellefteå	km2 and %	1) Calculation of surface area using maps, 2) calculation of percentage of the increase in open space in relation to built-form post-intervention	Area	Maps	Increased reclamation of contaminated land	
Novo Mesto	km2 and %	1) Calculation of surface area using maps, 2) calculation of percentage of the increase in open space in relation to built-form post-intervention	Area	Maps	Increased reclamation of contaminated land	

Table 18: Common KPI 6.4

Skellefteå and Novo Mesto measured land reclamation by calculating area in km² and the percentage increase in open space relative to built form. Using GIS maps, they assessed the effectiveness of interventions in converting degraded land into usable green spaces.

6.6 - Use of reclaimed/recycled building materials

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Dundalk	Kg, %	Calculation of the volume of paving blocks (sqm)	Quantities of reclaimed material	Data from the subcontractor	Increased reclamation of building materials	
Leuven	%	Calculation of the percentage of reclaimed materials from the Velodroom's deconstruction	Percentage of reclaimed material	Data from the builders and artist who undertook the works	Increased reclamation of building materials	

Table 19: Common KPI 6.6

Dundalk and Leuven assessed reclaimed construction materials used in public projects. Dundalk calculated the quantity in square meters and kilograms, while Leuven recorded percentages based on deconstruction reuse. Data was sourced from subcontractors and builders. This indicator supports circular economy strategies and resource-efficient urban planning.

6.7 - Road surface dedicated to pedestrians

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Dundalk	m2%	1) Measurement of road pre- intervention 2) Calculating the percentage of increase in pedestrianised roads post-intervention	Area	Maps	Increased share of pedestrian areas	
Castelfranco	m2%	1) Measurement of road pre- intervention 2) Calculating the percentage of increase in pedestrianised roads post-intervention	Area	Maps	Increased share of pedestrian areas	

Table 20: Common KPI 6.7

Dundalk and Castelfranco Veneto measured pedestrian space expansion using pre- and post-intervention surface area (m²) and calculated the percentage increase. The indicator helps quantify mobility improvements and efforts to prioritise pedestrians over cars, fostering healthier and more inclusive cities.

6.8 - Access of residents/employees by foot to open space: sports centre, recreation area, or green space

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Chania	No of residents	ArcGIS, integrating statistical data, is employed to 1) analyse the population living within a 300-meter buffer zone of existing recreational areas, 2) analyse the population living within a 300-meter buffer zone of various abandoned or underdeveloped public spaces that could accommodate the MULR.	GIS Data	Data from Hellenic statistical authority	Increased accessibility of recreation facilities	
Leuven	km	Google maps and CAD tools. Method: 1) Four entrances of the future park are identified on map, 2) 300m radii circles are designed from each entrance, 3) 21 departure points situated on the circumference of the circles, are selected and identified on map, 4) Walking distance between each point and relevant entrance is calculated with means of Google maps tool, 5) distances are compared, the longest is identified.	GIS Data	Data calculated based on Google maps and CAD tools (distance and walking distance)	Increased accessibility of sport and recreation facilities	

Table 21: Common KPI 6.8

Chania and Leuven evaluated pedestrian access to green and recreational areas using GIS tools and walking distance analysis. Chania combined demographic data with GIS to estimate the number of residents within 300 meters of both existing and potential green spaces. Leuven used CAD and Google Maps to simulate walking paths and identify accessibility barriers. These methods help determine the spatial inclusiveness of interventions.

6.9 - Access of residents to cultural facilities on foot

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Dundalk	km and/or min	Measurement of distances to cultural facilities pre and post interventions	Distance	Maps (Google maps walking distances)	Increased accessibility of cultural facilities	
Chania	No of residents	ArcGIS, integrating statistical data, is employed to 1) analyse the population living within a 300-meter buffer zone of existing cultural facilities. 2) analyse the population living within a 300-meter buffer zone of green spaces that presently lack cultural amenities but could host the MULR	GIS data	Data from Hellenic statistical authority	Increased accessibility of cultural facilities	
Leuven	km	Measurement of distances to cultural facilities pre and post interventions	Distance	Maps (Google maps walking distances)	Increased accessibility of cultural facilities	

Table 22: Common KPI 6.9

Chania, Dundalk, and Leuven assessed access to cultural amenities on foot. Chania used GIS and population data to analyse accessibility within 300 meters, targeting future cultural use of existing or planned green areas. Dundalk and Leuven focused on walking distances pre- and post-intervention using Google Maps. Chania's methodology was based on a forecast where MULaR can host cultural activities. This indicator supports equitable cultural access planning.

Challenge 7

7.1 - Openness of participatory processes

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Castelfranco	No. of people / year	Data collection from record keeping of participant data	No of people	1) Data collection from record keeping of participant data.	Increased and improved participation	
Leuven	No. of people / year	Data collection from record keeping of participant data	No of people	1) Data collection from record keeping of participant data.	Increased and improved participation	

Table 23: Common KPI 7.1

Castelfranco and Leuven tracked the number of citizens participating in engagement activities using attendance records. This metric measures how open and inclusive participatory activities have been throughout the intervention phases. High participation reflects transparent governance and citizen empowerment in urban planning.

7.3 - Social learning concerning urban ecosystems and their functions/services

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Castelfranco	No. of learning supporting units	Analysis of collected data to evaluate the social learning function of the proposed intervention	N/A	Interactions with totem	Increased awareness of urban ecosystems	

Novo Mesto	No. of learning supporting units	Analysis of collected data to evaluate the social learning function of the proposed intervention	N/A		Increased awareness of urban ecosystems	
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Table 24: Common KPI 7.3

Castelfranco and Novo Mesto evaluated the impact of their interventions on citizen understanding of urban ecosystems. Through interactive tools like the totem and analysis of engagement data, they assessed how knowledge transfer occurs in public space. The indicator supports long-term behavioural change and sustainability awareness.

7.4 - Perceptions of citizens on urban nature

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Castelfranco	number of visitors	1) Organisation of online and on-site events/workshop/initiatives 2) Promotion of events 3) Gather feedback about environmental awareness	Number of visitors	Surveys, registration forms, attendance lists, Distribution of gadgets (if foreseen) useful also to understand the number of participants	Increased awareness of urban ecosystems	
Novo Mesto	number of visitors	At stakeholder workshop, extent to which the project exploits opportunities to increase citizens' awareness of NBS was measured through a five-point scale questionnaire	Number of visitors, citizens' awareness	Surveys	Increased awareness of urban ecosystems	

Chania	number of visitors	Survey	Number of visitors, citizens' awareness	Surveys	Increased awareness of urban ecosystems	
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Table 25: Common KPI 7.4

This indicator captures public perceptions via surveys and workshops. Castelfranco, Novo Mesto, and Chania gathered feedback through questionnaires and participant counts. The aim is to measure changes in environmental awareness and attitudes toward urban nature. Results guide future awareness campaigns and participatory planning.

7.5 - Social values for urban ecosystems and biodiversity

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Skellefteå	number of visitors	Social return on investment	number of visitors	Focus groups	Increased awareness of urban ecosystems	
Castelfranco	number of visitors	Social return on investment	number of visitors	Focus groups	Increased awareness of urban ecosystems	
Novo Mesto	number of visitors	Five-point scale questionnaire	number of visitors	Questionnaire	Increased awareness of urban ecosystems	

Table 26: Common KPI 7.5

Pilots used social return on investment tools and questionnaires to measure how people value urban ecosystems and biodiversity. Skellefteå, Castelfranco, and Novo Mesto collected data through focus groups or surveys, highlighting the societal relevance of green interventions and justifying investment in nature-based solutions.

7.6 - Inter-departmental collaboration leading to NBS designs for multi-functionality

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Castelfranco	No. persons/entities	Semi-structured interview	Percentage of decision makers	Focus groups	Increased governance coordination for NBS	
Novo Mesto	No. persons/entities	Stakeholder mapping using Quip app	Percentage of decision makers	Stakeholder map	Increased governance coordination for NBS	

Table 27: Common KPI 7.6

Castelfranco and Novo Mesto assessed coordination between institutions using interviews and stakeholder mapping. The aim was to evaluate how well different departments worked together in designing multifunctional NBS. Strong collaboration indicates enhanced governance capacity for integrated urban development.

7.8 - Citizen participation in and co-creation of the design, implementation and evaluation of project interventions

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Skellefteå	No. of people / year	Record keeping	Number of people	Registration forms, record keeping	Increased and improved participation	
Dundalk	No. of people / year	Record keeping	Number of people	Registration forms, record keeping	Increased and improved participation	
Castelfranco	No. of people / year	Record keeping	Number of people	Registration forms, record keeping	Increased and improved participation	

Novo Mesto	No. of people / year	Record keeping	Number of people	Registration forms, record keeping	Increased and improved participation	
Gżira	No. of people / year	Record keeping	Number of people	Registration forms, record keeping	Increased and improved participation	
Chania	No. of people / year	Record keeping	Number of people	Registration forms, record keeping	Increased and improved participation	
Leuven	No. of people / year	Record keeping	Number of people	Registration forms, record keeping	Increased and improved participation	

Table 28: Common KPI 7.8

All pilots recorded the number of citizens participating in design, implementation, and evaluation stages. Data sources include workshop attendance and registration forms. This indicator reflects how participatory and inclusive the project was and supports co-design principles of urban interventions.

7.9 - Institutional learning concerning acquisition of knowledge and understanding

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Castelfranco	N/A	Semi-structured interviews will be designed to map the need of actors in charge of the institutional change	Qualitative	Semi-structured interviews	increased institutional capacity	
Novo Mesto	N/A	Attendance counting	Number of invited guests	Record keeping	increased institutional capacity	

Table 29: Common KPI 7.9

Castelfranco used semi-structured interviews to understand institutional learning, while Novo Mesto tracked stakeholder participation. The goal is to assess how institutions evolve and gain capacity from project experiences. This supports improved governance and organisational development.

7.11 - Number of individuals that are aware of the project's objectives, content and processes

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Skellefteå	no./% of individuals/participants	Record keeping	Number of people	Metrics from various events and dissemination/communication activities, Attendance sheets	Increased and improved participation	
Dundalk	no./% of individuals/participants	Record keeping	Number of people	Metrics from various events and dissemination/communication activities, Attendance sheets	Increased and improved participation	
Castelfranco	no./% of individuals/participants	Record keeping	Number of people	Attendance sheets	Increased and improved participation	
Novo Mesto	no./% of individuals/participants	Record keeping	Number of people	Attendance sheets	Increased and improved participation	
Gżira	no./% of individuals/participants	Record keeping	Number of people	Metrics from various events and dissemination/communication activities, Attendance sheets	Increased and improved participation	

Chania	No. of Attendees/Viewers	Record keeping	Number of people	Individuals considered the local community (No of people participated in Workshops, events, viewers of local newsletters etc)	Increased and improved participation	
Leuven	no./% of individuals/participants	Record keeping	Number of people	Metrics from various events and dissemination/communication activities, Attendance sheets	Increased and improved participation	

Table 30: Common KPI 7.11

This indicator tracks how many people became aware of the project through communication efforts. Metrics include event attendance and dissemination reach. All pilots documented numbers using registration logs, showing the effectiveness of outreach strategies in WP9.

7.13 - No of new information channels generated between public institutions & citizenship

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Dundalk	No of new information channels	Record keeping	No of new information channels	no. of information channels	increased institutional capacity	
Novo Mesto	No of new information channels	Record keeping	No of new information channels	no. of information channels	increased institutional capacity	

Table 31: Common KPI 7.13

Dundalk and Novo Mesto documented the creation of new channels of communication between institutions and citizens. The indicator captures institutional innovation and efforts to make governance more transparent and responsive.

7.16 - No of persons involved (on average) in the project activities

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Dundalk	No of persons / year	Record keeping	No of persons	Attendance sheets	Increased and improved participation	
Gżira	No of persons / year	Record keeping	No of persons	Attendance sheets	Increased and improved participation	
Leuven	No of persons / year	Record keeping	No of persons	Attendance sheets	Increased and improved participation	

Table 32: Common KPI 7.16

This indicator tracks the average number of people per year who participated in project events or activities. Attendance sheets and registration forms serve as primary data sources. It reflects the project's social reach and engagement success.

Challenge 8

8.5 - Personal and social background of people who participated in the project's activities

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Skellefteå	no. of people per category	Evaluation forms, activity/event registrations, questionnaires	personal and social background information	Evaluation forms, activity/event registrations, questionnaires	Fair participation to project activities	

Dundalk	no. of people per category	Evaluation forms, activity/event registrations, questionnaires	personal and social background information	Evaluation forms, activity/event registrations, questionnaires	Fair participation to project activities	
Castelfranco	no. of people per category	Evaluation forms, activity/event registrations, questionnaires	personal and social background information	Evaluation forms, activity/event registrations, questionnaires	Fair participation to project activities	
Novo Mesto	no. of people per category	Evaluation forms, activity/event registrations, questionnaires	personal and social background information	Evaluation forms, activity/event registrations, questionnaires	Fair participation to project activities	
Gžira	no. of people per category	Evaluation forms, activity/event registrations, questionnaires	personal and social background information	Evaluation forms, activity/event registrations, questionnaires	Fair participation to project activities	
Chania	no. of people per category	Evaluation forms, activity/event registrations, questionnaires	personal and social background information	Evaluation forms, activity/event registrations, questionnaires	Fair participation to project activities	
Leuven	no. of people per category	Evaluation forms, activity/event registrations, questionnaires	personal and social background information	Evaluation forms, activity/event registrations, questionnaires	Fair participation to project activities	

Table 33: Common KPI 8.5

Pilots collected demographic data using registration forms, surveys, and evaluation tools to ensure fair participation. The indicator assesses inclusiveness and social equity, highlighting whether diverse social groups engaged in the project.

8.8 - Participation of individuals with functional disabilities

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Dundalk	No. of individuals / year	Record keeping	No. of individuals, personal information	Evaluation/registration forms	Greater inclusion of people with functional disabilities	
Castelfranco	No. of individuals / year	Record keeping	No. of individuals, social background	Evaluation/registration forms	Greater inclusion of people with functional disabilities	
Novo Mesto	No. of individuals / year	Record keeping	No. of individuals, social background	Reservation platform, counter of the number of entries on purchased tickets for people with mobility impairments	Greater inclusion of people with functional disabilities	

Table 34: Common KPI 8.8

This table shows the number of people with disabilities who took part in project activities. Dundalk, Castelfranco, and Novo Mesto used evaluation forms and entry tracking to assess inclusiveness. The goal is to foster accessibility and equal participation.

8.10 - Accessibility of open public spaces and buildings for families with baby carriages and individuals with restricted mobility

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Castelfranco	m2	GIS Analysis	m2	GIS	Greater inclusion of families with babies and individuals with restricted mobility	
Novo Mesto	m2	GIS Analysis	m2	GIS	Greater inclusion of families with babies and individuals with restricted mobility	
Leuven	m2	GIS Analysis	m2	GIS	Greater inclusion of families with babies and individuals with restricted mobility	

Table 35: Common KPI 8.10

Castelfranco, Novo Mesto, and Leuven used mapping tools to measure accessible public spaces in square meters. This indicator evaluates how inclusive the physical environment is for families with baby carriages and individuals with restricted mobility.

Challenge 9

9.4 - Noise reduction rates (or exposure to noise pollution)

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Dundalk	dB(A)	Measurement of LDEN	LDEN	Sensors		Increased noise data
Castelfranco	dB(A)	Measurement of LDEN	LDEN	Sensors		Increased noise data
Gzira	dB(A)	Measurement of LDEN	LDEN	Sensors		Increased noise data
Chania	dB(A)	Measurement of LDEN	LDEN	Sensors		Increased noise data
Leuven	dB(A)	Measurement of LDEN	LDEN	Sensors		Increased noise data

Table 36: Common KPI 9.4

Dundalk, Castelfranco, Gzira, Chania, and Leuven measured environmental noise using sensors and calculated LDEN values. The goal is to collect data on the reductions in noise pollution and its contribution to improved quality of life.

9.5 - No of hours spent outdoors, time people spend in the facility

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Gzira	No of hours per week per capita / hours per capita	Data collection through a survey	time duration	Survey	Increased outdoor presence	
Leuven	No of hours per week per capita / hours per capita	Data collection through a survey	time duration	Survey	Increased outdoor presence	

Table 37: Common KPI 9.5

Gzira and Leuven collected self-reported data via surveys to estimate average hours per week spent outdoors. This process reflects how interventions impact outdoor activity and social well-being.

9.6 - Perceived well-being before and after the visit of green space

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Dundalk	Scales scores	Survey before and after visiting the Cubbie	Quantitative/score	Metrics from Cubbie	Increased health and well-being	
Castelfranco	Scales scores	Satisfaction Survey	Quantitative/ score	Survey	Increased health and well-being	
Leuven	Scales scores	Satisfaction Survey	Quantitative/ score	Survey	Increased health and well-being	

Table 38: Common KPI 9.6

Pilots assessed perceived well-being using pre- and post-intervention surveys with satisfaction scales. Dundalk used digital metrics from the Cubbie pod, while others used questionnaires. The aim is to evaluate psychological impacts of green spaces.

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Castelfranco	Scales' scores	WHO Quality of life, 26-item survey	Quantitative/score	Survey	Improved quality of life	
Novo Mesto	Scales' scores	Survey to assess quality of life	Quantitative/score	Survey	Improved quality of life	
Gżira	Scales' scores	Survey to assess quality of life	Quantitative/score	Survey	Improved quality of life	
Chania	Scales' scores	Survey to assess quality of life (Likert scale)	Quantitative/score	Survey		Increased number of data
Leuven	Scales' scores	Survey to assess quality of life	Quantitative/score	Survey	Improved quality of life	

9.8 - Feeling of improving the quality of life (the QoL questionnaire)

Table 39: Common KPI 9.8

Quality of life was assessed using standardised tools like the WHO QoL-26 survey or Likert-based questionnaires. Castelfranco, Novo Mesto, Gżira, Chania, and Leuven used this data to understand how green interventions influence life satisfaction.

9.13 - Residential attachment and satisfaction

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value

Castelfranco	Scales' scores	Survey (ad hoc 6-item)	Quantitative/score	Survey	Increased residential attachment and satisfaction	
Gżira	Scales' scores	Survey (adopted from the 'Satisfaction with Life Scale' (Diener et al, 1985)	Quantitative/score	Survey	Increased residential attachment and satisfaction	
Leuven	Scales' scores	Survey	Quantitative/score	Survey	Increased residential attachment and satisfaction	

Table 40: Common KPI 9.13

Castelfranco, Gżira, and Leuven used adapted scales to assess how connected residents feel to their neighbourhood. This indicator helps evaluate social cohesion and satisfaction with local urban environments.

9.16 - Number / share of people being physically active (min. 30 min 3 times per week)

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Novo Mesto	No of people / %	Vision system, counter	No. of people	Vision system, people counter	Increased outdoor physical activity (increased of data gathering of data of people being physical active)	
Chania	No of people	Survey	No. of people, data about physical activity	Survey		Increased data of people being physical active
Leuven	No of people / %	Survey and mobility counter	No. of people, data about physical activity	Survey	Increased outdoor physical activity (increased of data gathering of data of people being physical active)	

Table 41: Common KPI 9.16

Data on physical activity was collected via surveys or sensors. Novo Mesto used automated counters, while others relied on user self-reporting. The goal is to monitor trends in active lifestyles following green space enhancements.

9.19 - Increase in walking and cycling in and around areas of interventions

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Novo Mesto	No. of people / hours per week per capita	Sensors	No of visitors	Sensors	Increased outdoor physical activity	
Gżira	No. of people / hours per week per capita	Survey	No of visitors, data on active mobility	Survey	Increased outdoor physical activity	
Chania	No. of people / hours per week per capita	Sensors of public bikes	No of rides with the public bike system	Sensors		Increased outdoor physical activity
Leuven	No. of people / hours per week per capita	Sensors	No of visitors, data on active mobility	Survey and Sensors		Increased outdoor physical activity

Table 42: Common KPI 9.19

All listed pilots measured walking and cycling in intervention areas using sensors and surveys. The indicator tracks increased active mobility and supports arguments for healthier, greener city design.

9.36 - No. of noise data

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value

Chania	No. of added data/per year	Based on the summarized data collected from the Noise indicators (ID9.4). ArcGIS is employed to map the data and identify clusters within the city. This mapping highlights urban areas where data has been gathered, providing a spatial overview of the city.	Noise data	field measurements, sensors	Increased number of noise data	
Leuven	No. of added data/per year	Based on the summarized data collected from the Noise indicators (ID9.4).	Noise data	field measurements, sensors	Increased number of noise data	

Table 43: Common KPI 9.36

Chania and Leuven compiled noise data collected through sensors and visualised it using mapping tools. This indicator supports environmental monitoring and helps identify noise hotspots. In both pilots, these measurements were a direct form of impact due to the objectives of the VS

9.37 - Number of health and lifestyle data

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Chania	No. of added data	Summary of info received from relevant indicators (Number of health data that collected from the surveys)	Health & lifestyle data	surveys	No. of added health and lifestyle data	
Leuven	No. of added data	Summary of info received from relevant indicators	Health & lifestyle data	surveys	No. of added health and lifestyle data	

Table 44: Common KPI 9.37

Chania and Leuven gathered health and lifestyle metrics through surveys. These data points offer a broader understanding of how green infrastructure affects urban well-being and supports longitudinal impact assessments.

Challenge 10

10.1 - No. of jobs created; gross value added

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Dundalk	No. of jobs created; Euros	record keeping	no of people	Municipality database	increased job opportunities	
Novo Mesto	No. of jobs created; Euros	record keeping	no of people	Municipality database	increased job opportunities	
Chania	No. of jobs created; Euros	record keeping	no of people	Municipality database	increased job opportunities	
Leuven	No. of jobs created; Euros	record keeping	no of people	Municipality database	increased job opportunities	

Table 45: Common KPI 10.1

All pilots measured job creation and related economic benefits by recording the number of jobs and financial value added. Data from municipal databases helped quantify local economic impacts.

10.5 - Definition of parameters for (re)designing of green public spaces based on the well-being of users

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Novo Mesto	N/A	Developed parameters based on lessons learnt from implementation and H&WB data collected	N/A	Analysis of the Health & WB data, along with evaluation of the design and implementation process for all the Visionary Solutions	definition of parameters for (re)designing green public spaces based on the well-being of users	

Gżira	N/A	Developed parameters based on lessons learnt from implementation and H&WB data collected	N/A	Analysis of the Health & WB data, along with evaluation of the design and implementation process for all the Visionary Solutions	definition of parameters for (re)designing green public spaces based on the well-being of users	
Chania	N/A	Analysis of the vegetation data, Health & WB data and sensors data. Outcomes based on the other indicators results.	vegetation data, H&WB data, environmental data (temperature, humidity, air pollutants etc.)	Sensors, Questionnaires, field measurements & observation	definition of parameters for (re)designing green public spaces based on the well-being of users	
Leuven	N/A	Developed parameters based on lessons learnt from implementation and H&WB data collected	Benchmark	Analysis of the Health & WB data, along with evaluation of the design and implementation process for VS1-3	definition of parameters for (re)designing green public spaces based on the well-being of users	

Table 46: Common KPI 10.5

Pilots derived urban design recommendations based on health and well-being data collected during implementation. Gżira, Chania, Leuven, and Novo Mesto synthesised findings to inform guidelines for future green space planning.

10.6 - Replication of solutions

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Skellefteå	N/A	Replication potential questionnaire	Score	Survey	Replication potential of VS	
Dundalk	N/A	Replication potential questionnaire	Score	Survey	Replication potential of VS	
Castelfranco	N/A	Replication potential questionnaire	Score	Survey	Replication potential of VS	

Novo Mesto	N/A	Replication potential questionnaire	Score	Survey	Replication potential of VS	
Gżira	N/A	Replication potential questionnaire	Score	Survey	Replication potential of VS	
Chania	N/A	Replication potential questionnaire	Score	Survey	Replication potential of VS	
Leuven	N/A	Replication potential questionnaire	Score	Survey	Replication potential of VS	

Table 47: Common KPI 10.6

All cities applied a replication potential questionnaire to assess the transferability of their interventions. This provides a baseline for scaling up nature-based solutions across cities.

10.8 - Saved healthcare spending

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Gżira	Euros per year / %	Survey	Answers to the questionnaire on healthcare	Survey	Savings in healthcare spending	
Chania	Euros per year / %	Projections based on green space visitors and attributes	Euros saved / year	Survey	Savings in healthcare spending	
Leuven	Euros per year / %	Survey	Answers to the questionnaire on healthcare	Questionnaire	Savings in healthcare spending	

Table 48: Common KPI 10.8

Gżira, Chania, and Leuven estimated healthcare savings using surveys and visitor data. The indicator links green interventions to reduced healthcare costs, supporting economic and public health arguments for urban nature.

10.9 - Public / Private Investments in the 5 years of the project

Pilots	Units	Method/Tools	Type of Data	Sources of Data	Expected Outcome/Impact	
					Direct Impact	Added Value
Skellefteå	Euros	Record keeping of investments attracted to pilot city implementations, year of investments, Funding source during the project and financial projections	Financial record, funding sources	Financial record, funding sources	increased public, private investments	
Dundalk	Euros	Record keeping of investments attracted to pilot city implementations, year of investments, Funding source during the project and financial projections	Financial record, funding sources	Financial record, funding sources	increased public, private investments	
Castelfranco	Euros	Record keeping of investments attracted to pilot city implementations, year of investments, Funding source during the project and financial projections	Financial record, funding sources	Financial record, funding sources	increased public, private investments	Next generation fund for finalised projects (cycle and pedestrian pathway) and ongoing ("Casa degli Strepiti" ancient building)
Novo Mesto	Euros	Record keeping of investments attracted to pilot city implementations, year of investments, Funding source during the project and financial projections	Financial record, funding sources	Financial record, funding sources	increased public, private investments	
Gžira	Euros	Record keeping of investments attracted to pilot city implementations, year of investments, Funding source during the project and financial projections	Financial record, funding sources	Financial record, funding sources	increased public, private investments	

Chania	Euros	Record keeping of investments attracted to pilot city implementations, year of investments, Funding source during the project and financial projections	Financial record, funding sources	Financial record, funding sources	increased public private investments	
Leuven	Euros	Record keeping of investments attracted to pilot city interventions, year of investment, NBS Type, funding source during the project	Services and cultural entities	Financial record, funding sources	increased public private investments	

Table 49: Common KPI 10.9

Each pilot documented financial investments made during the project, including sources and projections. Data was compiled from municipal records and funding bodies. Castelfranco provided detailed examples linked to specific infrastructure upgrades. The indicator shows financial sustainability and commitment to nature-based interventions.

5.2 General outcomes of pilot cross comparisons

In the above analysis, showing the cross-comparisons of KPI outcomes between the pilots, some important outcomes that can be extendible to other projects can be noted. When using the methodologies outlined in previous deliberables and further highlighted in this deliverable, consistent comparisons can be made. Therefore, the results shown in this report can also be used as suitable benchmarks for other cities addressing similar challenges. One of the key important message in these results is the use of common units (e.g., °C, kWh/year, µg/m³, dB(A), km/min, counts/year). In addition, it is important to stress the need for transparent calculation approaches (e.g., pre/post differences, peak/mean summaries, GIS and model/equation-based estimates). Data sources (sensors and weather stations, field measurements, GIS/Google Maps, and record others) should be supported by appropriate data management and ideally made open access to allow for better replicability as will also be described in D7.4.

These outcomes can provide a practical template for stakeholders. Figure 4 provides a general overview from the comparisons to the implications. The first step is to identify KPIs that have been used by VARCITIES and assessing whether the site has conditions that do enable these comparisons to be made. The types of data to be collected need to be clearly identified and as much as possible maintain uniformity, as mentioned in terms of units and method of measurement. This will enable benchmarkability of data with VARCITIES results. Cities and projects can thus create comparable results and possibly further those results in identifying best practices that might not have necessarily been identified by VARCITIES.

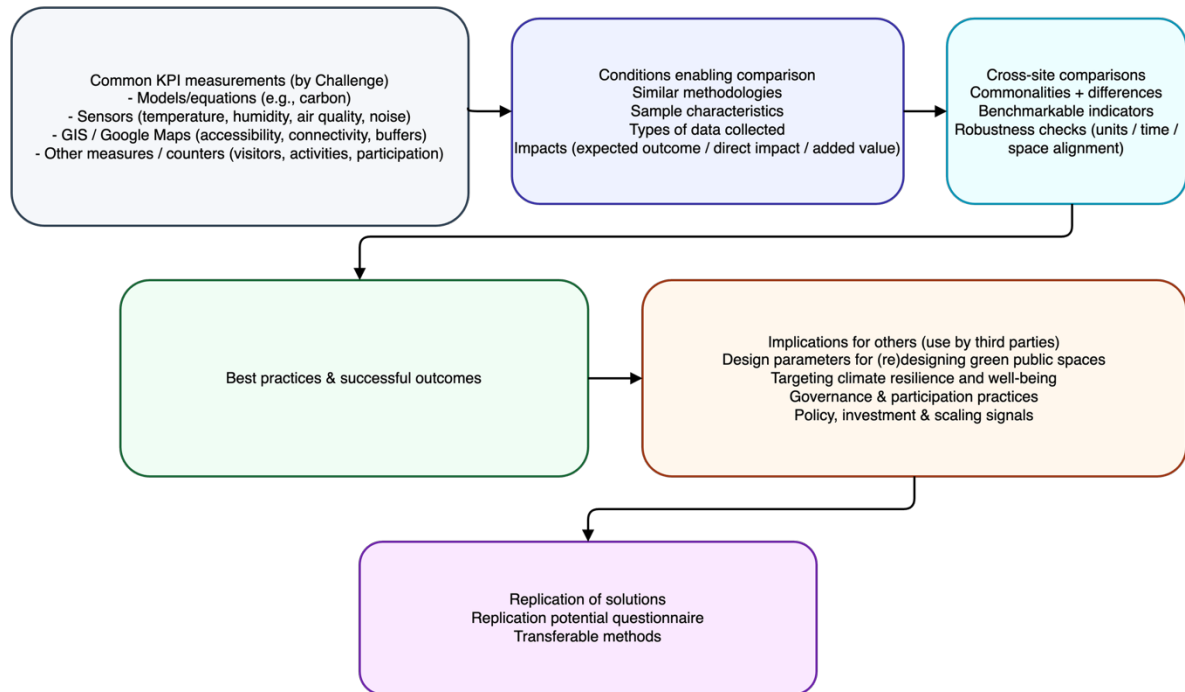


Figure 4 - Pilot Cross-Comparative Metrics and Impacts – From Comparisons to Implications

6 Conclusion

The VARCITIES Monitoring and Evaluation (M&E) Handbook has provided a comprehensive and systematic framework for assessing the effectiveness of Visionary Solutions (VS) across diverse urban contexts. Through the development and implementation of KPIs, this handbook has supported pilot cities in evaluating the environmental, social, and digital impacts of their solutions.

Following the introductory section, Chapter 2 presented an overview of the KPIs measured by each pilot, mapped against the corresponding EKLIPSE Challenge and categorised by thematic area. Section 3 (and Annex I) detailed the methodologies used to measure new indicators not previously described in Deliverable D7.2. It also included an overview of the evaluation methods, explaining how KPI assessments varied across pilot sites. These differences were based on local priorities and the nature of each Visionary Solution - whether a KPI reflected a direct impact or served as an added value.

The handbook then progressed to Section 4, which offers a comprehensive compilation of KPI results and evaluations, grouped by pilot site and challenge. Section 5 focuses on each pilot's Visionary Solution, presenting the objectives defined for each intervention, the expected impacts, and a general evaluation of whether these objectives were met.

Finally, the deliverable concludes by identifying commonalities in KPI measurements across the pilot sites, highlighting methodological parallels, similarities in data types collected, and recurring impact patterns in Section 6.

All pilot sites deployed a diverse range of data collection tools to develop a rigorous and holistic understanding of both the interventions implemented and the broader factors influencing their pilot area. These efforts addressed a wide array of thematic challenges, including climate mitigation and adaptation, water management, air quality, green space management, urban regeneration, social justice and social cohesion, public health and wellbeing, and economic opportunities linked to green jobs. To support this, pilots employed various types of sensors and digital tools to collect high-resolution environmental data. This included, but was not limited to, measurements of air pollution, water quality, temperature and humidity, noise levels, and vegetation indicators.

Extensive survey questionnaires were also distributed locally in each site, adding a more social dimension to the overall evaluation. The use of mapping tools was also prominent and successful in measuring spatial data, which complemented the technical and social aspects of the project. The resulting datasets contributed to a robust evidence base, enabling pilots to assess the performance and impact of their Visionary Solutions with greater precision and contextual relevance.

Cross-comparative analysis among pilot cities revealed both common challenges and transferable lessons, offering a valuable knowledge base for replication and upscaling. It also underscored the importance of flexibility in monitoring processes—adapting KPIs where necessary to reflect the specific needs and evolving contexts of each pilot city. These findings will serve as a foundational reference for the upcoming *Deliverable D7.4: The VARCITIES Replication Toolkit*, which will build on this work to develop actionable insights, best practices, and policy recommendations for broader implementation.

7 References

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Annex I - Methodology Reports for Additional Indicators

A1.1 Castelfranco Methodology Manual

The detailed methodology for Castelfranco was already presented in the previous deliverable D7.2: Report on the Evaluation Results and Analysis for Each Pilot. To avoid duplication, it is not repeated here. The KPI results and evaluation for all Castelfranco KPIs are presented in Section 4.

A1.2 Chania Methodology Manual

Challenge Name	Climate Mitigation and Adaptation
Indicator	Decrease in mean or peak daytime local temperatures
Challenge No.	1
KPI ID	2
Common KPI	Yes ☒ No ☐
General methodology	Experimental ☐ Simulation ☐ Statistical/surveys ☒
Expected data deliverable	Numeric ☒ Survey ☐ Qualitative ☐ Map ☐
Unit	°C
Required data processing	Yes ☒ No ☐

Procedure	1. Place sensors at specific locations determined by pilot 2. Record exact location of these sensors 3. Measure temperature with an hourly resolution or less 4. Calculate the daily mean $T = \frac{1}{N} \sum_{i=1}^N t_i$ Where N is the number of data points during one day with fixed resolution Calculate the daily peak $T_0 = \max_{i=1 \dots N}(t_i)$ Where T_0 is the daily maximum 5. Comparative data analysis with the weather datasets from adjacent sites
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Table 50: Chania KPI 1.2 Methodology

Description of Methodology for KPI 1.2

- Geographical scale: district to regional scale
- Sample sizes: 10 minutes data collection frequency for the summer period 2023 (June-August).
- Sensor Locations: In each one of the two green spaces, 4 sensors have been installed. In addition, one sensor has been installed in the urban area. For the data collection needs of the urban area, the local meteorological station in the centre of Chania city has also been used.



Figure 5: Sensors in MGC



Figure 6: Sensors in SAP

- Questions asked to participants: N/A
- Visual media/maps/calculations of the process: N/A

- Detailed information of how the data is being collected in practice: field measurements.
- Challenges encountered on site: vandalism, replacement of sensors

Challenge Name	Climate Mitigation and Adaptation
Indicator	Local energy production from renewable energy sources
Challenge No.	1
KPI ID	5
Common KPI	Yes ☐ No ☒
General methodology	Experimental ☒ Simulation ☒ Statistical/surveys ☐
Expected data deliverable	Numeric ☒ Survey ☐ Qualitative ☐ Map ☐
Unit	°C
Required data processing	Yes ☐ No ☒
Procedure	PV energy production data were collected from the solar panel system installed on the roof of the MULR. The system is equipped with integrated sensors and a data logging unit that continuously monitors and records energy output (kWh) on a monthly basis. The recorded values are aggregated to calculate the total annual renewable energy production. https://vrm.victronenergy.com/login

Table 51: Chania KPI 1.5 Methodology

Description of Methodology for KPI 1.5

- Geographical scale: local scale
- Sample sizes: 1 year measurement
- Sensor Locations: MULR (VS1)
- Questions asked to participants: N/A
- Visual media/maps/calculations of the process: N/A

- Detailed information of how the data is being collected in practice: Sensors feed a local platform that analyses the energy production from a PV system.
- Challenges encountered on site: N/A

Challenge Name	Climate Mitigation and Adaptation
Indicator	Number of temperature and humidity data
Challenge No.	1
KPI ID	8
Common KPI	Yes ☐ No ☒
General methodology	Experimental ☒ Simulation ☐ Statistical/surveys ☐
Expected data deliverable	Numeric ☒ Survey ☐ Qualitative ☐ Map ☐
Unit	No. of temperature and humidity data added per year
Required data processing	Yes ☒ No ☐
Procedure	Assessment of the volume of data generated by the installed sensors

Table 52: Chania KPI 1.8 Methodology

Description of Methodology for KPI 1.8

- Geographical scale: district scale
- Sample sizes: 1-year measurements
- Sensor Locations: In each one of the two green spaces, 4 sensors have been installed. In addition, two sensors have been installed in the urban area. For the data collection needs of the urban area, the local meteorological station in the centre of Chania city has also been used. Moreover, the sensors on bikes and bike stations (Deykalionios street, Markopoulou street) are taken into consideration, along with the sensor kit installed in the MULR.
- Questions asked to participants: N/A
- Visual media/maps/calculations of the process: vandalism, replacement of sensors



Figure 7: Sensor kit

- Detailed information of how the data is being collected in practice: field measurements.
- Challenges encountered on site: N/A

Challenge 4 KPIs - Chania pilot

Challenge Name	Green Space Management
Indicator	Recreational or cultural value of green spaces
Challenge No.	4
KPI ID	3a
Common KPI	Yes ☒ No ☐
Unit	No. of visitors/year
Procedure	Quantitative data on recreational and cultural value were collected through systematic record keeping of pre- and post-intervention activities organized by the MULR. Data included the number of cultural and recreational events held annually, as well as

	total yearly attendance. These records were used to benchmark community participation and assess the impact of MULR in activating green public spaces for cultural use.
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Table 53: Chania KPI 4.3a Methodology

Description of Methodology for KPI 4.3a

- Geographical scale: local scale
- Sample sizes: N/A
- Sensor Locations: MULR
- Questions asked to participants: N/A
- Visual media/maps/calculations of the process:



Figure 8. Visitors' participation in activities

- Detailed information of how the data is being collected in practice: Combining data from visitor monitor sensors and in-situ measurements
- Challenges encountered on site: N/A

Challenge Name	Green Space Management
Indicator	Recreational or cultural value of green spaces

Challenge No.	4
KPI ID	3b
Common KPI	Yes ☒ No ☐
Unit	No. of activities in green spaces/year
Procedure	Quantitative data on recreational and cultural value were collected through systematic record keeping of pre- and post-intervention activities organized by the MULR. Data included the number of cultural and recreational events held annually, as well as total yearly attendance. These records were used to benchmark community participation and assess the impact of MULR in activating green public spaces for cultural use.

Table 54: Chania KPI 4.3b Methodology

Description of Methodology for KPI 4.3b

- Geographical scale: local regional scale
- Sample sizes:
- Sensor Locations: N/A
- Questions asked to participants: N/A
- Visual media/maps/calculations of the process:



Figure 9. Recreational and cultural activities

- Detailed information of how the data is being collected in practice:
Record keeping on the activities organized.

- Challenges encountered on site: N/A

Challenge Name	Green Space Management
Indicator	Green-related social service provided to population
Challenge No.	4
KPI ID	7
Common KPI	Yes ☒ No ☐
Unit	Units N/A ☒
Procedure	Factors used to assess the social value of green spaces: 1. Nominal value: Total green area (m2) (areas that can be used by the population, areas that can be used by the population, but they are not equipped, equipped areas). 2. Added value: Type of equipment facilities, context factors (safety, accessibility, services and recreational opportunities)) 3. The above should be considered before and after the interventions.

Table 55: Chania KPI 4.7 Methodology

Description of Methodology for KPI 4.7

- Geographical scale: local scale
- Sample sizes: N/A
- Sensor Locations: N/A
- Questions asked to participants: N/A
- Visual media/maps/calculations of the process:
- Detailed information of how the data is being collected in practice:

Literature review on Green-related social services considering environmental features and amenities within public spaces that can either attract visitors or deter them if lacking. These include elements such as lighting, seating areas, cultural installations, and other infrastructure that enhance the comfort, safety, and appeal of green spaces, encouraging community use and engagement.

Challenge Name	Green Space Management
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Indicator	Number of vegetation data
Challenge No.	4
KPI ID	24
Common KPI	Yes ☐ No ☒
General methodology	Experimental ☒ Simulation ☐ Statistical/surveys ☐
Expected data deliverable	Numeric ☒ Survey ☐ Qualitative ☐ Map ☐
Unit	No. of vegetation data
Required data processing	Yes ☒ No ☐
Procedure	Data were collected through systematic field observations and direct measurements conducted as part of the MULR's community-based initiatives.

Table 56: Chania KPI 4.24 Methodology

Description of Methodology for KPI 4.24

- Geographical scale: district to regional scale
- Sample sizes: N/A
- Sensor Locations: Local meteorological stations in the centre of Chania city (applicable for the needs of I-Tree simulation, but not applicable for this KPI calculation)
- Questions asked to participants: N/A
- Visual media/maps/calculations of the process: N/A
- Detailed information of how the data is being collected in practice: observation and field measurements
- Challenges encountered on site: large number of data needed and inaccessible areas

Challenge 5 KPIs - Chania pilot

Challenge Name	Air/ambient quality
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Indicator	Number of days during which air quality parameters exceed threshold values
Challenge No.	5
KPI ID	14
Common KPI	Yes ☐ No ☒
General methodology	Experimental ☒ Simulation ☐ Statistical/surveys ☐
Expected data deliverable	Numeric ☒ Survey ☐ Qualitative ☐ Map ☐
Unit	µg/m3
Required data processing	Yes ☒ No ☐
Procedure	Air pollution concentrations for regulatory compliance are based on measured pollutant concentrations (PM10 and PM2.5, O3, NO2, SO2, CO and PAHs) in ambient air. Number of documented exceedances to the limit value established in the Air Quality Framework Directive (Directive 2008/50/EC) for PM2.5, PM10, NO2, SO2, CO and ground-level O3.

Table 57: Chania KPI 5.14 Methodology

Description of Methodology for KPI 5.14

- Geographical scale: district to regional scale
- Sample sizes: N/A
- Sensor Locations: The location of the installation of the stationary sensor kits inside Chania city is the following: 1. Markopoulou Sq., Chania 731 32 (Fourth Bicycle Distribution Station of Chania Municipality), 2. Defkalionos 14, Chania 731 32 (Third Bicycle Distribution Station of Chania Municipality)
- Questions asked to participants: N/A
- Visual media/maps/calculations of the process: N/A
- Detailed information of how the data is being collected in practice: field measurements.

- Challenges encountered on site: Data calibration

Challenge Name	Air/ambient quality
Indicator	Number of air quality data
Challenge No.	5
KPI ID	15
Common KPI	Yes ☐ No ☒
General methodology	Experimental ☒ Simulation ☐ Statistical/surveys ☐
Expected data deliverable	Numeric ☒ Survey ☐ Qualitative ☐ Map ☐
Unit	No. of air quality data added per year
Required data processing	Yes ☒ No ☐
Procedure	Assessment of the volume of data generated by the installed sensors

Table 58: Chania KPI 5.15 Methodology

Description of Methodology for KPI 5.15

Geographical scale: district scale

Sample sizes: N/A

- Sensor Locations: the sensors on bikes and bike stations (Deykalionios street, Markopoulou street) are taken into consideration for the calculation.
- Questions asked to participants: N/A
- Visual media/maps/calculations of the process: N/A
- Detailed information of how the data is being collected in practice: field measurements.
- Challenges encountered on site: N/A

Challenge 6 KPIs - Chania pilot

Challenge Name	Urban Regeneration
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Indicator	Access of residents/employees by foot to open space: sports centre, recreation area, or green space
Challenge No.	6
KPI ID	8
Common KPI	Yes ☐ No ☒
Unit	km/min
Procedure	Spatial analysis was conducted using GIS to assess population accessibility to defined recreational areas. Data inputs included high-resolution population distribution datasets, defined 300-meter walking distance buffer zones, and local geospatial databases identifying existing and potential public open spaces. The analysis compared pre- and post-intervention scenarios to quantify the impact of the MULR in expanding pedestrian access to recreational spaces.

Table 59: Chania KPI 6.8 Methodology

Description of Methodology for KPI 6.8

- Geographical scale: district to regional scale
- Sample sizes: N/A
- Sensor Locations: N/A
- Questions asked to participants: N/A
- Visual media/maps/calculations of the process:
- Detailed information of how the data is being collected in practice: Data collected from ELSTAT
- Challenges encountered on site: N/A

Challenge Name	Urban Regeneration
Indicator	Access of residents to cultural facilities on foot
Challenge No.	6
KPI ID	9

Common KPI	Yes ☐ No ☒
Unit	km/min
Procedure	A GIS-based spatial analysis was conducted to evaluate pedestrian access to cultural facilities. The analysis utilized population distribution data, local databases of cultural amenities, and a 300-meter walking distance buffer around both existing and potential MULR deployment sites. This approach allowed for a comparison between pre-intervention access and the extended cultural reach achievable through strategic placement of the MULR in currently underserved areas.

Table 60: Chania KPI 6.9 Methodology

Description of Methodology for KPI 6.9

- Geographical scale: district to regional scale
- Sample sizes: N/A
- Sensor Locations: N/A
- Questions asked to participants: N/A
- Visual media/maps/calculations of the process: N/A
- Detailed information of how the data is being collected in practice: Data collected from ELSTAT
- Challenges encountered on site: N/A

Challenge 7 KPIs - Chania pilot

Challenge Name	Participatory Planning and Governance
Indicator	Perceptions of citizens on urban nature
Challenge No.	7
KPI ID	4
Common KPI	Yes ☒ No ☐
Unit	Likert scale

Procedure	Citizen perceptions were evaluated through a pre- and post-intervention questionnaire administered as part of the MULR initiatives. The survey consisted of five Likert-scale questions assessing participants' knowledge, attitudes, and behaviours related to urban nature. The questionnaire was designed to capture shifts in public awareness and attitudes following engagement with MULR activities.
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Table 61: Chania KPI 7.4 Methodology

Description of Methodology for KPI 7.4

- Geographical scale: district to regional scale
- Sample sizes: 100 respondents
- Sensor Locations: N/A
- Questions asked to participants:

1.How knowledgeable are you about the benefits that urban nature can provide (e.g., mental health, physical health, air quality)?

2.How important do you think urban nature is for improving quality of life in your city?

3.How often do you visit urban GSs (e.g., parks, gardens) in your city?

4.Do you believe urban nature has a positive impact on physical and mental health?

5.Do you believe urban nature has a positive impact on physical and mental health?

- Visual media/maps/calculations of the process: N/A
- Detailed information of how the data is being collected in practice: before and after the educational activities, organized in MULR as part of socio-cultural events.
- Challenges encountered on site: N/A

Challenge 9 KPIs - Chania pilot

Challenge Name	Public Health and Wellbeing
Indicator	Increase in walking and cycling in and around areas of interventions
Challenge No.	9
KPI ID	19

Common KPI	Yes ☒ No ☐
Unit	Questionnaire score
Procedure	1. Data collection using questionnaire or acquisition of benchmark value from relevant sources.

Table 62: Chania KPI 9.19 Methodology

Description of methodology for KPI 9.19

- **Second table:** Average duration of system use for each active week.
- **Analysis period:** Starting on 1/9/23, divided into weeks.
- Each ride is assigned to the **corresponding week(s)** based on both its **start and finish time**.
- For rides spanning multiple weeks, the **duration is split into parts** corresponding to each week.
- For each week, the **sum of all ride durations (in minutes)** is calculated.
- This sum is then divided by the number of rides in that week to get the average ride duration per week.

Challenge Name	Public Health and Wellbeing
Indicator	Number of noise data
Challenge No.	9
KPI ID	36
Common KPI	Yes ☐ No ☒
General methodology	Experimental ☒ Simulation ☐ Statistical/surveys ☐
Expected data deliverable	Numeric ☒ Survey ☐ Qualitative ☐ Map ☐
Unit	No. of noise data added
Required data processing	Yes ☒ No ☐
Procedure	Assessment of the volume of data generated by the installed sensors.

Table 63: Chania KPI 9.36 Methodology

Description of methodology for KPI 9.36

- Sample sizes: N/A
- Sensor Locations: the sensors on bikes and bike stations (Deykalionios street, Markopoulou street) are taken into consideration for the calculation.
- Questions asked to participants: N/A
- Visual media/maps/calculations of the process: N/A
- Detailed information of how the data is being collected in practice: field measurements.

Challenge Name	Public Health and Wellbeing
Indicator	Number of health & lifestyle data
Challenge No.	9
KPI ID	37
Common KPI	Yes ☐ No ☒
General methodology	Experimental ☒ Simulation ☐ Statistical/surveys ☐
Expected data deliverable	Numeric ☒ Survey ☐ Qualitative ☐ Map ☐
Unit	No. of noise data added
Required data processing	Yes ☒ No ☐
Procedure	Data were gathered during MULR initiatives using four structured and validated questionnaires: the Quality-of-Life Questionnaire, Smoke Cessation Questionnaire, Physical Activity Questionnaire, and Comprehensive Health, Lifestyle, and GS Engagement Questionnaire. These instruments were designed to capture a wide range of health and lifestyle indicators across physical, mental, and general health domains, as well as environmental factors and lifestyle behaviours.

Table 64: Chania KPI 9.37 Methodology

Description of methodology for KPI 9.37

- Geographical scale: district scale
- Sample sizes: 1200 responses
- Sensor Locations: N/A
- Questions asked to participants: N/A
- Detailed information of how the data is being collected in practice:
- Challenges encountered on site: N/A

Challenge 10 KPIs - Chania pilot

Challenge Name	Potential for New Economic Opportunities and Green Jobs
Indicator	Number of Jobs created
Challenge No.	10
KPI ID	1
Common KPI	Yes ☒ No ☐
Unit	No. of new employment
Procedure	Employment impact was evaluated through a comparative review of staffing needs before and after the MULR intervention. Records were maintained to capture direct employment roles created to support the initiative.

Table 65: Chania KPI 10.1 Methodology

Description of Methodology for KPI 10.1

- Geographical scale: district to regional scale
- Sample sizes: N/A
- Sensor Locations: N/A
- Questions asked to participants: N/A
- Visual media/maps/calculations of the process: N/A
- Detailed information of how the data is being collected in practice: N/A
- Challenges encountered on site: N/A

Challenge Name	Potential for New Economic Opportunities and Green Jobs
Indicator	Definition of parameters for (re)designing of green public spaces based on the well-being of users
Challenge No.	10
KPI ID	5
Common KPI	Yes ☒ No ☐
Unit	N/A ☒
Procedure	Planning strategies were developed through an integrated analysis of multiple environmental and health-related datasets collected from VS1&2. These datasets include temperature and humidity readings, air quality measurements, noise levels, vegetation characteristics, and health and lifestyle indicators. This multidisciplinary approach enabled the identification of key parameters for the evidence-based redesign and optimization of green public spaces.

Table 66: Chania KPI 10.5 Methodology

Description of Methodology for KPI 10.5

- Geographical scale: district to regional scale
- Sample sizes: N/A
- Sensor Locations: N/A
- Questions asked to participants: N/A
- Visual media/maps/calculations of the process: N/A
- Detailed information of how the data is being collected in practice: Detailed information has been provided in the relevant KPIs, referring to environmental and health-related datasets.
- Challenges encountered on site: N/A

Challenge Name	Potential for New Economic Opportunities and Green Jobs
Indicator	Replication of Solutions

Challenge No.	10
KPI ID	6
Common KPI	Yes ☒ No ☐
Unit	N/A ☒
Procedure	Replication potential was assessed through structured feedback from stakeholders and cities across Europe. Data was collected via surveys conducted during conferences, clustering events, and dedicated Ws with follower cities.

Table 67: Chania KPI 10.6 Methodology

Description of Methodology for KPI 10.6

- Geographical scale: European scale
- Sample sizes: 65 Cities
- Sensor Locations: N/A
- Questions asked to participants: N/A
- Visual media/maps/calculations of the process: N/A
- Detailed information of how the data is being collected in practice: Data was collected via surveys conducted during conferences, clustering events, and dedicated Ws with follower cities.
- Challenges encountered on site: N/A

Challenge Name	Potential for New Economic Opportunities and Green Jobs
Indicator	Saved healthcare spending
Challenge No.	10
KPI ID	8
Common KPI	Yes ☒ No ☐
Unit	Euros per year/%

Procedure	Estimated Annual Healthcare Savings were calculated for six non-communicable diseases: Cardiovascular Disease, Stroke, Diabetes, High Cholesterol, High Blood Pressure, and Depression. The calculation is based on a standardized economic evaluation model using the following formula: $\text{Estimated Savings} = \text{Population} \times \text{Increase in GS Use (due to the intervention)} \times \text{Disease Prevalence} \times \text{Risk Reduction} \times \text{Annual Treatment Cost per Patient}$ The model draws on data collected during the MULR initiatives, capturing local patterns of GS usage, combined with evidence from scientific literature on disease prevalence, risk reduction and associated healthcare costs. The model estimates healthcare cost savings resulting from increased exposure to and engagement with GSs, which are linked to measurable reductions in disease risk.
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Table 68: Chania KPI 10.8 Methodology

Description of Methodology for KPI 10.8

- Geographical scale: district to regional scale
- Sample sizes: N/A
- Sensor Locations: N/A
- Questions asked to participants: N/A
- Visual media/maps/calculations of the process: N/A
- Detailed information of how the data is being collected in practice: Data collected through MULR initiatives
- Challenges encountered on site: N/A

Challenge Name	Potential for New Economic Opportunities and Green Jobs
Indicator	Public & private investments during/after the project
Challenge No.	10

KPI ID	9
Common KPI	Yes ☒ No ☐
Unit	Euros
Procedure	1. Data collection on internal public/private investment. 2. Assess and calculator 5-Year Investment Projection 3. Replication Funding Potential Forecast

Table 69: Chania KPI 10.9 Methodology

Description of Methodology for KPI 10.9

- Geographical scale: district to regional scale
- Sample sizes: N/A
- Sensor Locations: N/A
- Questions asked to participants: N/A
- Visual media/maps/calculations of the process: N/A
- Detailed information of how the data is being collected in practice: N/A
- Challenges encountered on site: N/A

Private and public investments related to the Chania pilot Visionary are being calculated following the guidance and supervision of the WP8 leaders (INCLECOM). The main aim of this data collection is to consider a 5-year timeframe to show the pilot investments, both through EU and internal funding, and how the pilot VS projects can be implemented again in other sites through diverse funding mechanisms after the project.

A forecast of the external private and public investment is then being projected below to show the total amount of investment that the Visionary Solutions could potentially finance to replicate the implementation.

A1.3 Dundalk Methodology Manual

Challenge 1 KPIs - Dundalk pilot

Challenge Name	Climate Mitigation and Adaptation
Indicator	Energy savings from lighting upgrades and improvements

Challenge No.	1
KPI ID	4
Common KPI	Yes ☐ No ☒
Unit	kWh year-1
Procedure	1. Using an energy metre or a simulation obtains data for the energy consumed before and after the intervention. Find the difference between the two energy measures giving the savings in kWhr per year

Table 70: Dundalk KPI 1.4 Methodology

Description of Methodology for KPI 1.4

To measure energy savings from lighting upgrades, a before-and-after comparison approach was applied. First, the technical specifications of the existing lighting system were documented, including the number, type, and wattage of luminaires (five 400W high pressure sodium floodlights and multiple 80W MBFU lamps). Following the intervention, these were replaced with lower-consumption LED alternatives (200W LED floodlights and 27W LED corn lamps with reflector).

Challenge 10 KPIs - Dundalk pilot

Challenge Name	Potential for New Economic Opportunities and Green Jobs
Indicator	Resource efficiency in the urban system
Challenge No.	10
KPI ID	3
Common KPI	Yes ☐ No ☒
Unit	Kg of CO2 per kWh

Procedure	1. Establish the annual electrical energy use in the municipality for a year prior to the intervention 2. Obtain the number of residents in the municipality for the same year as the energy used 3. Use an established emission factor in kg of CO₂ per kWh 4. Multiply the annual energy use by the emission factor to obtain the kg of CO₂. 5. Repeat the above steps for a year following the interventions keeping the same base emission factor.
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Table 71: Dundalk KPI 10.3 Methodology

Description of Methodology for KPI 10.3

First, the total municipal energy use (including thermal energy, transport fuels, and electricity) was established for the baseline year (2022) and for the year following interventions (2023).

To normalise results, the staff headcount was obtained for each year, enabling the calculation of CO₂ emissions per capita (kgCO₂/employee). An established emission factor (kgCO₂ per kWh) was applied consistently to both years, ensuring comparability and isolating the effect of interventions rather than external changes in the emissions factor.

Annual energy use was multiplied by the emission factor to determine total CO₂ emissions, which were then divided by the staff headcount to yield per-capita values. The same process was repeated for both years, enabling a direct comparison of results. The relative change was also assessed against the fossil CO₂ baseline (1,997,468 kgCO₂) to quantify progress towards efficiency and reduction targets.

Challenge Name	Potential for New Economic Opportunities and Green Jobs
Indicator	Increased footfall in the areas of interventions
Challenge No.	10
KPI ID	4

Common KPI	Yes ☐ No ☒
Unit	CO2 tons / year per capita
Procedure	1. Install sensor(s) at various locations in the proximity of the NBS interventions in order to record the number of people visiting the target sites 2. Record amount of people passing through area of intervention 3. Data acquisition frequency should be hourly/daily for the entire duration of the measurements

Table 72: Dundalk KPI 10.4 Methodology

Description of Methodology for KPI 10.4

People-counting sensors were installed at four locations: the front and rear gates, the alleyway, and between the corner of the library and the corner of No. 3 Roen Place.

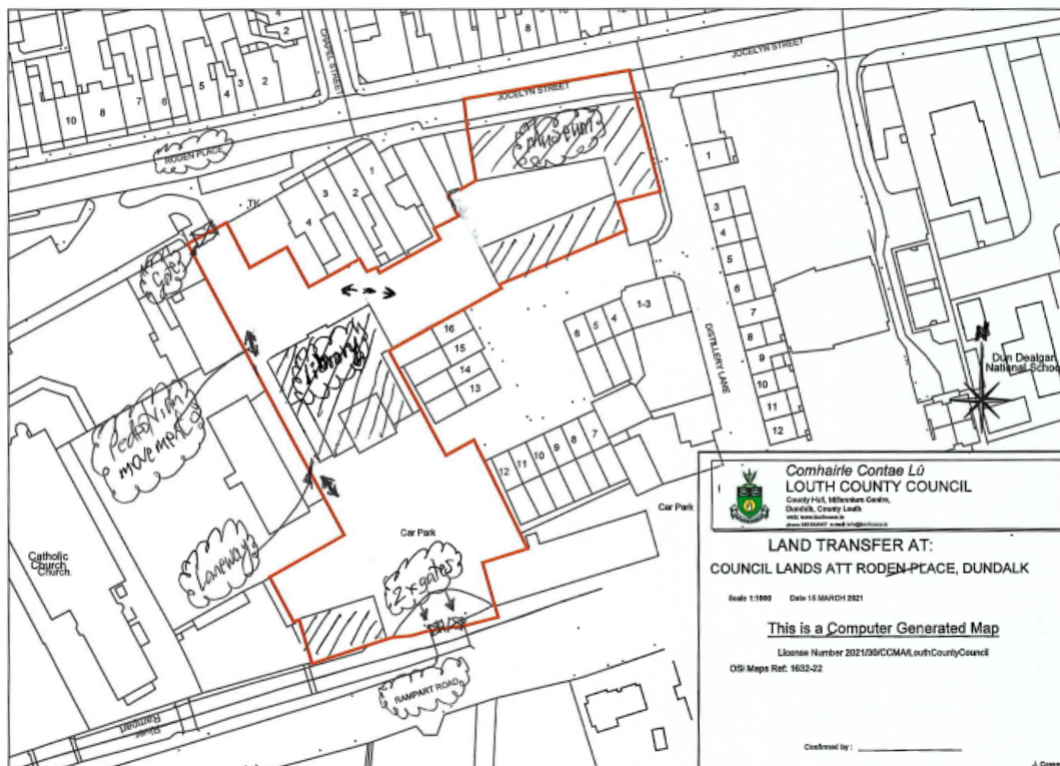


Figure 10: Site plan showing the areas where the sensors were placed in Dundalk

Challenge Name	Potential for New Economic Opportunities and Green Jobs
Indicator	Replication of Solutions
Challenge No.	10
KPI ID	6
Common KPI	Yes ☒ No ☐
Unit	N/A ☒
Procedure	1. A common strategy for replicability will be established between WP leaders and pilot leaders/experts 2. Determine the replicability of the VSs 3. Determine which VSs were most successful in terms of replication

Table 73: Dundalk KPI 10.6 Methodology

Description of Methodology for KPI 10.6

- Geographical scale: European scale
- Sample sizes: 65 Cities
- Sensor Locations: N/A
- Questions asked to participants: N/A
- Visual media/maps/calculations of the process: N/A
- Detailed information of how the data is being collected in practice: Data was collected via surveys conducted during conferences, clustering events, and dedicated WSs with follower cities.
- Challenges encountered on site: N/A

Challenge Name	Potential for New Economic Opportunities and Green Jobs
Indicator	Public & private investments during/after the project
Challenge No.	10
KPI ID	9
Common KPI	Yes ☒ No ☐
Unit	Euros

Procedure	1. Data collection on internal public/private investment. 2. Assess and calculator 5-Year Investment Projection 3. Replication Funding Potential Forecast
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Table 74: Dundalk KPI 10.9 Methodology

Description of Methodology for KPI 10.9

Private and public investments related to the Dundalk pilot Visionary are being calculated following the guidance and supervision of the WP8 leaders (INCLECOM). The main aim of this data collection is to consider a 5-year timeframe to show the pilot investments, both through EU and internal funding, and how the pilot VS projects can be implemented again in other sites through diverse funding mechanisms after the project.

A forecast of the external private and public investment is then being projected below to show the total amount of investment that the Visionary Solutions could potentially finance to replicate the implementation.

A1.4 Gżira Methodology Manual

The rationale below is relevant to the questionnaire related KPIs of the Gżira pilot. The KPIs 7.8, 7.11, 8.5, 8.9, 9.5, 9.8, 9.13, 9.19, 10.8 were merged into one survey;

The data collection methodology for the aforementioned KPIs is being implemented through survey questionnaires with residents living around the Gżira pilot sites. All KPIs being measured through a survey questionnaire have been merged into the same questionnaire. This approach was adopted to be able to collect data efficiently and avoid survey fatigue – considering there is a substantial amount of KPI being collected in this manner. Face-to-face and online questionnaires were conducted and distributed at pre-intervention stage to increase the possibilities of participation in terms of accessibility, allowing the research team to include inputs from the elderly population who are not knowledgeable about digital platforms, and include residents who were not at home during the hours when questionnaires were being conducted. The research team used a door-to-door strategy in an attempt to include all households within the Gżira pilot intervention areas. The data collection times were varied during the week, by allocating different hours for different days. Baseline data collected over a period of 3 months,

focusing on the following streets in rotation every week; Rue D'Argens, Triq tas-Sliema, Triq San Gorg, Manoel de Vilhena, Triq ir-Rebha, Triq Sir William Reid, Triq Nazju Ellul, Triq Luqa Briffa, Triq Turu Rizzo and Tal-Kubrit. This process will be repeated at the post-interventional stage, to evaluate any improvements brought about by NBS implementation. Since a large proportion of the sample population are transients – renting for a short period of time – it will not be possible to interview them at the post-intervention stage after two years. Other participants will be interviewed as replacements to be able to reach the quotes suggested below.

The sampling method implemented to reach a higher level of representativeness is that of a non-probability quota sampling, divided into age and gender groups. These calculations were based on the total percentage of people belonging to each age and gender group residing in Gżira at Regional level, which is only demographic information available, while taking the Northern Harbour region as a reference. The following quotas were set to achieve a 95% confidence level with a total sample of 205;

- Male 18-39 - 50
- Male 40-59 - 32
- Male 60+ - 28
- Female 18-39 - 39
- Female 40-59 - 26
- Female 60+ - 30

Out of a total relevant population of 2783, a total sample of 214 residents participated in the survey, of which 100 responses were collected from the online questionnaire and 114 from the face-to-face questionnaire. The geographical scale of this data is a mesoscale, at a city/locality level. Levels of precision, referring to margins of error and confidence levels, will vary according to the total number of responses from participants belonging to the different gender and age groups.

Challenge 1 KPIs - Gżira pilot

Challenge Name	Climate Mitigation and Adaptation
Indicator	C removed/stored by vegetation
Challenge No.	1
KPI ID	1

Common KPI	Yes ☒ No ☐
General methodology	Experimental ☐ Simulation ☒ Statistical/surveys ☐
Expected data deliverable	Numeric ☒ Survey ☐ Qualitative ☐ Map ☐
Unit	C tons/year
Required data processing	Yes ☒ No ☐
Procedure	1. Use a simulation/equations tool which calculates the amount of carbon storage on the basis of GIS data generated as a result of the VARCITIES Project 2. Determine the Carbon stored per km per year

Table 75: Gżira KPI 1.1 Methodology

Description of Methodology for KPI 1.1

To assess carbon sequestration by urban trees in Gżira, the i-Tree Eco model was used. A complete inventory of all trees within the study area was conducted by the Gżira Local Council, totalling 683 trees. Data collection focused on key parameters required for the model, including:

- Species identification
- Diameter at breast height (DBH, cm)
- Tree height (m)

The collected tree data was inputted into the i-Tree Eco software, which was used specifically to estimate annual and total carbon sequestration for the urban tree population. Default model parameters were applied, and no additional meteorological or pollution data were incorporated into the analysis. The model's output provided an estimate of carbon storage and sequestration expressed in metric tons, along with its associated economic value.

Challenge 4 KPIs - Gżira pilot

Challenge Name	Green Space Management
Indicator	Accessibility of urban green spaces for population
Challenge No.	4
KPI ID	2
Common KPI	Yes ☒ No ☐
Unit	km / min (by feet, by bus)
Procedure	1. Spatially join each (building) departure point to its nearest park access point (tool Distance to the nearest hub). As a result, a new shapefile is obtained with an attribute field containing the shortest distance to the closest park. 2. Classify proximity to the parks. Tamosiunas et al (2014) classified the distance to the closest park using a tertiles method. The resultant three categories classify proximity as high, moderate and low based upon distance. To obtain this KPI in terms of walking time, the Field calculator tool can be used. A conversion factor has to be set to measure a pedestrian walking speed (Bosina & Weidmann, 2017). For example, the average pedestrian walking speed in Spain is 1.59 m/s, or 95.4 m/min. The distance value in minutes can be obtained by dividing the distance in metres by the distance walked per minute. Note that it is generally not possible to walk in a completely straight line “as the crow flies” in urban areas. Thus, estimates of walking times based upon linear distances between two points in built-up urban areas (e.g., point of departure from building A to point of access to park B) are unlikely to be highly accurate.

Table 76: Gżira KPI 4.2 Methodology

Description of Methodology for KPI 4.2

Geographical scale: Neighbourhood

Sample size: 12 points

Walking distances between 12 designated points were measured using Google Maps' "walking directions" feature. The pre-implementation location was the Council of Europe Gardens in Gżira, and the post-implementation location was the newly developed green space at St. Clare Primary School.

For each of the 12 points, walking distances were recorded both before and after the implementation of the green space. Pre-implementation measurements were taken from the Council of Europe Gardens to each of the 12 points, while post-implementation measurements were taken from the same points to the new green space at St. Clare Primary School. The measurements were conducted by inputting the start and end locations into Google Maps and recording the walking time and distance for each route.

This approach allowed for a direct comparison of the walking distances and accessibility before and after the green space implementation.

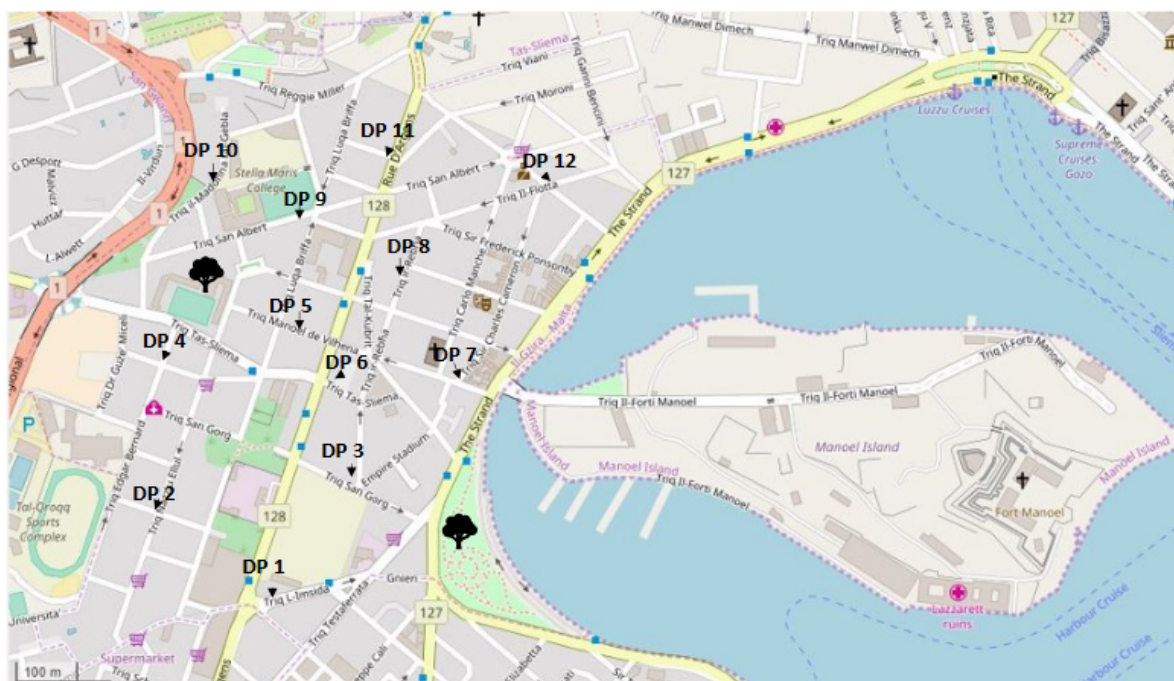


Figure 11: Walking points selected on Google Maps

Challenge Name	Green Space Management
Indicator	Recreational or cultural value of green spaces
Challenge No.	4
KPI ID	3a
Common KPI	Yes ☒ No ☐
Unit	No. of participants in green space events
Procedure	1. Record number of visitors in relation to green spaces

Table 77: Gzira KPI 4.3a Methodology

Description of Methodology for KPI 4.3a

Geographical scale: Neighbourhood

Sample size: N/A

Data for KPI 4.3a was collected to keep track of the number of participants attending events in local public gardens, to quantify the cultural value through social participation in such events. Here the measurements are related to the following cultural events organised in Gzira, including activities with temporary greening in urban spaces; several

activities organised in a large-scale cultural event organised at the Council of Europe Gardens, activities in green spaces recorded by the local council, and pop-up activities by VARCITIES.

Challenge Name	Green Space Management
Indicator	Recreational or cultural value of green spaces
Challenge No.	4
KPI ID	3b
Common KPI	Yes ☒ No ☐
General methodology	Experimental ☒ Simulation ☐ Statistical/surveys ☐
Expected data deliverable	Numeric ☒ Survey ☐ Qualitative ☐ Map ☐
Unit	No. of activities in green spaces
Procedure	1. Record number of activities organised in relation to green spaces

Table 78: Gżira KPI 4.3b Methodology

Description of Methodology for KPI 4.3b

Geographical scale: Neighbourhood

Sample size: N/A

The events listed in the results for KLPI 4.3b are the same as the ones mentioned in KPI 4.3a. Results available in Section 5 of this Deliverable.

Challenge Name	Green Space Management
Indicator	Species richness and composition with respect to indigenous vegetation and local/national biodiversity targets
Challenge No.	4
KPI ID	11
Common KPI	Yes ☒ No ☐
Unit	Units N/A ☒

Procedure	1. Use methods preferable to the pilot to establish identify indigenous species
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Table 79: Gżira KPI 4.11 Methodology

Based on the greening interventions in VS1 and VS3, species abundance and species richness were manually recorded using data from the planting plans.

Description of Methodology for KPI 4.11

Geographical scale: Neighbourhood

Sample size: N/A

Challenge Name	Green Space Management
Indicator	No. of sensory elements
Challenge No.	4
KPI ID	21
Common KPI	Yes ☒ No ☐
General methodology	Experimental ☐ Simulation ☐ Statistical/surveys ☒
Expected data deliverable	Numeric ☒ Survey ☐ Qualitative ☐ Map ☐
Unit	No. of sensors
Required data processing	Yes ☐ No ☒
Procedure	1. Record number of sensors installed in pilot site

Table 80: Gżira KPI 4.21 Methodology

Description of Methodology for KPI 4.21

Geographical scale: mesoscale

This KPI is being measured through record keeping, to track the number of sensors providing environmental data. The sensors being considered here are those that are directly monitoring the air quality in the pilot site, and at the University of Malta to be able to compare measurements with a diverse geographical location. These sensors are

directly providing information about the pilot site and transmitting to the H&WB Platform, designed and implemented in WP5, as an added value in terms of generating environmental data for Gżira which was previously non-existent.

Challenge 7 KPIs - Gżira pilot

Challenge Name	Participatory Planning and Governance
Indicator	No. of participants in citizen science activities
Challenge No.	7
KPI ID	18
Common KPI	Yes ☐ No ☒
General methodology	Experimental ☐ Simulation ☐ Statistical/surveys ☒
Expected data deliverable	Numeric ☒ Survey ☐ Qualitative ☐ Map ☐
Unit	Total No. of people who participated in citizen science activities throughout the project
Required data processing	Yes ☒ No ☐
Procedure	1. Record Keeping of participants in citizen science activities

Table 81: Gżira KPI 7.18 Methodology

Description of Methodology for KPI 7.18

Geographical scale: Macroscale

Sample size: total number of participants in citizen science activities

For KPI 7.18, records of data from registration forms distributed during events are being collected to measure the amount of people that were interested in taking part in citizen science activities. Events being considered here are the pop-up parks in VS1, air quality co-monitoring in VS2 and a cultural event organised at the council of Europe gardens as part of VS3.

Challenge 8 KPIs - Gżira pilot

Challenge Name	Social Justice and Social Cohesion
Indicator	The availability and distribution of parks (different types) or ecosystem services with respect to specific individual or household socioeconomic profiles landscape design
Challenge No.	8
KPI ID	1
Common KPI	Yes ☐ No ☒
Unit	Distance, No. of households in various categories
Procedure	1. Collect socio-economic data about residents 2. Check walking distance to public green spaces 3. Post-Intervention data collection by repeating the process. 4. Compare data

Table 82: Gżira KPI 8.1 Methodology

Description of Methodology for KPI 8.1

Geographical scale: Neighbourhood

Sample

size:

N/A

This KPI investigates the availability and distribution of different types of parks and ecosystem services in Gżira, Malta, with respect to specific socioeconomic profiles of individuals or households. The analysis is based on five income brackets:

- Less than €15,350
- €15,351 - €17,999
- €18,000 - €21,999
- €22,000 - €49,999
- €50,000 - €74,999

For each income bracket, household locations were mapped based on socioeconomic data collected through the pre-implementation questionnaire with residents, and proximity to a park, namely the Council of Europe Gardens, was measured.

The analysis involved examining whether lower-income households have equitable access to the green spaces available, and related environmental benefits. Manoel Island is not being considered due to construction works restricting public access to the area.

Challenge Name	Social Justice and Social Cohesion
Indicator	Participation of immigrants
Challenge No.	8
KPI ID	9
Common KPI	Yes ☐ No ☒
Unit	%
Procedure	1. No Pre-Intervention measurement needed 2. Data collection from record keeping of participant data. Any form of participation in events organised by VARCITIES Pilots is relevant. 3. Calculate % of immigrants participating in project activities relative to total participation

Table 83: Gżira KPI 8.9 Methodology

Description of Methodology for KPI 8.9

Geographical scale: Macroscale

Sample size: total number of participants in activities

The percentage of immigrant participants in the Gżira pilot will be calculated across all the different activities, including survey questionnaires, and will be obtained through the evaluation forms provided after the events. These participants will comprise the percentage of the total population who were not born in Malta but travelled to the country and settled. This percentage will be calculated and evaluated at the end of the project, which will reflect the total number of immigrant participants from the sample (total number of participants). This KPI will evaluate how successful the project interventions were in terms of inclusion of diverse communities and cultural integration.

The following is the question in evaluation forms relevant for this KPI which will be compared with the personal and social background of participants in activities;

1. How would you describe your ethnic group?

The survey questions in the pre-intervention and post-intervention questionnaire which will provide this information are the following;

1. Place of Birth
2. What is/are your citizenship(s)?
3. For how long have you been living in Malta or Gozo?
4. For how long have you been living in Gżira?

Challenge 9 KPIs - Gżira pilot

Challenge Name	Public Health and Wellbeing
Indicator	Noise reduction rates (Exposure to noise pollution)
Challenge No.	9
KPI ID	4
Common KPI	Yes ☒ No ☐
Unit	dB(A)
Procedure	For fixed points: 1. Measure LDEN (in situ measurements): acoustic acquisition (in dB(A)) on hourly periods (with typically 1 sec sampling rate), gathered on 3 periods (Day, Evening, Night) and next aggregated on 24h (see definition above). 2. Georeferenced data for built-up area: data from OPENSTREETMAP (OSM) 3. Road traffic counts: data from district, city or regional agencies 4. Number of inhabitants exposed to noise, and total number of inhabitants

Table 84: Gżira KPI 9.4 Methodology

Description of Methodology for KPI 9.4

Geographical scale: Neighbourhood

Sample size: N/A

Noise measurements were conducted over the course of one day, capturing data at different times of the day to assess variations in noise levels at pre and post-implementation stages.

At both stages, measurements were taken at a fixed location, a street intersecting Rue D'Argens, ensuring consistent coverage of the area. Noise levels were recorded using calibrated sound level meters, with readings taken at regular intervals throughout the day, including early morning, midday, and evening to capture peak and off-peak noise conditions.

The pre-implementation stage was measured before any changes or interventions, while the post-implementation stage was measured after the implementation of VS 1: Rue D'Argens: Micro-greening Interventions through a Participatory Design Process.

This is how the Lden was calculated:

- First find the average sound level (Leq) in dB(A) for the Day, Evening and Night separately. To take this average, the averaging time for the respective periods of the day are as follows:
 - Day: 07:00 – 19:00 (12 hours)
 - Evening: 19:00 – 23:00 (4 hours)
 - Night: 23:00 – 07:00 (8 hours)
- Use the formula for LDEN or use an online tool to calculate it based on the day, evening and night averaged levels
- Repeat for every day measured if you have multiple days to get LDEN every day.

Challenge Name	Public Health and Wellbeing
Indicator	No of hours spent outdoors, time people spend in the facility
Challenge No.	9
KPI ID	5
Common KPI	Yes ☒ No ☐
Unit	Questionnaire score

Procedure	1. Pre-Intervention data collection through questionnaire or acquisition of benchmark value from relevant sources. 2. Post-Intervention data collection by asking the same questions as in the pre-intervention questionnaire or source. 3. Compare data
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Table 85: Gżira KPI 9.5 Methodology

Description of Methodology for KPI 9.5

Geographical scale: Mesoscale

Sample size: 214

For KPI 9.5, the Gżira pilot has calculated the number of hours spent outdoors for the residents who participated in the survey. This information will be useful to determine any increase in time people spend outdoors due to the Gżira pilot VS implementations, specifically to show if the infrastructural NBS at Rue D'Argens and St. Clare primary school encourage people to spend time in these spaces. This information will be calculated based on responses at the post-intervention stage.

The questions posed in relation to KPI 9.5 at pre-intervention and post-intervention stages are the following;

Pre-intervention question:

1. How much time do you on average spend outdoors on a weekly basis?
 - a. 0 hours
 - b. 1 – 5 hours
 - c. 5 – 10 hours
 - d. 10 – 15 hours
 - e. 15 – 20 hours
 - f. 20< hours

Post-intervention questions:

1. How much time do you on average spend outdoors on a weekly basis?
 - a. 0 hours

- b. 1 – 5 hours
 - c. 5 – 10 hours
 - d. 10 – 15 hours
 - e. 15 – 20 hours
 - f. 20< hours
2. Did the NBS intervention in your area encourage you to spend more time outdoors or specifically around implementation? If so, how many hours are you spending outdoors on a weekly basis?
- a. 0 hours
 - b. 1 – 5 hours
 - c. 5 – 10 hours
 - d. 10 – 15 hours
 - e. 15 – 20 hours
 - f. 20< hours

Challenge Name	Public Health and Wellbeing
Indicator	Feeling of improving the quality of life (the Quality-of-Life questionnaire)
Challenge No.	9
KPI ID	8
Common KPI	Yes ☒ No ☐
Unit	Questionnaire score

Procedure	1. Pre-Intervention data collection through questionnaire or acquisition of benchmark value from relevant sources. As a diagnostic tool: - To assess the overall satisfaction of individuals regarding their environment or existing NBS in their environment; - To assess users' satisfaction if a given NBS is targeted. As an assessment tool: - To measure the efficiency of an NBS after its implementation by comparison with environmental quality of life before the NBS implementation; 2. Finally, the EQoL scale can give specific hints if a specific public and more vulnerable are targeted (for example, elderly people or patients). 3. Post-Intervention data collection by asking the same questions as in the pre-intervention questionnaire or source. 4. Compare data
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Table 86: Gżira KPI 9.8 Methodology

Description of Methodology for KPI 9.8

Geographical scale: Microscale

Sample size: 214

The methodology implemented to collect data related to citizens' health and wellbeing for KPI 9.8 were like that of other questionnaire related KPIs with Gżira residents, who live nearby the Gżira pilot sites. The questions were included in the merged survey questionnaire for the reasons mentioned above. The sampling method used is the same as the other KPIs which are targeted at the same community group, and the sample will consist of the same residents who participated, both at pre-intervention and post-intervention stages. Due to the considerable amount of KPI survey questions included in

the survey, the research team needed to prioritise, merge or slightly edit the most relevant questions for the Gżira pilot interventions found in the EQoL survey, to not overwhelm participants. Some of the other questions were replaced with others which are more suitable for the evaluation of the implementation of Gżira pilot's Visionary Solutions.

The following are the questions which were included in the survey:

Pre-intervention questions:

Questions which have been included from the EQoL Survey in a different format below:

- 1. How would you rate your quality of life?
- 2. How satisfied are you with your health?
- 7. How well are you able to concentrate?
- 8. How safe do you feel in your daily life?
- 12. Do you have enough money to meet your needs?
- 16. How satisfied are you with your sleep?
- 19. How satisfied are you with yourself?
- 20. How satisfied are you with your personal relationships?
- 26. How often do you have negative feelings, such as blue mood, despair, anxiety, depression?

Pre-intervention Questions:

- What is affecting your daily environment, personal health and wellbeing, in the city? List Factors in Bullet Points
- Over the last 12 months would you say your health has been?
 - (1) Very Good / (2) Good / (3) Neutral / (4) Bad / (5) Very bad, (0) I don't know
- In the past six months, how often have you had the following? Answer for each: Rarely or Never / About every month / About every week / More than once a week / About every day / I didn't
 - Asthma
 - Headache

- Allergies
 - Sore throat
 - Stomach pain
 - Back pain
 - Feeling depressed
 - Irritability or feeling nervous
 - Mind fog or difficulty to concentrate
 - Difficulties in getting to sleep
 - Nausea
 - Feeling anxious
 - Other: _____
- Below are six statements that you may agree or disagree with. Using the 1 - 7 scale below, indicate your agreement or disagreement with each item by placing the appropriate number on the line preceding that item. Please be open and honest in your response. (1) Strongly Agree / (2) Agree / (3) Slightly Agree / (4) Neutral / (5) Slightly Disagree / (6) Disagree / (7) Strongly Disagree / (0) No opinion
 - In most ways my life is close to my ideal.
 - The conditions of my life are excellent.
 - I am satisfied with my life.
 - So far, I have gotten the important things I want in life.
 - If I could live my life over, I would change almost nothing.
 - My quality of life is affecting my psychological and physical well being
 - How satisfied are you with...? (5) Very Unsatisfied, (4) Unsatisfied, (3) Neutral, (2) Satisfied, (1) Very Satisfied, (0) I don't know
 - Your standard of living?
 - Your health?
 - Your achievements in life?
 - Your personal relationships?
 - The balance between the time you spend on your paid work and the time you spend on other aspects of your life?
 - The relationship with other residents in the neighbourhood
 - What is your perceived sense of safety in your neighbourhood?

- Very safe / Safe / Neutral / Unsafe / Very unsafe / I do not know
- Below are five statements that you may agree or disagree with. Using the 1 - 7 scale below, indicate your agreement with each item by placing the appropriate number on the line preceding that item. Please be open and honest in your response.

Answers for each question: (7) Strongly agree (6) Agree (5) Slightly agree (4) Neutral (3) Slightly disagree (2) Disagree (1) Strongly disagree (0) I don't know

- There is a lot of air pollution in the city
- We are facing serious problems of air, water and soil pollution in the city
- Proper efforts are not taken into account by the government for the implementation of environmental laws
- I am happy with the overall environmental conditions of the city
- Please indicate what your family/household can usually afford (based on the last 3 - 5 years)? - in case more socio-economic data is needed
 - Less than basic needs
 - Basic needs
 - Some needs but not all
 - All needs
 - All needs and more
 - Prefer not to say
 - Unsure
- In the last year, have you participated in a leisure or cultural activity? Multiple options can be selected
 - Museum Visit
 - Local Cultural Activities
 - Art exhibition
 - Theatre
 - Cinema
 - Live Music
 - Literature
 - Archaeological Sites
 - Crafts

- Nature-related group activity
- Food-related group activity
- Religious activity
- Sports
- Other: _____
- Cannot define it
- No, other reason

Post-intervention questions:

The same questions will be repeated for the same target group at the post-intervention stage. Some questions may be added to correlate the results to the Gżira Pilot Visionary Solutions.

Challenge Name	Public Health and Wellbeing
Indicator	Residential attachment and satisfaction
Challenge No.	9
KPI ID	13
Common KPI	Yes ☒ No ☐
Unit	Questionnaire score
Procedure	1. Pre-Intervention data collection through 'Satisfaction with Life Scale' (Diener et al, 1985) questionnaire or acquisition of benchmark value from relevant sources. More info can be found in the Common methodologies excel file on Teams. We have included the methodology of another KPI found in the TF2 Handbook, General wellbeing and happiness (21.3, p.985), which is the most similar to 9.13. 2. Post-Intervention data collection by asking the same questions as in the pre-intervention questionnaire or source. 3. Compare data

Table 87: Gżira KPI 9.13 Methodology

Description of Methodology for KPI 9.13

Geographical scale: Microscale

Sample size: 214

The data collection method related to citizens' residential attachment and satisfaction for KPI 9.13 is identical to that of other questionnaire related KPIs with Gżira residents and was conducted with the same target group. The questions were included in the main survey questionnaire for the reasons mentioned above. The sampling method used is the same as the other questionnaire related KPIs, and the sample will consist of the same residents who participated in both at pre-intervention and post-intervention stages. The questions below were adopted from the 'Satisfaction with Life Scale' (Diener et al, 1985) questionnaire as suggested in the TF2 Handbook: Appendix of Methods related to general wellbeing and happiness. Post-intervention results will again be compared to the pre-intervention data collected to identify improvements and multiple benefits. Additional questions were included to specifically evaluate the Gżira pilot sociocultural and infrastructural NBS interventions.

The following are the questions which were included in the survey from the SWLS:

Pre-intervention questions:

- Below are 5 statements that you may agree or disagree with. Using the 1 – 7 scale below, indicate your agreement with each item placing the appropriate number on the line preceding that item. Please be open and honest in your response.

Answers for each question: (7) Strongly agree (6) Agree (5) Slightly agree (4) Neutral (3) Slightly

disagree (2) Disagree (1) Strongly disagree (0) I don't know

- In most ways my life is close to my ideal
 - The conditions of my life are excellent
 - I am satisfied with my life
 - So far, I've gotten the important things I want in life
 - If I could live my life over, I would change almost nothing
-
- Post intervention questions will consist of the same set of questions

Challenge Name	Public Health and Wellbeing
Indicator	Increase in walking and cycling in and around areas of interventions
Challenge No.	9
KPI ID	19
Common KPI	Yes ☒ No ☐
Unit	No of people/%
Procedure	1. Pre-Intervention data collection through questionnaire or acquisition of benchmark value from relevant sources. 2. Post-Intervention data collection by asking the same questions as in the pre-intervention questionnaire or source. 3. Compare data

Table 88: Gżira KPI 9.19 Methodology

Description of Methodology for KPI 9.19

Geographical scale: Microscale

Sample size: 214

The methodology implemented to collect data related to citizens' health and wellbeing for KPI 9.8 is identical to that of other questionnaire related KPIs with Gżira residents, with the same target group. The questions were included in the merged survey questionnaire for the reasons mentioned above. The sampling method used is the same as the other questionnaire related KPIs, hence the sample will consist of the same residents who participated in both at pre-intervention and post-intervention stages. The questions below were developed in order to calculate any increase in walking or cycling in the area brought about by the Gżira Visionary Solutions. Post-intervention results will again be compared with the pre-intervention data collected, with an added question asking respondents directly if the implemented NBS have encouraged this behaviour.

Pre-intervention question

3. What is your usual mode of transport in Malta?
 - a. Walking

- b. Cycling
- c. Car
- d. Motorcycle
- e. Bus
- f. Electric / Hybrid Car
- g. Electric Scooter
- h. Taxi
- i. Carpooling
- j. Car sharing

Post-intervention questions

4. What is your usual mode of transport in Malta?
 - a. Walking
 - b. Cycling
 - c. Car
 - d. Motorcycle
 - e. Bus
 - f. Electric / Hybrid Car
 - g. Electric Scooter
 - h. Taxi
 - i. Carpooling
 - j. Car sharing

5. Did the NBS intervention in your area encourage you to walk or cycle more in the area?
 - a. Yes
 - b. No

Challenge 10 KPIs - Gżira pilot

Challenge Name	Potential for New Economic Opportunities and Green Jobs
Indicator	New business attracted (a) and increase in start-up funding in pilot site (b)
Challenge No.	10
KPI ID	2a
Unit	No. of new businesses

Procedure	1. Identify number of active businesses at pre-intervention stage 2. Establish type of company that is relevant to NBS/VS intervention, and categorise in Type A (immediately relevant), Type B (somewhat relevant) and Type C (not relevant) [VA1] 3. Repeat steps 1 and 2 at post-intervention stage
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Table 89: Gżira KPI 10.2a Methodology

Description of Methodology for KPI 10.2a

Geographical scale: Macroscale

Sample size: N/A

The data for KPI 10.2a is being obtained from the Malta Business Registry, a Maltese government agency responsible for the registration, compliance and commercial partnerships within the Maltese Islands. The research team is keeping a record of the total number of active businesses in Gżira annually and determining their relevance according to the following NBS Type Categories;

1. Type A - Immediately Relevant
2. Type B - Somewhat Relevant
3. Type C – Not Relevant

Challenge Name	Potential for New Economic Opportunities and Green Jobs
Indicator	New business attracted (a) and increase in start-up funding in pilot site (b)
Challenge No.	10
KPI ID	2b
Common KPI	Yes ☐ No ☒
Unit	SME funding in Euros/year
Procedure	1.Record keeping SME funding offering services within the pilot site throughout the project (if applicable)

Table 90: Gżira KPI 10.2b Methodology

Description of Methodology for KPI 10.2b

Geographical scale: Mesoscale

Sample size: N/A

Data related to local funding available for SMEs was requested from a local governmental entity, called SEM (Servizzi Ewropej f'Malta), who were referred to the research team by other governmental entities in the same sector. Localised funding, particularly within Gżira, was not available, given the differences in geographical size when compared to larger European cities. Instead, start-up funding is available for businesses who want to start a business all over the Maltese Islands. Therefore, it is difficult to correlate results to the intervention area.

Challenge Name	Potential for New Economic Opportunities and Green Jobs
Indicator	Definition of parameters for (re)designing of green public spaces based on the well-being of users
Challenge No.	10
KPI ID	5
Common KPI	Yes ☒ No ☐
Unit	N/A ☒
Procedure	1. Design parameters being developed based on lessons learnt from implementation of VSs and health and wellbeing data. 2. Co-evaluate results with expert stakeholders

Table 91: Gżira KPI 10.5 Methodology

Description of Methodology for KPI 10.5

Data for KPI 10.5 is being collected internally through an internal analysis of the lessons learnt of the implementation phase, and the health and wellbeing data collected throughout the project lifecycle. This data has been collated, and the several parameters identified are outlined hereunder. VS1 and VS3 are the main solutions that have been included in this KPI, due to their infrastructural and sociocultural elements.

When considering cultural and environmental characteristics of Gżira, it is evident that due to a lack of space, limited opportunities for permanent infrastructure exists. The road

network is very narrow, including pavements that are less than 1m wide, with minor exceptions in certain locations. Above all, public transport does not work very efficiently, and a soaring car population is apparent. This was one of the challenges encountered in the infrastructural implementation of VS1, which is the micro-greening of a bus stop with additional benches and shelter to incentivise bus stop use for the public. Given the limited space available in Rue D'Argens, the University of Malta team managed to identify pockets for sociocultural activities with the endorsement of the Gżira local council. Educational hands-on and participatory activities were organised in these spaces to increase social value and raise awareness about the exclusive infrastructure of the street, which is car dominant. Meaningful feedback was received by the audience and participants, mainly related to the much-needed social spaces that were temporarily provided.

Similarly, for VS3 the University of Malta team implemented Nature-based Solutions (NbS) with a bottom-up participatory element to include the school community's perspective in the design and implementation phases, involving teachers, parents and students at both schools in the process. The team had limited budget and sought additional funding from Arts Council Malta to develop an outdoor learning space at St. Clare Primary School. For this reason, low-cost interventions had to be considered, while maximising their functionalities as much as possible. The modular furniture developed for the pop-up activities in VS1 was later donated to St. Clare Primary School as part of the cubic structure (outdoor learning space), as part of their circular approach to the implementation.

The main parameters that were developed are included below;

- Low-cost materials and structures
- Modularity
- Multifunctionality
- Participatory planning
- Social Inclusiveness - Designated social spaces

Challenge Name	Potential for New Economic Opportunities and Green Jobs
Indicator	Replication of Solutions
Challenge No.	10
KPI ID	6

Common KPI	Yes ☒ No ☐
Unit	N/A ☒
Procedure	1. A common strategy for replicability will be established between WP leaders and pilot leaders/experts 2. Determine the replicability of the VSs 3. Determine which VSs were most successful in terms of replication

Table 92: Gżira KPI 10.6 Methodology

Description of Methodology for KPI 10.6

KPI 10.6 measures the replication potential of Visionary Solutions. All the Gżira Visionary Solutions are being considered in the data collection of this KPI, and a quantitative survey questionnaire was the method of choice across all pilot sites. The questionnaire was distributed in two main events; the GoGreenRoutes Final Clustering event which had an audience composed of various other municipalities, Universities, non-profit and commercial entities involved in sister EU projects, and the Partner Cities Webinar organised as part of WP9 dissemination activities to engage other European Cities with the intention of receiving feedback and potentially replicating Visionary Solutions.

The structure of the questionnaire was set by first showing information about every Visionary Solution, followed by a question. Each question had a scale of 1 – 5, 1 being not replicable at all and 5 being highly replicable. The questions below were included;

- VS1: Micro-greening Interventions: On a scale of 1 to 5, how would you rate the replicability of the presented solution(s)?
- VS2: Citizen Science on air quality to increase H&WB awareness: On a scale of 1 to 5, how would you rate the replicability of the presented solution(s)?
- VS3: Educational community garden/Art playground: On a scale of 1 to 5, how would you rate the replicability of the presented solution(s)?

The following responses were supplemented by information to guide the respondents in making better informed decisions;

- 5 – Highly replicable (minimal to no barriers)
- 4 – High replicability (minor barriers/challenges to be addressed)

- 3 – Moderate replicability (both strength and limitations)
- 2 – Low replicability (there is some potential but also significant challenges)
- 1 – No replicability at all (significant barriers to replication)

Challenge Name	Potential for New Economic Opportunities and Green Jobs
Indicator	Saved healthcare spending
Challenge No.	10
KPI ID	8
Common KPI	Yes ☒ No ☐
Unit	Units: Euros per year / %
Procedure	1. Pilot city to determine baseline value through pre-intervention survey or other available sources 2. Data Collection at post-intervention stage through questionnaire or available sources. 3. Quantify results (if applicable) 4. Compare results

Table 93: Gżira KPI 10.8 Methodology

Description of Methodology for KPI 10.8

Geographical scale: Microscale

Sample size: 214

Questions for KPI 10.8 were included in the main questionnaire, and therefore it was conducted with the same target group using the same sampling method. Due to the significant number of questions included within the survey, the research team did not follow the HDI or SDI indicated above and have opted for a simpler approach to collect data about healthcare expenditure. The following questions were the ones included in the survey. This information will provide data on how much medication is required by individuals to function in their daily life. Another question will be introduced at the post-intervention stage to understand if the NBS implemented in Gżira had any impact on this expenditure.

Pre-intervention question;

What is your monthly expenditure on healthcare including health insurance?

Amount: _____

Post-intervention questions;

What is your monthly expenditure on healthcare including health insurance?

Amount: _____

Was this figure affected by NBS implemented in your area?

Challenge Name	Potential for New Economic Opportunities and Green Jobs
Indicator	Public & private investments during/after the project
Challenge No.	10
KPI ID	9
Common KPI	Yes ☒ No ☐
Unit	Euros
Required data processing	Yes ☐ No ☒
Procedure	1. Data collection on internal public/private investment. 2. Assess and calculator 5-Year Investment Projection 3. Replication Funding Potential Forecast

Table 94: Gżira KPI 10.9 Methodology

Description of Methodology for KPI 10.9

Private and public investments related to the Gżira pilot Visionary are being calculated following the guidance and supervision of the WP8 leaders (INCLECOM). The main aim of this data collection is to consider a 5-year timeframe to show the pilot investments, both through EU and internal funding, and how the pilot VS projects can be implemented again in other sites through diverse funding mechanisms after the project.

A forecast of the external private and public investment is then being projected below to show the total amount of investment that the Visionary Solutions could potentially finance to replicate the implementation.

A1.5 Leuven Methodology Manual

Challenge 1 KPIs - Leuven pilot

Challenge Name	Climate Mitigation and Adaptation
Indicator	Number of temperature and humidity data
Challenge No.	1
KPI ID	8
Common KPI	Yes ☐ No ☒
General methodology	Experimental ☒ Simulation ☐ Statistical/surveys ☐
Expected data deliverable	Numeric ☒ Survey ☐ Qualitative ☐ Map ☐
Unit	No. of temperature and humidity data added per year
Required data processing	Yes ☒ No ☐
Procedure	1. Data collection entails summarizing the information received from relevant indicators, such as ID1.2, 1.3, 5.5, towards creating a strong knowledge based on the existing environmental conditions in the city of Leuven.

Table 95: Leuven KPI 1.8 Methodology

Description of Methodology for KPI 1.8

- **Data collection approach:** Data collection entails summarizing the information received from relevant indicators, such as ID1.2, 1.3 and 5.5, once these are closed, towards creating a strong knowledge base on the existing environmental conditions in the city of Leuven. The total of the collected data is calculated over a year since the date of the sensor's installation.
- **Geographical scale:** district scale

- **Sample sizes:** Calculation of measurements over 1 year

Table 96: Leuven (BE) - Table of results for number of collected data for KPI1.8

Type of Data	Sample	Sample Rate
Solar Radiation	11945	15 mins
Air Pressure	2621	30 mins
Humidity	11945	15 mins
Air Temperature (Degrees Celsius)	11945	15 mins
UV Index	11945	15 mins

- **Sensor Locations:** See map in Figure 12.



Figure 12: Leuven (BE) - Overview of all installed sensors

- Questions asked to participants: N/A
- Visual media/maps/calculations of the process: N/A
- Detailed information of how the data is being collected in practice: field measurements by the installed sensors: Leuven. Cool 142, providing data on temperature and humidity on a 15-minute basis, from 12/10/2023 until 12/10/2024 and Leuven.cool 067, providing data on temperature and humidity on a 15-minute basis, from 1/10/2023 until 1/10/2024, one SENSEEDGE stick and one air quality sensor.

- Challenges encountered on site: N/A
- The purpose of collecting the data is to contribute to the creation of a strong knowledge based on the existing environmental conditions in the city of Leuven.

Challenge 4 KPIs - Leuven pilot

Challenge Name	Green Space Management
Indicator	Accessibility of urban green spaces for population
Challenge No.	4
KPI ID	2
Common KPI	Yes ☒ No ☐
General methodology	Experimental ☐ Simulation ☐ Statistical/surveys ☒
Expected data deliverable	Numeric ☒ Survey ☐ Qualitative ☐ Map ☐
Unit	Km / min (by feet, by bus)
Required data processing	Yes ☐ No ☒

Procedure	1. Spatially join each (building) departure point to its nearest park access point (tool Distance to the nearest hub). As a result, a new shape- file is obtained with an attribute field containing the shortest distance to the closest park. 2. Classify proximity to the parks. Tamosiunas et al (2014) classified the distance to the closest park using a tertiles method. The resultant three categories classify proximity as high, moderate and low based upon distance. To obtain this KPI in terms of walking time, the Field calculator tool can be used. A conversion factor has to be set to measure a pedestrian walking speed (Bosina & Weidmann, 2017). For example, the average pedestrian walking speed in Spain is 1.59 m/s, or 95.4 m/min. The distance value in minutes can be obtained by dividing the distance in metres by the distance walked per minute. Note that it is generally not possible to walk in a completely straight line “as the crow flies” in urban areas. Thus, estimates of walking times based upon linear distances between two points in built-up urban areas (e.g., point of departure from building A to point of access to park B) are unlikely to be highly accurate.
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Table 97: Leuven KPI 4.2 Methodology

Description of Methodology for KPI 4.2

- **Data collection approach:** Using the Google maps tool, six future entrances of the park currently under construction have been identified: Entrance North 1&2, Entrance West, Entrance South 1&2 and Entrance Est. Similarly, all the nearest bus-stops have been identified (Figure 13). The walking distance in minutes between the nearest bus-stop and entrances of the park is calculated for the six

connection options. The data for each itinerary is available on Zenodo. As a second step and according to the suggested methodology (Tamosiunas et al, 2014), using a tertiles method, the distances to the closest park were classified as moderate or low (no high distances were identified).

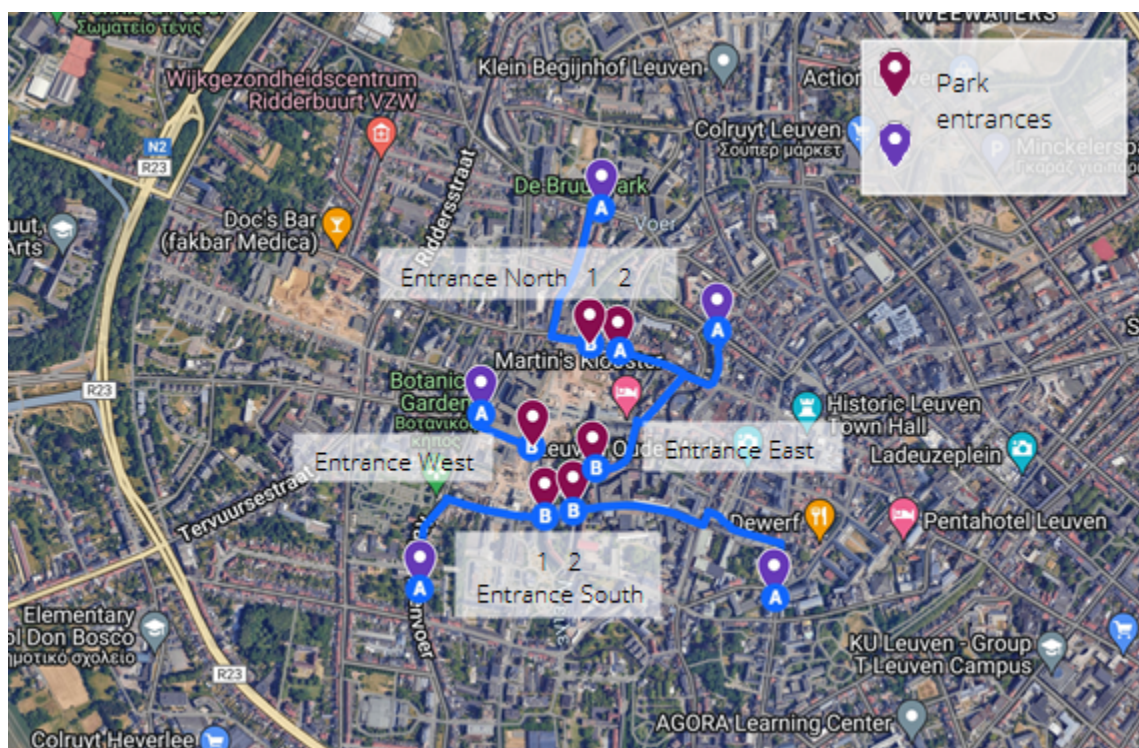


Figure 13: Leuven accessibility of green spaces map

- **Geographical size:** microscale/ mesoscale
- **Sample size:** Six itineraries (walking distances in meters) are measured
- **Questions:** N/A
- **Visual media:** Map featuring the itinerary between the nearest bus-stops and the entrances of the future park (Figure 13).
- **Detailed information of how the data is being collected in practice:** Walking distance and walking time calculated by means of Google maps tool, on Leuven's map. Then the results are classified using the "Tamosiunas et al (2014)" method.
- **Challenges encountered on site:** The accurate location of the entrance points is not yet defined, as the construction of the overall park is still on-going.

- **The purpose of collecting the data:** This KPI is monitoring the contribution of the project to the increase of accessibility of urban green spaces for the population.

Challenge Name	Green Space Management
Indicator	Recreational or cultural value of green spaces (Number of visitors)
Challenge No.	4
KPI ID	3a
Common KPI	Yes ☒ No ☐
General methodology	Experimental ☐ Simulation ☐ Statistical/surveys ☒
Expected data deliverable	Numeric ☒ Survey ☐ Qualitative ☐ Map ☐
Unit	No. of visitors
Procedure	1. Record number of visitors in relation to green spaces

Table 98: Leuven KPI 4.3a Methodology

Description of Methodology for KPI4.3a

- **Data collection approach:** Leuven's (mobile) urban living room (VS1-3), called "Olevodroom", is implemented on an unsealed open area and will be shortly relocated in the heart of the new green urban park, currently under construction in Hertogensite. The data for monitoring this KPI derive from the pilots' record keeping on the number of people (children included), that participated in the events held in the Olevodroom. As a starting point, we consider the inauguration event, held on the site on March 31st 2024. Considered for this KPI were 89 events associated with the Olevodroom, targeting all age groups. These consisted a variety of activities such as music events, circus performances, open dance lessons, after school activities for children, theatre, sports, community gatherings and even city camping on the site! All the events, with names, dates and number of participants, are listed and uploaded in Zenodo. According to the pilot's record keeping, a total of 24.846 people attended the events from March until October 2024, when the Olevodroom's 1st operating

season ended. The next operation season is from May to October 2025. The city envisages to relocate the urban living room in the “heart” of the future park, once the works are completed.

Additional data is gathered by the Telraam traffic sensor, installed across the Est-West axe (Figure 15) of Hertogensite site. The sensor counts the visitors of the park, pedestrians as well as cyclists. The data received are automatically uploaded and available on the VARCITIES platform. As the park is not yet finalized, the actual measurements are considered as a baseline measurement.



Figure 14: Leuven Olevodroom photos from the socio-cultural events



Figure 15: Leuven location of traffic counters

- **Geographical size:** microscale/ mesoscale
- **Sample size:** N/A
- **Questions:** N/A
- **Visual media:** Photos from the inauguration event of the urban living room, VS1-3 (Figure 14) and map featuring the location of the installed traffic counters on Hertogensite (Figure 15).
- **Detailed information of how the data is being collected in practice:** Data on the number of participants in the events derives from the city's record keeping. Data on pedestrians and bikers are collected by the Telraam traffic sensor. The city's record keeping provides data also on the number of visitors and events held in the Velodroom in 2023. The evaluation of the results is achieved through comparing the data: 2023 (pre-) versus 2024 (post-). All data is available on Zenodo.
- **Challenges encountered on site:** NA
 - **The purpose of collecting the data:** This KPI is monitoring the contribution of the project to the increase of the number of visitors of the new urban green space.

Challenge Name	Green Space Management
Indicator	Recreational or cultural value of green spaces (Number of recreational activities or cultural events, people involved, children in educational activities)
Challenge No.	4
KPI ID	3b
Common KPI	Yes ☒ No ☐
General methodology	Experimental ☐ Simulation ☐ Statistical/surveys ☒
Unit	No. of activities in green spaces
Procedure	1. Record number of activities organised in relation to green spaces 2. Metric: No. of recreational activities held per unit time

Table 99: Leuven KPI 4.3b Methodology

Description of Methodology for KPI 4.3b

- **Data collection approach:** Leuven's (mobile) urban living room (VS1-3), called "Olevodroom", is implemented on an unsealed open area and will be shortly relocated in the heart of the new green urban park, currently under construction in Hertogensite. The data for monitoring this KPI derive from the pilots' record keeping on the number of recreational activities and cultural events held in Olevodroom. As a starting point, we consider a Neighborhood gathering that was held on the 16th of May 2023, aiming to enhance the engagement of citizens and communicate the evolution of the VS.
- In March 2024, during the co-design and co-implementation phase, youngsters from the local community participated in a 10-day assembly & construction lab, organized by the contracted artist undertaking the works. During the workshop the artist worked in close collaboration with the participants, teaching and improving their skills, while implementing the new urban living room. Following the finalization of the construction, an inauguration event with high attendance, was held on March 31st, 2024. The Olevodroom's agenda included several events, 89 in total, targeting all age groups, proposing a variety of activities such as music events, circus

performances, open dance lessons, after school activities for children, theatre, sports, community gatherings and even city camping on site! Monitoring included the number of events held by trimester, with themes and dates listed and uploaded in Zenodo. The city's record keeping provides data also on the number of visitors and events held in the Velodroom in 2023. The evaluation of the results is achieved through comparing the data: 2023 Velodroom (pre-) versus 2024 Olevodroom (post-).



Figure 16: Leuven photos from the agenda of the Olevodroom

- **Geographical size:** microscale/ mesoscale
- **Sample size:** 100 events (89 socio-cultural events, 11 co-design & co-implementation events)
- **Questions:** N/A
- **Visual media:** Photos from the inauguration event of the urban living room, VS1-3 and photos from the agenda of events (Figure 16).
- **Detailed information of how the data is being collected in practice:** Record keeping of the events and activities organised in the park, including the co-design and co-implementation phase.
- **Challenges encountered on site:** N/A

- **The purpose of collecting the data:** This KPI is monitoring the contribution of the project to the increase of the number of events/ activities in relation to the urban green space.

Challenge Name	Green Space Management
Indicator	Increased connectivity to green infrastructure
Challenge No.	4
KPI ID	14a
Common KPI	Yes ☐ No ☒
General methodology	Experimental ☐ Simulation ☒ Statistical/surveys ☒
Unit	Ha
Procedure	1. Creating simulations by using buffers around park/s 2. Comparing pre-intervention and post-intervention data

Table 100: Leuven KPI 4.14a Methodology

Description of Methodology for KPI 4.14a

- **Data collection approach:** Hertogensite, an area formerly with impervious surfaces, will be transformed into a green space in the heart of the town, significantly contributing to improving the interconnexion of green spaces, by creating new “green corridors”. This network of interconnected green spaces is extremely valuable for increasing biodiversity, whereas promoting walking and cycling in town.

The adopted data collection approach consists of the following 3 steps:

1. Identifying, on Leuven’s map, all the neighbouring green spaces,
2. Measuring the distance in meters between them and
3. Comparing to the pre-intervention values

All distances were measured by means of Google maps tool, focusing on walking itineraries. The identified nearby green spaces are Handbooghof park, situated in the North of Hertogensite, Janseniuspark situated in the South, Joris Helleputteplein in the Est and the Botanical Garden in the West. Walking distance between the existing green spaces was measured (d1, d2, d3 and d4: pre-intervention measurements) and shown in blue lines in Figure 17 . As a next step, the walking distance connecting the new park with the neighbouring green spaces

was calculated (D1, D2, D3 and D4: post-intervention measurements) highlighted in orange lines in Figure 17. Finally, the results were compared, indicating that the significantly decreased walking distance to an urban green space.

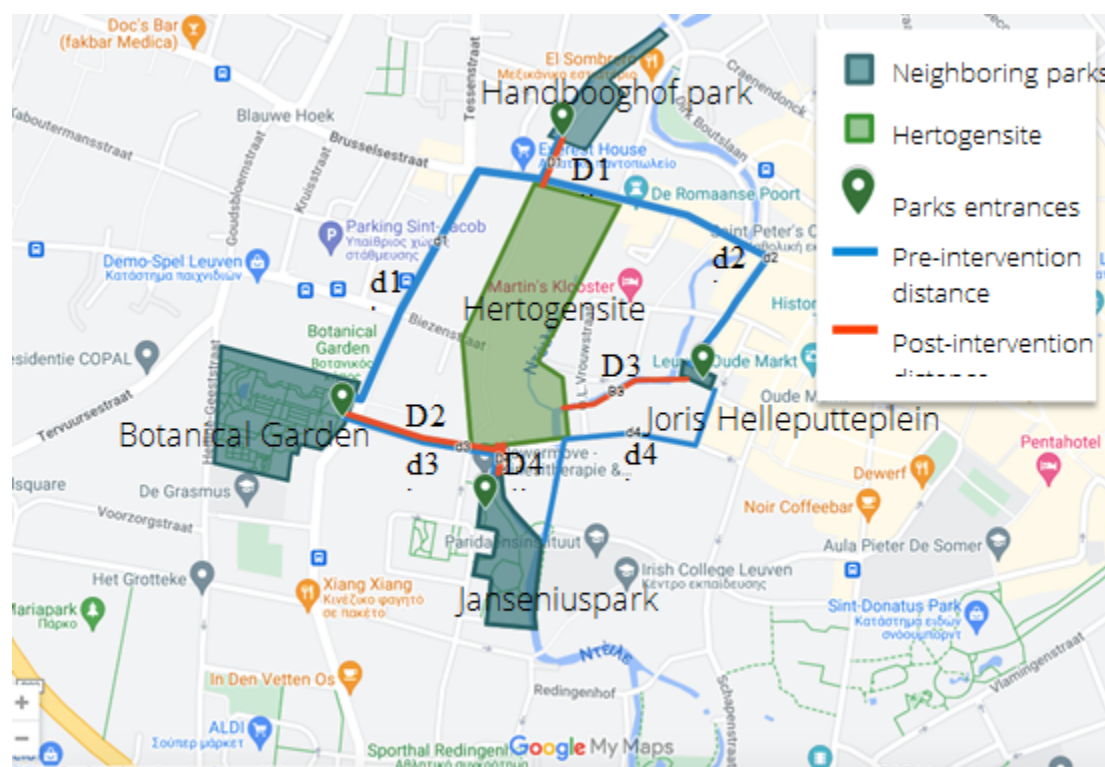


Figure 17: Leuven interconnection of green spaces

- **Geographical size:** microscale/ mesoscale
- **Sample size:** itineraries towards 4 neighbouring, existing green spaces
- **Questions:** N/A
- **Visual media:** Map featuring the network of the existing and new green spaces, along with the walking distance between them before & after intervention (Figure 17).
- **Detailed information of how the data is being collected in practice:** Walking distance between the green spaces pre and post intervention, on Google maps. The distances are represented with itinerary lines on the map: pre-intervention with blue lines and post intervention with orange lines. The data and the comparing results are uploaded on Zenodo.

- **Challenges encountered on site:** The location of the future entrances of the park are not yet precise, due to the on-going works on the site.
- **The purpose of collecting the data:** This KPI is monitoring the contribution of the project to the increase of interconnection among the green spaces in the city of Leuven.

Challenge 6 KPIs - Leuven pilot

Challenge Name	Urban Regeneration
Indicator	Use of reclaimed/recycled building materials
Challenge No.	6
KPI ID	6
Common KPI	Yes ☐ No ☒
Unit	m3, tons, %
Procedure	1. Creation of an inventory of the materials present before the dismantling of the Velodroom (Figure 18). In the case of the Velodroom these are mainly wood and metal. 2. Quantification: Measuring the quantity of each type of material. This can be done by weight, volume or number of units. 3. Reclamation process: Careful dismantling and collection of the reusable materials identified, ensuring that they are not damaged during this process to maintain their usability 4. Documentation: Record keeping of the quantities of materials reclaimed. This includes noting the type of material, the amount reclaimed and any relevant details about their condition. 5. Calculation of the percentage of reclaimed materials by comparing the quantity of materials reclaimed and the total quantity of materials originally present in the building.

Table 101: Leuven KPI 6.6 Methodology

- **Data collection approach:** Collecting information from bill of quantities and construction specification documents for the dismantling of the pre-existing Velodroom structure and providing an estimation of the percentage of reclaimed units of wood for the construction of the Olevodroom structure.
- **Geographical size:** microscale/ mesoscale
- **Sample size:** N/A
- **Questions asked to participants:** N/A
- **Visual media:** Figure 18, Figure 19
- **Detailed information of how the data is being collected in practice:**
Record keeping, bills of quantities. The steps followed include:
 1. Creation of an inventory of the materials present before the dismantling of the Velodroom. In the case of the Velodroom these are mainly wood and metal structural elements and joints.
 2. Quantification: Measuring the quantity of the elements. This can be done by weight, volume or number of units.
 3. Reclamation process: Careful dismantling and collection of the reusable materials identified, ensuring that they are not damaged during this process to maintain their usability.
 4. Documentation: Record keeping of the quantities of materials reclaimed. This includes noting the type of material, the amount reclaimed and any relevant details about their condition.
 5. Calculation of the percentage of reclaimed materials (wooden and metal elements) by comparing the quantity of materials reclaimed and the total quantity of materials originally present in the dismantled structure (Velodroom).

Inventory of wood of the Velodroom:

STRUCTURE

Wooden section 6x15 cm

Length 400cm: 100 units (diagonals)

Length 495cm: 34 units (horizontal)

Length 148cm: 34 units (vertical)

Variable length between 148cm and 339cm: 66 units (vertical)

Variable length between 415cm and 495cm: 66 units (horizontal)

Length of approx. 100cm: approx. 400 units (beams)

Length of approx. 500cm: approx. 30 units (beams)

FENC / RAILINGS

Timber profile 6x2.5 cm

Length of approx. 350cm: approx. 200 units (handrails)

FLOOR

Wooden profile 10x2.5 cm (right-hand section)

Length 400cm: approx. 320 units

Length 100cm: approx. 320 units

Trapezoids 2.5cm thick (curves)

one side 10 cm the other 15 cm Length 400cm: 450 units

one side 8.5cm the other 10cm length 100cm: 450 units

Estimation of materials used for the Olevodroom

The amount of wood used from Velodroom for the realization of the Olevodroom is 80 %

- The remaining 20% is still on site for the possible reconstruction of the Olevodroom, elsewhere on the site. The reconstruction will require spare boards to replace broken ones. The remaining wood will be incorporated by the artist into other art objects or structures by Decoratelier .

- the smallest pieces (under 20cm) were used as traps under the structure

- Amount of other materials used (screws, bolts, etc.) from the Velodrome for the realization of the Olevodroom: 80 %, the rest of the screws were often drilled out so cannot be reused.

- Used quantity of other materials: pallet racks reclaimed: 33 steel uprights/120 steel beams.

- Quantity of **new** wood for realization of the Olevodroom: 2 % only for inner ring railing

- Quantity of **new** steel elements: 10 % of the used pallet racks was new.

- Quantity of **new** other metal joints (screws, bolts, etc.): 20 %

- **Challenges encountered on site:** N/A
- **The purpose of collecting the data** is to assess the quantity of building materials that were reclaimed from pre-existing structures. Specifically pertaining to the Leuven pilot site, the initiative involves the reclaiming and reusing of materials from the former Velodrome in order to construct the Olevodroom (a lightweight versatile structure combining accessible resting

and exercise elements). This sustainable approach reflects the city's effort to repurpose and integrate existing materials into the ongoing construction processes, thereby minimizing waste and promoting environmental sustainability.



Figure 18: Leuven Velodroom structure



Figure 19: Leuven – Reclaimed materials used for the construction of the Olevodroom

Challenge Name	Urban Regeneration
Indicator	Access of residents/employees by foot to open space: sports centre, recreation area, or green space
Challenge No.	6
KPI ID	8
Common KPI	Yes ☐ No ☒
Unit	Km
Procedure	1. Spatially join each (building) departure point to its nearest park access point (tool Distance to the nearest hub). As a result, a new shape-file is obtained with an attribute field containing the shortest distance to the closest park. 2. Classify proximity to the parks. Tamosiunas et al (2014) classified the distance to the closest park using a tertiles method. The resultant three categories classify proximity as high, moderate and low based upon distance (shown as an example): To obtain this KPI in terms of walking time, the Field calculator tool can be used. A conversion factor has to be set to measure a pedestrian walking speed (Bosina & Weidmann, 2017). For example, the average pedestrian walking speed in Spain is 1.59 m/s, or 95.4 m/min. The distance value in minutes can be obtained by dividing the distance in metres by the distance walked per minute. Note that it is generally not possible to walk in a completely straight line “as the crow flies” in urban areas. Thus, estimates of walking times based upon linear distances between two points in built-up urban areas (e.g., point of departure from building A to point of access to park B) are unlikely to be highly accurate. Complementary data that may be useful in contextualizing the green space proximity index:

	City level descriptive statistics: It will measure the impact of the NBS at municipal level: Overall statistics can also be calculated by a QGIS tool called Basic statistics for numeric fields. As a result, a set of measures is derived: - o Descriptive statistics in terms of distance and travel time: 1. Minimum / maximum distance to the closest park (m) 2. Average distance to the closest park (m). - o Statistics regarding number of inhabitants from each defined starting point (building) are also useful to contextualize the index. 3. Number of people that live in the proximity of the facility 4. Proportion of people having the closest park in the high, moderate or low proximity category. 5. District level descriptive statistics: A neighbourhood level study is also recommended in order to find deficient areas in greenspace availability, or probability of overcrowded green areas 6. Collect baseline information 7. Collect Post-Intervention data 8. Compare data to calculate percentage of the increase in accessibility
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Table 102: Leuven KPI 6.8 Methodology

Description of Methodology for KPI 6.8

- **Data collection approach:** Using the Google maps tool, four future entrances of the park, currently under construction, have been identified: Entrance North, Entrance West, Entrance South and Entrance Est. For each of the above entrances, a circle of 300m is defined and the walking distance between the points of departure situated on the circumference and the park entrance, is calculated. As a second step, walking distances are compared and the longest distance is identified.

- **Geographical size:** microscale/ mesoscale
- **Sample size:** Number of points of departure on the circumference of 300 radius circles: 21 points / walking distances calculated.
- **Questions:** N/A
- **Visual media:** Map featuring the itineraries between the departure points and the entrances of the future park (Figure 20, Figure 21, Figure 22).
- **Detailed information of how the data is being collected in practice:** The collection data method includes the following steps:
 1. Four entrances are identified on Leuven's map.
 2. Four circles of 300 radius, are created based on each entrance.
 3. 21 points situated on the circumference of the circles, are selected and identified on map.
 4. Walking distances from each point to the relevant entrance, are calculated in meters, by means of Google maps tool. Finally, the results are compared, and the longest distance is identified.
- **Challenges encountered on site:** The accurate location of the entrance points is not yet defined, as the construction of the overall park is still on-going.
- **The purpose of collecting the data:** This KPI is monitoring the contribution of the project to the increase of the accessibility on foot, of the residents, to local open urban/green spaces, for sports and recreation.

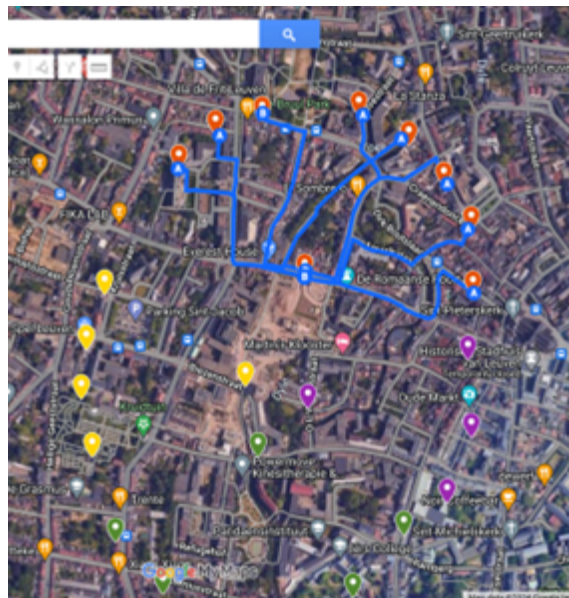


Figure 20: Leuven (BE) - Map featuring the walking itineraries departing from a 300-buffer zone towards the future North entrance of the park (orange pins)

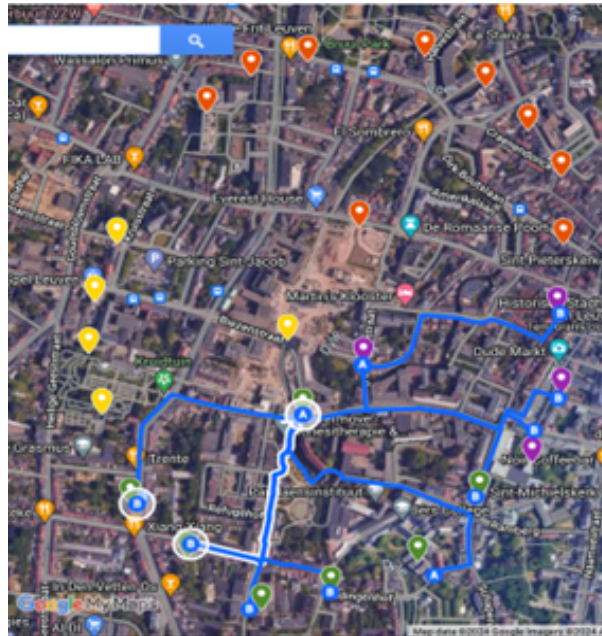


Figure 21: Leuven (BE) - Map featuring the walking itineraries departing from a 300-buffer zone towards the future Est (purple pins) and South (green pins) entrance of the park

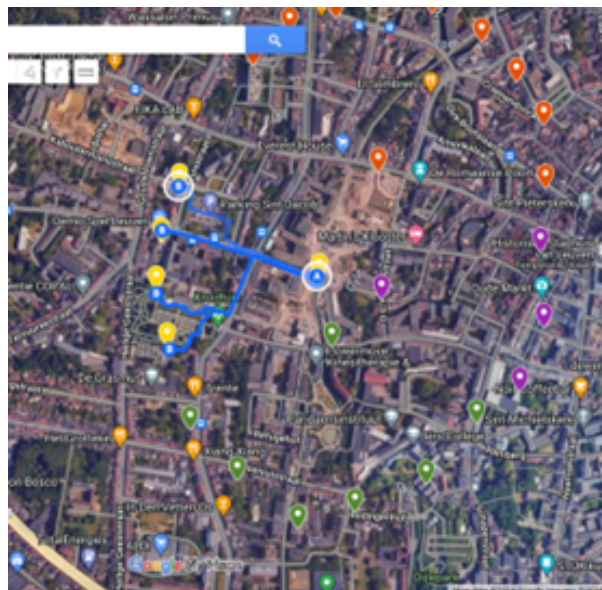


Figure 22: Leuven (BE) - Map featuring the walking itineraries departing from a 300-buffer zone towards the future West entrance of the park (yellow pins).

Challenge Name	Urban Regeneration
Indicator	Access of residents to cultural facilities on foot
Challenge No.	6
KPI ID	9
Common KPI	Yes ☐ No ☒
Unit	Km
Procedure	TF2 Handbook: A variety of methods exist from applied/public participation techniques through to earth observation/remote sensing approaches. For further details on measurement tools and metrics, including those adopted by past and current EU research and innovation projects can be found in: Connecting Nature Indicator Metrics Reviews: Env48_Applied and Env48_RS 1. Collect baseline data on distance of residents to cultural facilities 2. Post-Intervention data collection by repeating the process 3. Compare data to calculate distance

Table 103: Leuven KPI 6.9 Methodology

Description of Methodology for KPI 6.9

- **Data collection approach:** Using the Google maps tool, the main entrance of the new urban living room “Olevodroom” is identified and a circle of 300m radius is defined around the entrance point. Next, the walking distances between the points of departure, situated on the circumference of the circle and the urban living room’s entrance, are calculated. As a final step, walking distances are compared and the longest distance is identified.
- **Geographical size:** microscale/ mesoscale
- **Sample size:** Number of points of departure on the circumference of 300 radius circles: 16 points, Max distance 0,55 km.
- **Questions:** N/A
- **Visual media:** Map featuring the itinerary between the 16 selected departure points and the entrance of the Olevodroom (Figure 23).

- **Detailed information of how the data is being collected in practice:** A buffer zone of 300m distance from the Olevodroom entrance is defined and 16 points of departure are identified on map. Walking distances in km, are calculated by means of Google maps tool, on Leuven's map. Then the results are compared, and the longest distance is identified.
- **Challenges encountered on site:** N/A
- **The purpose of collecting the data:** This KPI is monitoring the contribution of the project to the increase of the accessibility on foot, of the residents, to cultural facilities. Figure 23: Leuven (BE)- Map featuring the access on foot to the Olevodroom

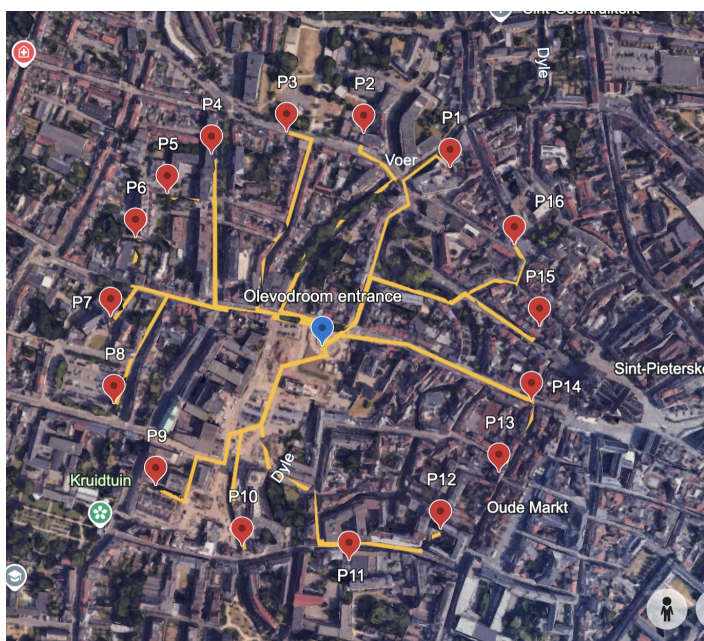


Figure 24: Leuven (BE)- Map featuring the access on foot to the Olevodroom

Challenge 7 KPIs - Leuven pilot

Challenge Name	Participatory Planning and Governance
Indicator	No of activities involving children
Challenge No.	7
KPI ID	17
Common KPI	Yes ☐ No ☒

Unit	No of activities involving children
Procedure	1. Record Keeping of number of activities involving children 2. Post-Intervention data collection by analysing records 3. Calculate total number of activities

Table 104: Leuven KPI 7.17 Methodology

Description of Methodology for KPI 7.17

- Data collection approach:** The data has been collected throughout record keeping during the project's events, by monitoring the number of activities that either involve, or are specifically targeted at children. For this purpose, two different age groups have been identified: 1. Children under 12 and 2. Children between 12 and 18 years old. The events considered refer to the co-creation phase (Neighbourhood gathering 1 & 2), the co-implementation phase (construction & assembly camp), the Inauguration event and the cultural events following the opening of the Olevodroom, such as Circus performance, After-school clubs, theatre and interactive performances for young children, concerts and events designed for entire families/ all ages were also considered.
A total of 36 events involving children under 12yrs and 44 events involving children aged from 12 to 18 years, were held from March to October 2024, in the Olevodroom.
- Geographical size:** microscale/ mesoscale
- Sample size:** 80 events, 36 events for children under 12yrs, 44 events for 12-18yrs
- Questions:** N/A
- Visual media:** Figure 25
- Detailed information of how the data is being collected in practice:** Record keeping during project activities
- Challenges encountered on site:** No specific challenges encountered.
- The purpose of collecting the data is to** enable reporting on the increased and improved participation of citizens and in particular children.



Figure 25: Leuven - Activities involving children

Challenge 8 KPIs - Leuven pilot

Challenge Name	Social Justice and Social Cohesion
Indicator	Accessibility of open public spaces and buildings for families with baby carriages and individuals with restricted mobility
Challenge No.	8
KPI ID	10
Common KPI	Yes ☒ No ☐
Unit	m2 of area easily accessible to people with physical limitations (no of families participating)
Procedure	1. Data collection through GIS 2. Process data

Table 105: Leuven KPI 8.10 Methodology

Description of Methodology for KPI 8.10

- Data collection approach:** The data collection approach for KPI8.10 is calculating, with means of GIS tools, the footprint of the Olevodroome area, considered as accessible space. As a second step, the area is compared to the area that was accessible before, when the Velodroom was in operation. Both

projects consist of a wooden structure, embracing an open plan space (scene) and a large open space around it, including access to the bar and utilities. The plan is entirely accessible in both cases, except from parts of the wooden structure which are not accessible due to high slope. As a conclusion, the implemented solution offers a highly accessible space, while the level of accessibility, compared to the situation before, has not been significantly changed.

- **Geographical size:** microscale/ mesoscale
- **Sample size:** 3.486 m²
- **Questions:** n/a
- **Visual media:** Figure 26, Map with measurements: The footprint of the accessible area of the Olevodroom is shown highlighted in fuchsia, equivalent to 3.486m²



Figure 26: VS1-3 Olevodroom accessible area

- **Detailed information of how the data is being collected in practice:** The measurement of the area was based on a scaled implementation plan

provided by the city of Leuven. Using CAD software, we calculate the total accessible surface of the direct surrounding area, by subtracting the area of the built space and the Olevodrrrom wooden construction surface.

- **Challenges encountered on site:** n/a
- **The purpose of collecting the data is to** determine the degree of accessibility of implemented solution.

Challenge 9 KPIs - Leuven pilot

Challenge Name	Public Health and Wellbeing
Indicator	Noise reduction rates
Challenge No.	9
KPI ID	4
Common KPI	Yes ☒ No ☐
Unit	dB(A)
Procedure	1. Measure LDEN (in situ measurements); acoustic acquisition (in dB(A)) on hourly periods (with typically 1 sec sampling rate), gathered on 3 periods (Day, Evening, Night) and next aggregated on 24h (see definition above). 2. Georeferenced data for built-up area: data from OPENSTREETMAP (OSM) 3. Road traffic counts: data from district, city or regional agencies 4. Number of inhabitants exposed to noise, and total number of inhabitants

Table 106: Leuven KPI 9.4 Methodology

Description of Methodology for KPI 9.4

- **Data collection approach:** Four smart-ready lighting poles will be installed aside the main north-south path crossing the park. In 2 of these smart lighting poles, noise sensors have been integrated. These sensors measure the overall environmental noise during day, evening and night hours. They will also be used as a nudging tool, regulating the lighting intensity of the poles in case night noise occurs. "Fluvius", the Flemish network operator, was assigned with

the delivery and installation of the light poles. Currently both lighting poles with noise sensors are assembled and delivered. One of them is currently installed on site and connected to the platform. The installation of the second pole is not yet planned. The data collection, started on the 24th of April 2025, is on-going and will continue until the end of the project.

- **Geographical size:** microscale/ mesoscale
- **Sample size:** N/A
- **Questions:** N/A
- **Visual media:** Figure 27, Figure 28, Figure 29
- **Detailed information of how the data is being collected in practice:** Data captured, on a 15' frequency by the noise sensors will be sent via the platform of the sensor provider to the Smart City Data Platform (SCDP) of Leuven, managed by Urban Sense, a technical partner of the City of Leuven. Based on predefined criteria (e.g. night noise exceeding 80dB for more than two seconds), a trigger will be sent from the SCDP to the platform of the light infrastructure provider to change the light intensity of the lighting poles. The SCDP contains a context broker from which data can be made available for onboarding on the Health & Well-being platform. The data are processed on an hourly basis for calculating the average values in the day, evening and night period, for each day (LDEN).
- **Challenges encountered on site:** The exact location could not be defined for a long period, as works on the general site are still advancing. The implementation of the poles with noise sensors was delayed, due to technical issues, high expertise and coordination required. The monitoring period includes measurements starting on 24/04/2025, covering May and June 2025. Due to the on-going construction, the monitored noise levels during the working hours (9am to 19pm), are higher than what would be normally expected.
- **The purpose of collecting the data is to:** The smart lighting poles aim to mitigate noise problems in the city of Leuven. Collecting data on the noise levels in the long term will help the city evaluate the contribution of this innovating solution to the noise pollution management.



Figure 27: Leuven - Noise sensor for smart lighting pole

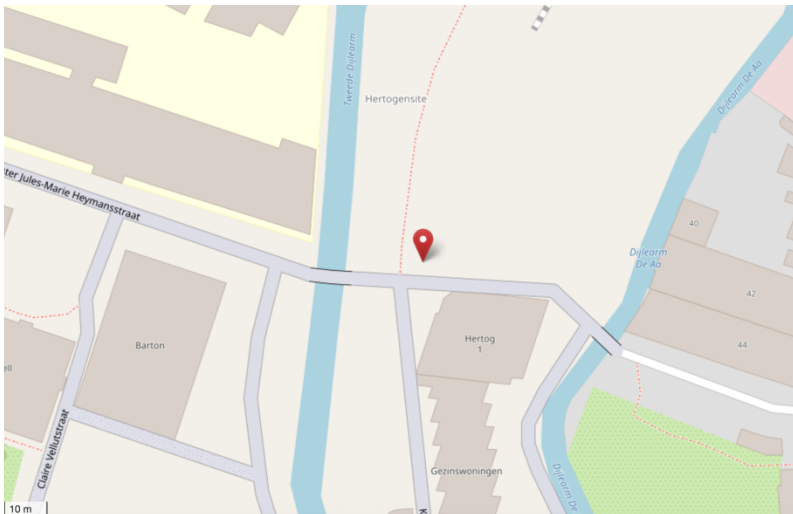


Figure 28: Leuven - Location of smart lighting pole on site



Figure 29: Leuven - Smart lighting pole and schematic of its components /
Photo of installed lighting pole with noise sensor

Challenge Name	Public Health and Wellbeing
Indicator	Perceived well-being before and after the visit of green space
Challenge No.	9
KPI ID	6
Common KPI	Yes ☒ No ☐
Unit	N/A ☒
Procedure	1. Data collection (after visit) through questionnaire Compare data among visitors

Table 107: Leuven KPI 9.6 Methodology

Description of Methodology for KPI 9.6

- **Data collection approach:** The data for ID9.6 was collected through a quick satisfaction survey. This survey, under the form of “smilies”, was proposed to the participants of five socio-cultural events, held in the Olevodroom in July, August and September 2024. Questions, regarding the participants’ emotional state, were addressed both **before** and **after** each event.
 - **Geographical size:** microscale/ mesoscale
 - **Sample size:** 313 events’ participants filled-in the survey.
 - **Questions:**
 1. How would you rate your emotional state **before** your visit (to the Olevodroom)?
 2. How would you rate your emotional state **after** your visit (to the Olevodroom)?Suggested, multiple choice answers with the use of symbols (smilies) :
 1. Poor 
 2. Neutral 
 3. Good 

Additionally, the participants were asked two more questions:

- Is this the first time you come here? YES/NO
- What do you think could be improved? Open field.

- **Visual media:** Filled-in copy of the questionnaire (Figure 30).
- **Detailed information of how the data is being collected in practice:** 313 participants of the socio-cultural events held in the Olevodroom on July 24th, August 7th, 14th & 21st and September 15th 2024, during a neighborhood festival, were asked to rate their emotional state, both before and after participating in the events/ activities. The data collection process was operated anonymously, by a co-worker (trainee), employed by Leuven city, on printed copies of the questionnaire.
- **Challenges encountered on site:** N/A
- **The purpose of collecting the data is to** demonstrate how VARCITIES interventions led to Increased health and well-being of citizens.

Datum: 24/07/2024
 Activiteit: Zomerpodium
 Voor/Na

ENQUÊTE OLEVODROOM

1

☒ Ja ☒ Nee

Is het de eerste keer dat je hier bent?
☐ Ja ☒ Nee

☒

☐

☐

Wat kan er volgens jou nog verbeteren?

2

☒ Ja ☒ Nee

Is het de eerste keer dat je hier bent?
☐ Ja ☒ Nee

☒

☐

☐

Wat kan er volgens jou nog verbeteren?

3

☒ Ja ☒ Nee

Is het de eerste keer dat je hier bent?
☐ Ja ☒ Nee

☒

☐

☐

Wat kan er volgens jou nog verbeteren?

4

☒ Ja ☒ Nee

Is het de eerste keer dat je hier bent?
☐ Ja ☒ Nee

☒

☐

☐

Wat kan er volgens jou nog verbeteren?

☐ Ja ☐ Nee

Is het de eerste keer dat je hier bent?
☐ Ja ☐ Nee

☐

☐

☐

Wat kan er volgens jou nog verbeteren?

Figure 30: Leuven - Extract from the data collection process

Challenge Name	Public Health and Wellbeing
Indicator	Number of noise data
Challenge No.	9
KPI ID	36
Common KPI	Yes ☒ No ☐
General methodology	Experimental ☒ Simulation ☐ Statistical/surveys ☐
Expected data deliverable	Numeric ☒ Survey ☐ Qualitative ☐ Map ☐
Unit	No. of noise data added
Required data processing	Yes ☒ No ☐
Procedure	1. Generate noise data about target areas

Table 108: Leuven KPI 9.36 Methodology

Description of Methodology for KPI 9.36

- **Data collection approach:** Data collection entails calculating the total number of available entries for indicator *ID9.4 6_Noise reduction rates*, once this is closed, towards creating a strong knowledge base on the existing environmental conditions in the city of Leuven. The evaluation will be done through comparing the number of available data for the intervention area, pre- and post- the implementation of the VSs. Currently both lighting poles with noise sensors are assembled and delivered, while one of them is installed on site and connected to the platform. The installation of the second pole is not yet planned. The data collection, started on the 24th of April 2025, is on-going and will continue until the end of the project.
- **Geographical scale:** district scale
- **Sample size:** 5.684 entries
- **Questions asked to participants:** N/A
- **Visual media/ maps:** N/A
- **Detailed information of how the data is being collected in practice:**
Addition of available noise data, as described in ID9.4. Available noise data from 25/04/25 until 24/06/2025, on a 15 minutes basis.
- **Challenges encountered:** The implementation of VS4 has been delayed, therefore, the monitoring was rescheduled and the data collection is on-going until the end of the project.
- **The purpose of collecting the data** is to contribute to the creation of a strong knowledge base on the existing environmental conditions in the city of Leuven.

Challenge Name	Public Health and Wellbeing
Indicator	Number of health & lifestyle data
Challenge No.	9
KPI ID	37
Common KPI	Yes ☒ No ☐
General methodology	Experimental ☒ Simulation ☐ Statistical/surveys ☐

Expected data deliverable	Numeric ☒ Survey ☐ Qualitative ☐ Map ☐
Unit	No. of noise data added
Required data processing	Yes ☒ No ☐
Procedure	1. Data collection entails summarizing the information received from relevant indicators, such as ID9.5, 9.6, 9.8, 9.13, ID9.16, ID9.19

Table 109: Leuven KPI 9.37 Methodology

Description of Methodology for KPI 9.37

- **Data collection approach:** Data collection entails summarizing the information received from relevant indicators, such as ID9.5, 9.6, 9.8, 9.13, ID9.16 and ID9.19, once these are closed, towards creating a strong knowledge base on the existing health & lifestyle conditions in the city of Leuven. The evaluation will be done through comparing the number of available data for the intervention area pre- and post- the implementation of the VSs.
 - **Geographical scale:** district scale
 - **Sample sizes:** 1373 entries
 - **Sensor Locations:** N/A
 - **Questions asked to participants:** N/A
 - **Detailed information of how the data is being collected in practice:**
The data for this KPI have been derived through calculation of the relevant KPIs mentioned here above. The data have been collected through surveys covering the categories of health and lifestyle data, as shown in the table below.
 - **Challenges encountered on site:** N/A
 - **The purpose of collecting the data is** the evaluation of H&WB of citizens in the city of Leuven.

Table 110: Leuven - Health and lifestyle data categories considered

General health	Medical assistance in daily life
	general health rate
Mental health	Sleep satisfaction
	Negative emotions frequency
Social relations	Social interaction frequency

	Participation in leisure or cultural activities
Residential & Neighborhood Environment	Green space availability
	Social interaction frequency in the Neighborhood
	Participation in cultural events in the Neighborhood
	Satisfaction with the Neighborhood environment
	Sense of community
	Frequency of interaction with neighbors
	Frequency of participation in local, cultural events
	Willingness to move to another region
Quality of life and well-being	Causes of discomfort in daily environment, health and well-being
	Safety
	Quality of life rates
	Sleep satisfaction
	Standard of living satisfaction
	Satisfaction of health
	Personal relationships satisfaction
Physical activity	Duration of outdoors presence
	Duration of walking
	Duration of cycling
	Frequency and duration of strenuous Physical Activity
	Frequency and duration of moderate Physical Activity
	Sitting duration on a weekday
	Sitting duration on a weekend day
	Frequency of vehicle use
	Duration of vehicle use

Challenge 10 KPIs - Leuven pilot

Challenge Name	Potential for New Economic Opportunities and Green Jobs
Indicator	Number of Jobs created
Challenge No.	10
KPI ID	1
Common KPI	Yes ☒ No ☐

General methodology	Experimental ☐ Simulation ☐ Statistical/surveys ☒
Expected data deliverable	Numeric ☒ Survey ☐ Qualitative ☒ Map ☐
Unit	Units: No. of new employment N/A ☒
Required data processing	Yes ☒ No ☐
Procedure	1. Record keeping of internal and external employees involved in the implementation of VSs (Ex: Subcontractors/freelancers, staff employed for implementation and maintenance of interventions and others) 2. Specify in which VS they were involved in and employment type

Table 111: Leuven KPI 10.1 Methodology

Description of Methodology for KPI 10.1

- **Data collection approach:** The data collection for this indicator derives from the pilot's record keeping. The new created jobs can be directly (funded by the project's budget) or indirectly connected to the project. The Olevodroom manager, responsible for the organisation of the implementation and events, the artist who has designed and implemented the structure and the youngsters who have participated in the implementation lab (18 pers. appr.) are directly connected to the project. In addition, approximately 260 artists have performed during the events held.
- **Geographical scale:** microscale/ mesoscale
- **Sample sizes:** N/A
- **Questions asked to participants:** N/A
- **Detailed information of how the data is being collected in practice:** N/A
- **Challenges encountered on site:** N/A
- **The purpose of collecting the data is** to create a data base on the number of new jobs, related to the VARCITIES project.

Challenge Name	Potential for New Economic Opportunities and Green Jobs
Indicator	Definition of parameters for (re)designing of green public spaces based on the well-being of users
Challenge No.	10
KPI ID	5
Common KPI	Yes ☒ No ☐
Unit	N/A ☒
Procedure	1. Design parameters being developed based on lessons learnt from implementation of VSs and health and wellbeing data. 2. Co-evaluate results with expert stakeholders

Table 112: Leuven KPI 10.5 Methodology

Description of Methodology for KPI 10.5

- **Data collection approach:** Throughout the experience of supporting Leuven during the co-design phase, application for permit, rejection of the initial project and finally re-design of the urban living room (VS1-3), we have come up with some valuable conclusions with regards to the parameters of designing green public spaces:

1. Flexibility and Adaptability

- Emphasize lightweight, modular, and temporary structures that can be easily relocated, repurposed, or upgraded to meet the changing needs of the community.
- Design for adaptability to engage diverse groups across adjacent neighbourhoods and accommodate evolving community dynamics.
- Avoid permanent, heavy constructions to safeguard green spaces and maintain ecological integrity.
- Favor solutions that simplify permit processes, reducing bureaucratic hurdles.

2. Diverse Space Provision

- Create a mix of open and sheltered areas to support a variety of activities while accommodating different weather conditions and user preferences.

3. Multifunctionality

- Implement an open-plan layout that facilitates a broad range of events and activities, such as cultural performances, exhibitions, recreational workshops, and social gatherings, fostering a vibrant, multifunctional community space.

4. Accessibility and Inclusivity

- Prioritize universal accessibility, ensuring all individuals, regardless of age or ability, can fully engage with the space.
- Incorporate inclusive design features to reflect and celebrate the diversity of the community.

5. Circularity in Construction

- Utilize sustainable, reusable, and recyclable materials to minimize waste and environmental impact.
- Design with disassembly in mind, enabling components to be reused or repurposed in future projects.
- Incorporate renewable energy sources and water management systems to enhance ecological sustainability.

6. Community Involvement

- Actively engage the local community in the design and implementation process to ensure the space reflects their needs and aspirations.
- Facilitate workshops, co-creation activities, and participatory planning to foster a sense of ownership and connection among users.
- Encourage ongoing community stewardship to maintain and evolve the space over time.

- **Geographical scale:** N/A
- **Sample sizes:** N/A
- **Sensor Locations:** N/A
- **Questions asked to participants:** N/A
- **Detailed information of how the data is being collected in practice:** The data derives from the analysis of the Health & WB data, along with evaluation

of the design and implementation process for all the Visionary Solutions. WP leaders and experts are assigned with combining the above and concluding in a benchmark of parameters for (re)designing public urban green spaces, based on the well-being of users.

- **Challenges encountered on site:** N/A
- **The purpose of collecting the data is** to ensure that the lessons learnt throughout the implementation of the VARCITIES projects will be translated into a useful toolkit of good practices to be replicated by other cities in the future.

Challenge Name	Potential for New Economic Opportunities and Green Jobs
Indicator	Replication of Solutions
Challenge No.	10
KPI ID	6
Common KPI	Yes ☒ No ☐
Unit	N/A ☒
Procedure	1. A common strategy for replicability will be established between WP leaders and pilot leaders/experts 2. Determine the replicability of the VSs 3. Determine which VSs were most successful in terms of replication

Table 113: Leuven KPI 10.6 Methodology

Description of Methodology for KPI 10.6

- **Data collection approach:** The indicator ID10.6 measures the replication potential of Visionary Solutions. All the Visionary Solutions are being considered in the data collection of this KPI, and a quantitative survey questionnaire was the method of choice across all pilot sites. The questionnaire was distributed to the participants of three main events; the Crowdhelix Event in Castelfranco, the GoGreeRoutes Final Clustering event, which had an audience composed of various other municipalities, Universities, non-profit and commercial entities involved in sister EU projects, and the Partner Cities Webinar, organized as part of WP9 dissemination activities to engage other European Cities with the intention of receiving feedback and potentially replicating Visionary Solutions.

- **Geographical size:** macroscale
- **Sample size:** N/A
- **Questions:**
 1. VS1-3, VS2, VS5: (Mobile) Urban Living-room and data collection as part of an integrated re-development intervention: On a scale of 1 to 5, how would you rate the replicability of the presented solution(s)?
 - 5 – Highly replicable (minimal to no barriers)
 - 4 – High replicability (minor barriers/challenges to be addressed)
 - 3 – Moderate replicability (both strength and limitations)
 - 2 – Low replicability (there is some potential but also significant challenges)
 - 1 – No replicability at all (significant barriers to replication)
 2. VS4: IoT infrastructure for smart lighting and noise measurements: On a scale of 1 to 5, how would you rate the replicability of the presented solution(s)?
 - 5 – Highly replicable (minimal to no barriers)
 - 4 – High replicability (minor barriers/challenges to be addressed)
 - 3 – Moderate replicability (both strength and limitations)
 - 2 – Low replicability (there is some potential but also significant challenges)
 - 1 – No replicability at all (significant barriers to replication)
- **Visual media:** Figure 31, Figure 32, Figure 33
- **Detailed information of how the data is being collected in practice:** The structure of the process was set by first presenting the following information with respect to the grouped Visionary Solutions:
 - A brief description of the VS and its objectives
 - Overview of expected outcomes.
 - Categorized main components were categorized (NbS/ Digital/ Socio-cultural)
 - Information on the number and type of monitored KPIs
 - Timeline of implementation,
 - Addressed SDGs,

- Participatory potential,
- Level of Complexity
- Investment required.

The participants could vote in an online survey accessed through a QR code.

- **Challenges encountered on site:** N/A
- **The purpose of collecting the data is to** define the replication potential of each grouped Visionary Solution.

18 Integrated Visionary Solutions were developed and implemented through a participatory process involving identified STKs and local communities in our **7 pilots**.

Know our solutions and have your

Our venture for Healthy, Happy and Resilient Cities continues! In this context, **we are assessing the replication potential** of the implemented Visionary Solutions.

We invite you to have your say with respect to:

- The replication potential of the VARCITIES implemented solutions



Scan & vote 😊

VARCITIES



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 869505.

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Figure 31: Leuven - QR code for voting replicability

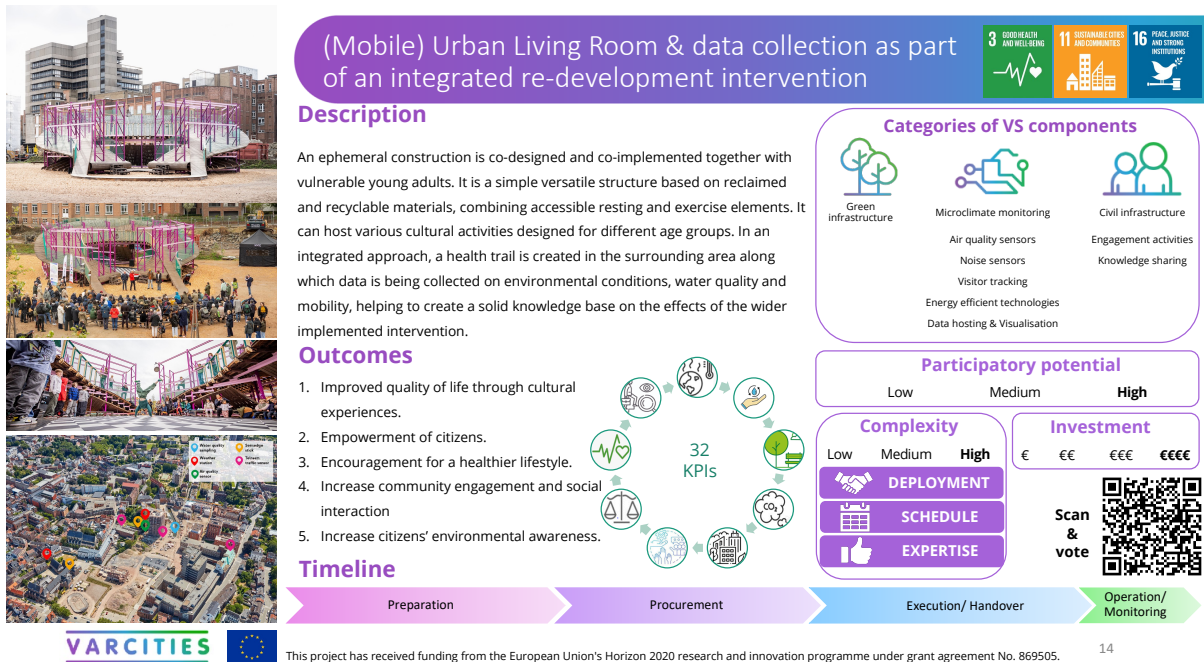


Figure 32: Leuven - Presentation of VS1,2,3,5

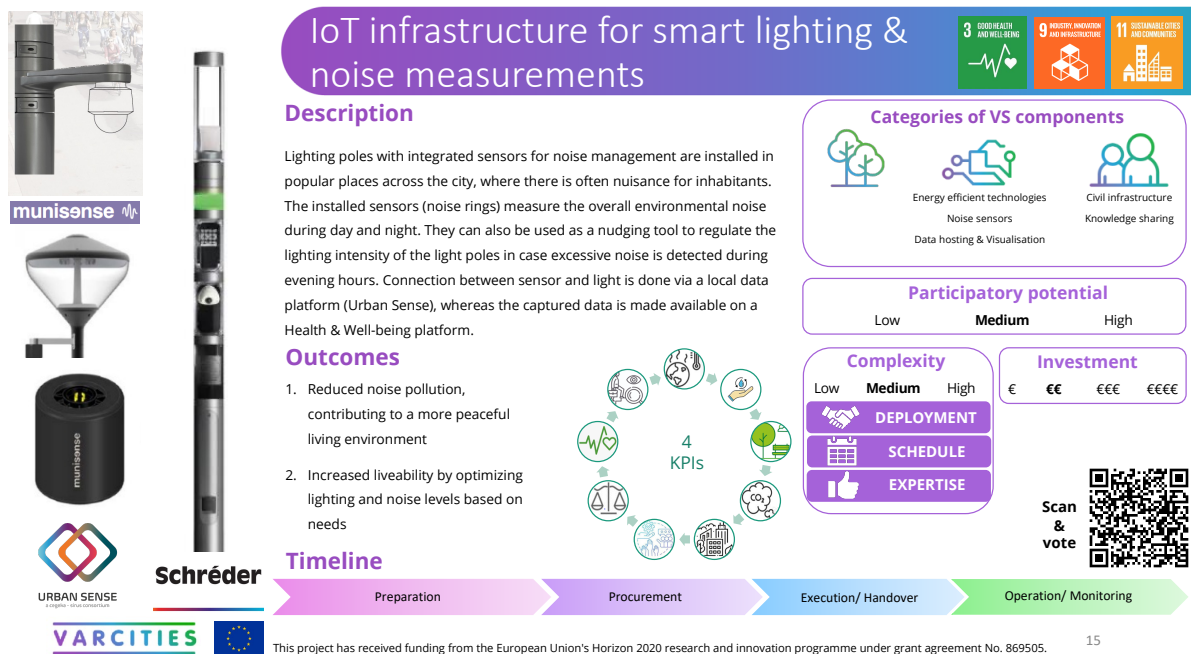


Figure 33: Leuven - Presentation of VS4

Challenge Name	Potential for New Economic Opportunities and Green Jobs
Indicator	Saved healthcare spending

Challenge No.	10
KPI ID	8
Common KPI	Yes ☒ No ☐
Unit	Euros per year / %
Procedure	1. Pilot city to determine baseline value through pre-intervention survey or other available sources 2. Data Collection at post-intervention stage through questionnaire or available sources. If the survey option is preferred, questions from the Human Development Index (HDI), Social Deprivation Index (SDI) and other questions related to healthcare expenditure need to be included - questions will be aligned among pilots for cross-pilot evaluation 3. Quantify results (if applicable) 4. Compare results

Table 114: Leuven KPI 10.8 Methodology

Description of Methodology for KPI 10.8

- **Data collection approach:** After research on the available city's registers and relevant websites, it was concluded that there is no exploitable data on the annual healthcare spending of the citizens of Leuven. Therefore, a new approach for the data collection was selected, through a dedicated questionnaire. A set of 11 questions was created (see questions below) and distributed to the participants of the three co-evaluation workshops, organized in November 2024. 36 filled-in questionnaires were collected and encoded to relevant data file, available on Zenodo.
- **Geographical size:** microscale/ mesoscale
- **Sample size:** 36 questionnaires
- **Questions:** The questionnaire addressed to the participants of the co-evaluation workshops included the following set of questions:
 1. How often do you visit green environments? (e.g. parks, forests, gardens)
 2. How does visiting a green environment affect your physical health/wellbeing?
 3. How does visiting a green environment affect your mental health/wellbeing?
 4. Have you experienced long-term health benefits from visiting green environments?

5. If 'yes', please list the long-term health benefit in the blank below;
 6. How many times have you visited the Olevodrome?
 7. How did visiting the Olevodrome affect your physical health?
 8. What impact did visiting the Olevodrome have on your mental health/mental well-being?
 9. Currently, the Olevodrome is located on a vacant lot, where in the future the performing arts hall will be built. In the near future, a park will be realized on the Hertogensite. Imagine the Olevodrome located in a green space. So how often would visit the Olevodrome?
 10. So how would visiting the Olevodrome affect your physical health?
 11. So what impact would a visit to the Olevodrome have on your mental health/mental well-being?
- **Detailed information of how the data is being collected in practice:** On the 28th and 30th of November 2024, three co-evaluation workshops have been organized and led by the city. A total of 36 participants have filled-in the questionnaire with regards to the contribution of the implemented solution to their physical and mental health. The results of the collected data, with graphs, have been uploaded on Zenodo.
 - **Challenges encountered on site:** N/A
 - **The purpose of collecting the data** is to evaluate the contribution of the implemented solutions in decreasing the healthcare spending in Leuven, and consequently promoting citizens' health and wellbeing.

Challenge Name	Potential for New Economic Opportunities and Green Jobs
Indicator	Public & private investments during/after the project
Challenge No.	10
KPI ID	9
Common KPI	Yes ☒ No ☐
Unit	Euros

Figure 34: Leuven (BE)- Extract from the results of the questionnaire

Procedure	1. Data collection on internal public/private investment. 2. Assess and calculator 5-Year Investment Projection 3. Replication Funding Potential Forecast
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Table 115: Leuven KPI 10.9 Methodology

Description of Methodology for KPI 10.9

- **Data collection approach:** Discussions with the pilot have been organized to determine the services and cultural entities, developed in relation to the operation of the new Olevodroom, can be included in the monitoring of KPI 10.9. The list of enterprises is as follows:
 - Artist who undertook the design and construction of the Olevodroom
 - Youngsters who participated in the co-implementation phase for a fee
 - Moving bench developer, enterprise
 - Architects who worked for the initial (rejected) project
 - Independent artists & cultural entities presenting events in the Olevodroom
 - Olevodroom's Bar, enterprise
- **Geographical size:** microscale/ mesoscale
- **Sample size:** N/A
- **Questions:** N/A
- **Visual media:** N/A

Detailed information of how the data is being collected in practice: The pilot will gather data about the economic growth of the above entities, through direct interrogation and the city's records.

- **Challenges encountered on site:** N/A
- **The purpose of collecting the data** is to evaluate the contribution of the VARCITIES, to the creation of new potential for economic opportunities and green jobs.

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Challenge 4 KPIs - Novo Mesto pilot

Challenge Name	Green Space Management
Indicator	Green-related social service provided to population
Challenge No.	4
KPI ID	7
Common KPI	Yes ☒ No ☐
Unit	N/A ☒
Procedure	Factors used to assess the social value of green spaces: 1. Nominal value: Total green area (m2) (areas that can be used by the population, areas that can be used by the population but they are not equipped, equipped areas). 2. Added value: Type of equipment facilities, context factors (safety, accessibility, services and recreational opportunities)) 3. The above should be considered before and after the interventions.

Table 116: Novo Mesto KPI 4.7 Methodology

Description of Methodology for KPI 4.7

This indicator evaluates the social value of green spaces provided to the population, considering both the total available green area and qualitative improvements in accessibility, safety, and recreational potential before and after interventions.

The assessment consists of two main components:

1. **Nominal Value – Total Green Area**
The total green space within the pilot area is measured in square meters (m²) and classified into three categories:
 - a. **Usable areas for residents** – Lawns, walking paths, children's playgrounds, fitness trails.
 - b. **Unimproved areas** – Natural spaces without infrastructure.
 - c. **Improved areas** – Equipped with infrastructure such as benches, lighting, playgrounds, fitness trails, parking lots, and sports facilities.

2. Added Value – Quality and Context Factors

The qualitative assessment considers the following five factors:

- a. **Equipment & Infrastructure** – Condition and presence of playgrounds, benches, lighting, sports infrastructure, and fitness trails.
- b. **Safety** – Crime rates, lighting, and presence of security measures (e.g., cameras).
- c. **Accessibility** – Availability of pedestrian and cycling paths, and access for people with disabilities.
- d. **Services** – Socializing opportunities, information boards, restrooms, food services.
- e. **Recreational Opportunities** – Sports fields, outdoor fitness equipment, organized sports events.

Measurement Method

- Each factor is scored on a scale from 1 (poor condition) to 5 (excellent condition).
- Scores are recorded for both the pre-intervention and post-intervention periods.
- Data sources include site measurements, field observations, stakeholder feedback, and statistical records (e.g., crime statistics for safety).
- Changes in nominal value are determined through direct measurement of green space areas before and after the intervention.
- Changes in added value are assessed by comparing pre- and post-intervention scores for each qualitative factor

Challenge Name	Green Space Management
Indicator	Increased connectivity to sports facilities
Challenge No.	4
KPI ID	14b
Common KPI	Yes ☒ No ☐
Unit	%
Procedure	1. Relative change of area of existing Green Infrastructure connected before and after VS implementation.

Table 117: Novo Mesto KPI 4.14b Methodology

Description of Methodology for KPI 4.14b

In geographical information systems, connectivity refers to the degree of interconnectedness between different geographic elements, such as green infrastructures. For this project, we are evaluating the relative change in the area of green infrastructure connectivity before and after the implementation of the Sustainable Forest Path (VS2).

The areas under consideration for the calculation are:

- **Connection between the Velodrome and the Equestrian Centre** (before and after VS2 implementation).
- **Connection between the Swimming Pool and the Equestrian Centre** (before and after VS2 implementation).

The Sustainable Forest Path (VS2) serves as a key improvement to the green infrastructure, enhancing the connectivity between these sites. To calculate the relative change in connectivity, we will compare the distances between these key locations before and after the implementation of VS2.

The formula used to determine the percentage change in connectivity is as follows:

Relative change in connectivity = $\frac{\text{New distance (Dn)} - \text{Old distance (Do)}}{\text{Old distance (Do)}} \times 100$

Example Calculation: Using real distances from the green infrastructure:

- Old distance (before VS2 implementation): 1002 meters.
- New distance (after VS2 implementation): 355.67 meters.

Applying the formula:

$355.67\text{m}/1002\text{m} \times 100 = 281.76\%$

This indicates a significant increase in connectivity after the implementation of the Sustainable Forest Path (VS2), reflecting a 281.76% improvement in the connection between the designated green infrastructure areas.

Key Considerations:

- **Velodrome to Equestrian Centre:** Before VS2, the distance between these two locations was considerably longer. After the construction of the

Sustainable Forest Path, this distance has been greatly reduced, improving connectivity.

- Swimming Pool to Equestrian Centre:** Similarly, the path between these two sites has been optimized, further contributing to enhanced accessibility and connectivity within the green infrastructure network.

Challenge 5 KPIs - Novo Mesto pilot

Challenge Name	Air/ambient quality
Indicator	Reduction of air pollution
Challenge No.	5
KPI ID	6
Common KPI	Yes ☒ No ☐
Unit	µg/m3
Procedure	1. Install sensor(s) at various locations in the proximity of the NBS interventions 2. Record the latitude and longitude of the sensor position and height of the sensor(s) above ground level 3. Data acquisition frequency should be below 15 min for the entire duration of the measurements 4. Take the mean quantities on a daily basis $X=\frac{1}{N}\sum_{i=1}^N x_i$ Where N is the number of daily measurements with a constant temporal resolution

Table 118: Novo Mesto KPI 5.6 Methodology

Description of Methodology for KPI 5.6

We have two air quality sensors. The first air quality sensor is installed at the sanitary facility near the motor park in the Pilot area of Novo Mesto. The second one is installed in the urban area. Data collection started on January 12, 2024. The data collection interval

is 1 hour. We measure the following parameters: CAQI24, PM1, PM10, PM25, temperature and air humidity.

CAQI - Common Air Quality Index - is a number on a scale from 0 to 100, where higher numbers indicate poorer air quality.

PM - particulate matter - microscopic particles of solid or liquid matter suspended in the air.

PM1 = ultrafine particles

PM2.5 = fine particles

PM10 = coarse particles

Challenge 7 KPIs - Novo Mesto pilot

Challenge Name	Participatory Planning and Governance
Indicator	Perceptions of citizens on urban nature
Challenge No.	7
KPI ID	4
Common KPI	Yes ☒ No ☐
Unit	No. of visitors
Procedure	1. Questionnaire(s) in Stakeholder workshops 2. Quantify data (if applicable)

Table 119: Novo Mesto KPI 7.4 Methodology

Description

of

Methodology

for

KPI

7.4

This indicator measures how effectively a project utilizes opportunities to raise awareness among citizens about Nature-Based Solutions (NBS), ecosystem services, sustainability, and the environment. The goal is to assess the impact of the project on educating citizens and enhancing their understanding of sustainable practices and environmental solutions.

During the Stakeholders' Workshop held in November 2023 at the Pool Novo Mesto, 37 participants were surveyed to gather insights into their perceptions of the project's visionary solutions. The target group consisted of stakeholders actively engaged in sustainability, including community members, local authorities, and representatives from environmental organizations.

In the questionnaire, participants were asked: “How do you perceive the visionary solutions of the project?” The responses were collected using a five-point Likert scale, where:

- 1 = Not at all visionary
- 2 = Slightly visionary
- 3 = Moderately visionary
- 4 = Very visionary
- 5 = Extremely visionary

The target group for this evaluation was composed of key stakeholders, including individuals with a vested interest in sustainability and environmental issues within the local community. These participants were chosen due to their potential to influence and engage with broader citizen groups, thus amplifying the project’s educational impact.

The results of this survey provide a structured way to evaluate the extent to which the project successfully exploits opportunities to increase public awareness and educate citizens on NBS and sustainability. The collected data will inform further project development and citizen engagement strategies.

In the first evaluation period, with 37 respondents, the average score was 4.5, indicating a strong perception of the project as visionary. However, during the second period, based on 36 responses, the score decreased to 3.36, showing a moderate perception of visionary solutions. In the third period, with 42 respondents, the score improved again to 4.55, reflecting a renewed sense of the project's visionary impact. In the most recent evaluation, also based on 42 responses, the score slightly decreased to 4.33, but still indicates a very positive perception of the project’s visionary elements.

Challenge Name	Participatory Planning and Governance
Indicator	Social values for urban ecosystems and biodiversity
Challenge No.	7
KPI ID	5
Common KPI	Yes ☒ No ☐
Unit	No. of visitors

Procedure	1. Questionnaire(s) in Stakeholder workshops 2. Quantify data (if applicable)
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Table 120: Novo Mesto KPI 7.5 Methodology

Description of Methodology for KPI 7.5

This indicator assesses how much participants feel they can contribute ideas and see those ideas implemented as part of a Nature-Based Solutions (NBS) project. The purpose is to evaluate the level of engagement and policy learning among stakeholders during the project, providing insights into their ability to actively participate in shaping the project outcomes.

At a stakeholders' workshop held in November 2023 at the Pool Novo Mesto, 37 participants were surveyed. The target group for this survey consisted of stakeholders directly involved in the project, including community leaders, environmental experts, and local authorities. Their participation is crucial for assessing the project's capacity to incorporate diverse ideas and foster policy learning.

Participants were asked:

“To what extent were you able to contribute to the discussion?”

Responses were collected using a five-point Likert scale, where:

- 1 = Not at all
- 2 = Slightly
- 3 = Moderately
- 4 = Very much
- 5 = Completely

The participants were key stakeholders involved in the NBS project, representing groups with the potential to influence policy and project direction. The workshop was designed to encourage open discussion, ensuring that participants could contribute ideas and engage with the project's planning and implementation process.

The average of all responses was calculated to determine the overall extent to which participants felt empowered to contribute. This result helps in understanding the effectiveness of the project in enabling policy learning and stakeholder engagement, offering valuable feedback for future workshops and participatory initiatives.

The average of all responses was calculated to determine the overall extent to which participants felt empowered to contribute. In the first evaluation period, with 37 respondents, the average score was 4.16, indicating a high level of perceived empowerment among participants. During the second period, based on 36 responses, the score slightly decreased to 3.78, showing a moderate sense of contribution. In the third period, with 42 respondents, the score dropped further to 3.26, reflecting some challenges in participant engagement. However, in the most recent evaluation, also based on 42 responses, the score improved to 4.1, indicating a renewed sense of empowerment and engagement in the process.

These results help in understanding the effectiveness of the project in enabling policy learning and stakeholder engagement, offering valuable feedback for future workshops and participatory initiatives.

Challenge Name	Participatory Planning and Governance
Indicator	Inter-departmental collaboration leading to NBS designs for multi-functionality
Challenge No.	7
KPI ID	6
Common KPI	Yes ☒ No ☐
Unit	No. persons/entities
Procedure	1. Pre-Intervention data collection or benchmarking using aforementioned methods. 2. Post-Intervention data collection by following the same procedure 3. Quantify data (if applicable) 4. Compare data

Table 121: Novo Mesto KPI 7.6 Methodology

Description of Methodology for KPI 7.6

This indicator measures the diversity of actors involved in the co-production or participatory process within a project, focusing specifically on the role of decision-makers in relation to the total number of stakeholders. The goal is to assess the balance and representation of different types of actors, such as decision-makers, community members, and technical experts, within the collaborative framework of the project.

For this evaluation, we utilized the stakeholder mapping process, conducted within the Quip application as part of WP4 (Work Package 4) of the VARCITEIS project. This mapping process identified and categorized all stakeholders involved in the project.

- Calculation:
 - We focused on decision-makers—stakeholders representing the government or those with the authority to influence project outcomes.
 - The number of decision-makers was divided by the total number of identified stakeholders in the VARCITIES project and then multiplied by 100 to yield the percentage of decision-makers.

Percentage of decision-makers=(Total number of stakeholders Number of decision-makers)×100

The data for this indicator was collected through the stakeholder mapping process, identifying key actors involved in the VARCITIES project. This process captured various types of stakeholders, including decision-makers from government, local authorities, community leaders, technical experts, and citizens participating in the co-production activities.

The target group for this mapping included all stakeholders actively engaged in the project’s participatory processes. This ranged from high-level decision-makers representing government entities to community members and other participants from civil society.

This indicator offers insights into the proportion of decision-makers involved in the participatory process relative to the total number of stakeholders. By highlighting the representation of key decision-makers, the project can assess whether the participatory process is inclusive and adequately balanced between different types of actors, ensuring a more comprehensive approach to co-production and governance in the VARCITIES project.

Challenge Name	Participatory Planning and Governance
Indicator	Improved coordination of NBS strategies within and across levels of governance
Challenge No.	7
KPI ID	7

Common KPI	Yes ☐ No ☒
Unit	N/A ☒
Procedure	1. Pre-Intervention data collection or benchmarking using aforementioned methods. 2. Post-Intervention data collection by following the same procedure 3. Quantify data (if applicable) 4. Compare data

Table 122: Novo Mesto KPI 7.7 Methodology

Description of Methodology for KPI 7.7

The table in the Quip application is a dynamic document that undergoes monthly revisions. At the end of the reporting period, we review the results. Based on our own analysis, we determined the Level of Impact for each stakeholder.

Challenge Name	Participatory Planning and Governance
Indicator	Citizen participation in and co-creation of the design, implementation and evaluation of project interventions
Challenge No.	7
KPI ID	8
Common KPI	Yes ☒ No ☐
Unit	No. of people / year
Procedure	1. Record keeping of citizens who participated through the duration of the project in co-creation, co-design, co-implementation and co-evaluation of the project interventions

Table 123: Novo Mesto KPI 7.8 Methodology

Description of Methodology for KPI 7.8

The methodology for this indicator is based on record keeping of citizens who participated in the project through the various stages of co-creation, co-design, co-implementation, and co-evaluation of project interventions. Participation was measured

by tracking involvement in events where citizens had the opportunity to engage in these processes.

In addition to the general public, a vulnerable target group, including the blind and visually impaired, also actively participated in the process, ensuring that the project interventions considered the needs of all citizens, particularly those with specific challenges.

To date, the results have been gathered from specific events where participants were able to contribute to the project's development and evaluation. The data collection includes the following key results:

- First result: 37 participants at a meeting with decision-makers.
- Second result: 36 participants at the PistaFest event.
- Third result: 87 participants across a range of different events.
- Final result: 199 participants at a local cultural event and a meeting with key stakeholders.

This approach ensures a comprehensive understanding of citizen engagement in the co-creation process, capturing how participants, including vulnerable groups such as the blind and visually impaired, have influenced the design and execution of project interventions. The data gathered will continue to inform how effectively the project incorporates citizen feedback and involvement.

Challenge Name	Participatory Planning and Governance
Indicator	Institutional learning concerning acquisition of knowledge and understanding
Challenge No.	7
KPI ID	9
Common KPI	Yes ☒ No ☐
Unit	N/A ☒
Procedure	1. Record Keeping

Table 124: Novo Mesto KPI 7.9 Methodology

Description of Methodology for KPI 7.9

For the methodology, we utilized attendance counting at the event. At the pool opening, we only considered invited guests (representatives from ministries, sports federations,

coaches, etc.). For the Friendship Games, we counted all competitors, and during the school exchange, we counted all students and representatives from regional development agencies who visited Pilot Novo Mesto.

Challenge Name	Participatory Planning and Governance
Indicator	Number of individuals that is aware of the project's objectives, content and processes
Challenge No.	7
KPI ID	11
Common KPI	Yes ☒ No ☐
Unit	No. of individuals aware of the project
Procedure	1. Record Keeping of number of individuals who were involved in the project through workshops, meetings, collaborations, conferences, etc. specific to the pilot city

Table 125: Novo Mesto KPI 7.11 Methodology

Description of Methodology for KPI 7.11

This indicator tracks the total number of individuals actively involved in the project's participatory processes, including workshops, meetings, collaborations, and conferences specific to Pilot Novo Mesto. The aim is to document engagement levels and ensure comprehensive participation across various activities, highlighting both direct and indirect involvement.

We employed multiple methods for record-keeping, ensuring that all individuals who participated in relevant activities were accounted for. The key methods include:

- **Attendance Counting:** Manual counting of participants during events.
- **Attendance Lists:** Utilizing official attendance lists collected during workshops, meetings, and guided tours.
- **Photographic Records:** Using event photographs to cross-check and verify attendance figures.

We only considered individuals who actively participated in:

- **Presentations:** Attendees of formal project presentations in Pilot Novo Mesto.
- **Workshops (stakeholders' meetings, cultural and social events):** Participants in workshops that discussed the project's goals, outcomes, and collaborative opportunities.
- **Guided Tours of Pilot Novo Mesto:** Attendees who took part in guided tours of the project area, including notable events such as the pool opening and Family Aquathlon.

Some of the Events Considered:

- **Pool Opening:** The number of participants who attended the guided tour of Pilot Novo Mesto during the pool opening event was counted.
- **Family Aquathlon:** Only parents and coaches who were present for the guided tour and at the Pool before the competition were included in the attendance count.
- **Youth Sports Games:** Participants in the Youth Sports Games were also counted as part of the project's co-creation and participation tracking.
- **Breakdancing Competition:** The attendance at the breakdancing competition was recorded, considering both participants and spectators.
- **Children's Event on the Fitness Trail:** The event designed for children at the trim track involved participants engaging in physical activities and was included in the attendance records.
- **Event for Educators:** Educators participating in an event designed to introduce them to the project's interventions were also counted.
- **Sports Day for the Blind and Visually Impaired:** A dedicated sports day for the blind and visually impaired was held, with participants actively involved in various activities.
- **Visit by Foreign Residents:** The event involving a visit from foreign residents living in the city was also part of the co-creation process, and their attendance was recorded.

Dissemination Activities:

In addition to event-based participation, dissemination efforts were also measured to calculate broader engagement:

- **WP9 Metrics:** Data from social media posts, including engagement figures (likes, shares, comments) on relevant posts promoting the project.
- **Flyers Distributed:** The number of flyers distributed for workshops, guided tours, and other activities was recorded to estimate outreach impact.

This indicator provides a detailed account of how many individuals engaged with the project through direct participation in events and workshops, as well as through dissemination activities. By tracking both in-person and outreach efforts, the project can evaluate its effectiveness in reaching and involving diverse groups within the Pilot Novo Mesto area.

Challenge Name	Participatory Planning and Governance
Indicator	No of new information channels generated between public institutions & citizenship
Challenge No.	7
KPI ID	13
Common KPI	Yes ☒ No ☐
Unit	No of new information channels
Procedure	1. Record Keeping of all participants and the activities they were involved in 2. Post-Intervention data collection by analysing records 3. Quantify data (if applicable) 4. Compare data

Table 126: Novo Mesto KPI 7.13 Methodology

Description of Methodology for KPI 7.13

This indicator measures the number of new information channels established to provide visitors with real-time updates and relevant information about Pilot Novo Mesto. These channels are essential for enhancing communication and ensuring that visitors have access to important data about the facilities.

Pilot Novo Mesto has developed the following four new communication channels:

- **Booking Platform:**
 - Provides real-time data on various metrics such as:
 - Water temperature
 - Air temperature

- Pool occupancy
 - Visitors can use this platform to plan their visits based on real-time conditions, improving their experience and enabling better management of the pool's capacity.
- **Information Board at the Velodrome:**
 - Displays relevant data and announcements related to events, schedules, and occupancy levels at the Velodrome.
 - Visitors can quickly access key information about training sessions, recreational activities, and competitions.
- **Information Board at the Novo Mesto Pool:**
 - Provides up-to-date information on pool-related events, schedules, and conditions.
 - Similar to the Velodrome board, it helps visitors stay informed about pool activities and occupancy.
- **Digital platform of the Olympic Center Novo Mesto:**
 - The Platform serves as an additional communication channel. It provides detailed information about events, services, and updates related to the pilot site, further enhancing public access to information.

To calculate the number of new information channels, we identified and verified the distinct communication tools introduced since the project began. These include both digital platforms and physical information boards, which are actively used by visitors. Each new platform was counted as a separate information channel.

Total Number of New Channels: 4

- Booking platform
- Information board at the Velodrome
- Information board at the Novo Mesto Pool
- Digital platform of the Olympic Center Novo Mesto

The creation of these four new information channels represents a significant improvement in visitor communication and facility management at Pilot Novo Mesto. By providing real-time data and essential information, these channels enhance the overall experience and ensure visitors have timely access to relevant updates.

Challenge Name	Participatory Planning and Governance
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Indicator	No civil society entities that have participated in the execution of the project in relation to the total of entities with presence in the neighbourhood
Challenge No.	7
KPI ID	14
Common KPI	Yes ☐ No ☒
Unit	% of entities that participated in the project in relation to the total number of entities with presence in the neighbourhood
Procedure	1. Record Keeping of all entities that participated in the execution of the project 2. Post-Intervention data collection by analysing records 3. Quantify data (if applicable) 4. Compare data

Table 127: Novo Mesto KPI 7.14 Methodology

Description of Methodology for KPI 7.14

The methodology for calculating this indicator involves record keeping of all civil society entities that participated in the execution of the project within the Novo Mesto pilot area. Post-intervention data collection was conducted by analysing the records of organizations that were actively involved in the project.

We maintained detailed records of all entities that took part in the project, including their involvement through various events, activities, and interventions. The entities included in this analysis are:

- Sports clubs
- Schools
- Kindergartens
- Health centres
- Non-governmental organizations (NGOs)

These organizations participated in the project through various means, such as co-organizing events, offering services, or being active in workshops and activities linked to the project's execution.

The total number of civil society entities in the City Municipality of Novo Mesto is 105. For the Novo Mesto pilot area, we calculated the percentage of participating entities using the following formula:

Number of participating entities / Total number of entities in the neighbourhood × 100

This formula provides the percentage of civil society entities that actively took part in the execution of the Varcities project.

The data collected is compared against the total number of civil society entities present in the Novo Mesto neighbourhood to determine the overall engagement level. This comparison helps to highlight the extent to which civil society was integrated into the project, enabling better insights into community participation.

This methodology offers a clear and structured approach to assessing civil society involvement in the project. By quantifying the level of participation and comparing it with the total number of entities in the area, the project team can evaluate the reach and impact of the VARCITIES project in the Novo Mesto pilot area.

Challenge 8 KPIs - Novo Mesto pilot

Challenge Name	Social Justice and Social Cohesion
Indicator	Personal and social background of people who participated in the project's activities
Challenge No.	8
KPI ID	5
Common KPI	Yes ☒ No ☐
Unit	N/A ☒
Procedure	1. Analysis of Evaluation forms sent in Stakeholder workshops, activity/event registrations and other forms of personal and social background information related to project participation

Table 128: Novo Mesto KPI 8.5 Methodology

Description of Methodology for KPI 8.5

This indicator focuses on the analysis of evaluation forms collected during stakeholder workshops, activity/event registrations, and other forms of participation in the project. The aim is to gather personal and social background information from participants to better understand the demographic profile of those involved in the project and evaluate their engagement.

The evaluation forms were distributed to participants at various project-related events, including:

- **Stakeholder Workshops:** These workshops engaged community members, decision-makers, and technical experts to gather feedback on the project's progress and impact.
- **Activity and Event Registrations:** During events such as presentations, workshops, and guided tours, participants were asked to provide personal and social background information via the registration forms.

The evaluation forms included several demographic and social background questions to understand the participants' profiles. These questions were aimed at capturing:

- **Age:** Participants were asked to indicate their age group (e.g., under 18, 18-35, 36-50, 51+).
- **Nationality:** The evaluation form included a question about participants' nationality to understand the diversity of the group.
- **Gender:** Respondents were asked to select their gender (male, female, other) to analyse gender representation in project activities.
- **Education Level:** The forms collected information on participants' highest level of education (e.g., primary, secondary, higher education) to evaluate the educational background of those engaged in the project.

Activities Where Forms Were Used:

2. **Stakeholder Workshops:** Forms were distributed to participants during workshops, especially in events where project goals and policies were discussed.
3. **Guided Tours and Event Registrations:** Evaluation forms were also used during the registration process for guided tours and large-scale events such as the Pool Opening, Family Aquathlon, and other major activities organized within the Pilot Novo Mesto area.

The analysis of the evaluation forms provides critical insights into the personal and social backgrounds of participants. By analysing factors such as age, nationality, gender, and education level, the project can assess its inclusivity and demographic reach, ensuring diverse participation across various events and activities. These results are essential for tailoring future engagements and fostering a more inclusive participatory process.

Challenge Name	Social Justice and Social Cohesion
Indicator	Participation of entities representing groups of persons with functional disabilities
Challenge No.	8
KPI ID	7
Common KPI	Yes ☐ No ☒
Unit	N/A ☒
Procedure	1. No Pre-Intervention measurement needed 2. Data collection from record keeping of participant data. Any form of participation in events organised by VARCITIES Pilots is relevant. 3. % of entities representing groups of persons with functional disabilities with respect to the total number of entities of this type that have participated in the project activities 4. Process data

Table 129: Novo Mesto KPI 8.7 Methodology

Description of Methodology for KPI 8.7

This indicator measures the participation of organizations that represent or include persons with functional disabilities within the Pilot Novo Mesto area. The goal is to assess the level of inclusion of these groups in activities organized in the project, providing insights into how well the project accommodates the needs of people with disabilities.

Within the City Municipality of Novo Mesto, there are a total of 105 institutions, non-governmental organizations, and entities. In the specific area of Pilot Novo Mesto, 30 organizations are actively organizing activities. Among these, several organizations are dedicated to or include people with functional disabilities. The target group for this indicator includes entities and organizations that provide

services, organize activities, or represent individuals with functional disabilities. These organizations play a crucial role in ensuring the inclusivity of the Varcities project and facilitating participation for all.

To calculate the percentage of organizations that include persons with disabilities, we used the following formula:

Percentage of organizations including people with disabilities=(Total number of organizations organizing activities at Pilot Novo Mesto / Number of organizations including people with disabilities)×100

Number of organizations including people with disabilities: 6

- ŠD Plavalček
- Konjeniško društvo Češča vas
- Društvo šola življenja
- Društvo slepih in slabovidnih
- OŠ Dragotin Kette
- Zveza Društev slepih in slabovidnih Slovenije

Total number of organizations at Pilot Novo Mesto: 30

Using this formula, we can calculate the percentage of organizations that involve or represent people with disabilities within the Pilot Novo Mesto project.

This indicator provides a clear view of the level of participation by organizations that represent or include people with disabilities. The result is an essential metric for assessing how inclusive the project is and ensuring that it meets the needs of all community members, particularly those with functional disabilities.

Challenge Name	Social Justice and Social Cohesion
Indicator	Participation of individuals with functional disabilities
Challenge No.	8
KPI ID	8
Common KPI	Yes ☒ No ☐
Unit	No. of participants with functional disabilities

Procedure	1. No Pre-Intervention measurement needed 2. Data collection from record keeping of participant data. Average number of individuals with functional disabilities using facilities & participating in the activities carried out under the project per unit time. 3. % of entities representing groups of persons with functional disabilities with respect to the total number of entities of this type that have participated in the project activities 4. Process data
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Table 130: Novo Mesto KPI 8.8 Methodology

Description of Methodology for KPI 8.8

This indicator tracks the number of individuals with functional disabilities, specifically mobility impairments, who participate in activities at the facilities within Pilot Novo Mesto. The focus is on their engagement in sports and recreational activities, providing insights into how inclusive the project is for people with disabilities.

The data is collected from individuals with mobility impairments who utilize the facilities in the Pilot Novo Mesto area, particularly the Sports Park in Češča vas, the Velodrome, and the swimming pool. The total sample includes individuals whose participation is recorded through various channels, including facility reservations, ticket purchases, and regular use of sports facilities.

The target group consists of people with mobility impairments who engage in exercise and recreational activities organized by:

- Non-governmental organizations (NGOs)
- Disabled sports associations These groups regularly rent the sports facilities, ensuring that people with disabilities have access to sports and recreational opportunities.

Reservation Platform:

- The number of individuals with mobility impairments who reserve facilities at the **Sports Park in Češča vas** is recorded through the platform's booking system.

Facility Rentals:

- Data on the number of people with mobility impairments who participate in activities at the **Velodrome** and **swimming pool** is obtained through the rental records of NGOs and disabled sports associations.

Swimming Pool Ticket Sales:

- For the swimming pool, the number of participants with mobility impairments is tracked through ticket sales. Tickets purchased specifically for people with mobility impairments are counted using a ticket entry system.

This indicator provides a comprehensive overview of the participation of individuals with functional disabilities in Pilot Novo Mesto's sports and recreational facilities. By measuring engagement through reservation systems, facility rentals, and ticket sales, the project ensures that individuals with mobility impairments are actively included in the area's recreational opportunities.

Challenge Name	Social Justice and Social Cohesion
Indicator	Accessibility of open public spaces and buildings for families with baby carriages and individuals with restricted mobility
Challenge No.	8
KPI ID	10
Common KPI	Yes ☒ No ☐
Unit	No. of accesses / year
Procedure	1. Pre-Intervention data collection through GIS or acquisition of benchmark value from relevant sources. 2. Take measurements of number of accesses / years until stipulated time

	3. Process data 4. Compare data
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Table 131: Novo Mesto KPI 8.10 Methodology

Description of Methodology for KPI 8.10

This indicator assesses the accessibility of public spaces and buildings in Pilot Novo Mesto, focusing on families with baby carriages and individuals with restricted mobility. The evaluation aims to ensure that these groups can easily access and use the facilities, contributing to a more inclusive and accommodating environment.

Accessibility is measured using data from the reservation platform, where non-governmental organizations, associations, and individual users book the use of facilities in the Pilot Novo Mesto area. The system tracks bookings for various activities, with a specific focus on users with restricted mobility and families participating in organized events.

Facilities Considered: The accessibility of the following key locations is evaluated:

- Swimming Pool: Used for family-oriented activities such as the swimming course for small children.
- Velodrome: Frequently accessed by individuals with restricted mobility for sports and recreational activities.
- Open Public Spaces: Various open areas in the Pilot Novo Mesto are also considered in the accessibility evaluation.

Target Group:

- Families with Baby Carriages: Families who participate in organized activities, particularly the swimming course for small children, are a key focus. The accessibility of pathways, ramps, and entrances for baby carriages is a critical aspect of this indicator.
- Individuals with Restricted Mobility: This group includes people with mobility impairments who regularly access public buildings and open spaces, such as the Velodrome and swimming pool, through organized activities and personal use.

The specific access points evaluated in this indicator include:

- Entrances and Ramps: The main entrances to the swimming pool and Velodrome, which are equipped with ramps and accessible pathways to facilitate movement for individuals with restricted mobility and families with strollers and a pool ramp for individuals with restricted mobility to access the pool.
- Parking Facilities: Designated parking spaces close to the entrance of each facility, reserved for individuals with mobility impairments and families with baby carriages, ensuring ease of access.
- Pathways and Sidewalks: The public spaces in Pilot Novo Mesto have wide pathways designed to accommodate baby carriages and wheelchairs, with smooth, even surfaces to improve accessibility.

This indicator provides valuable insights into the accessibility of public spaces and buildings for families with baby carriages and individuals with restricted mobility in Pilot Novo Mesto. By tracking reservations and participation through the platform and evaluating the physical accessibility of key facilities, the project ensures a more inclusive environment that meets the needs of all users.

Challenge 9 KPIs - Novo Mesto pilot

Challenge Name	Public Health and Wellbeing
Indicator	Feeling of improving the quality of life (the Quality-of-Life questionnaire)
Challenge No.	9
KPI ID	8
Common KPI	Yes ☒ No ☐
Unit	Questionnaire score
Procedure	1. Data collection after visit pilot site

Table 132: Novo Mesto KPI 9.8 Methodology

Description of Methodology for KPI 9.8

We measured the improvement in quality of life through unstructured interviews. On September 8, 2023, we opened the Novo Mesto Pool. The reception of the Novo Mesto Pool became the entry point for all facilities and activities in the Pilot Novo Mesto area.

Receptionists asked guests whether they felt their quality of life had improved with the New Novo Mesto Pool. With new swimming programs for babies and swimming courses for children, parents believe that living conditions have improved. The same opinion is shared by seniors who now have more opportunities for daily exercise in the Pilot Novo Mesto area.

Challenge Name	Public Health and Wellbeing
Indicator	Number / share of people being physically active (min. 30 min 3 times per week)
Challenge No.	9
KPI ID	16
Common KPI	Yes ☒ No ☐
Unit	No of people / %
Procedure	1. Pre-Intervention data collection through International Physical Activity Questionnaire (IPAQ) or acquisition of benchmark value from relevant sources. 2. Post-Intervention data collection by asking the same questions as in the pre-intervention questionnaire or source. 3. Compare data

Table 133: Novo Mesto KPI 9.16 Methodology

Description of Methodology for KPI 9.16

At the Velodrome facility, a vision system is installed, which serves as a people counter. For physically active individuals engaging in 30 minutes per day, 3 days a week, we utilized the people counter at the Velodrome. This is because cyclists, athletes, recreational cyclists, recreational athletes, and veteran athletes train there. All of them have scheduled slots and regular training sessions. We obtained all the data using machine vision, the people counter, and exported the data via an IoT platform.

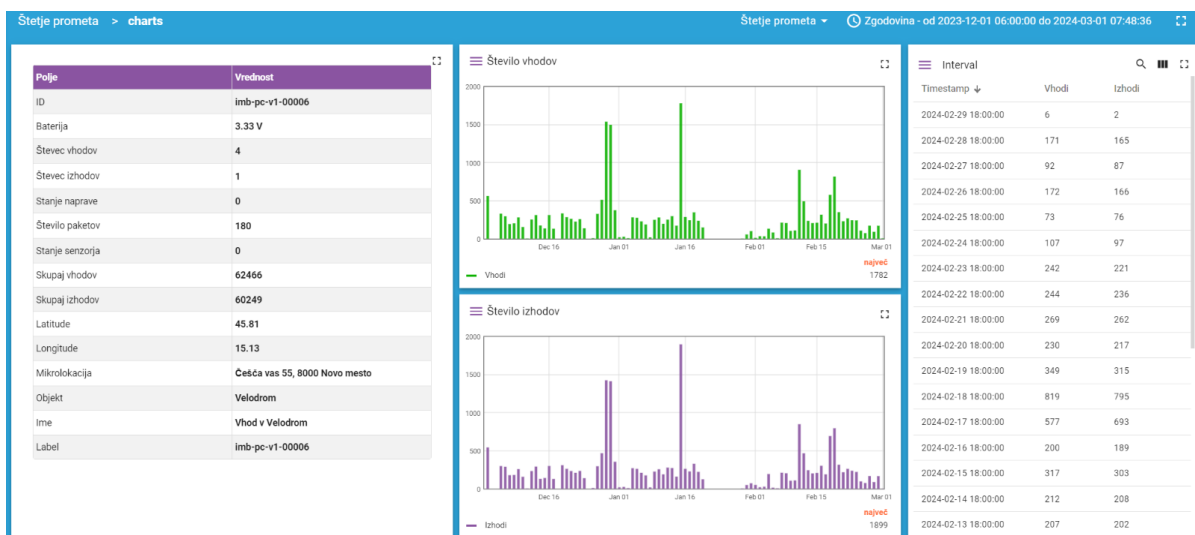


Figure 35: Novo Mesto physical activity sensors

On the left side, there is a sum counter from the installation. It is counting in and out. On the right side, there is a daily report. We export daily reports from period from platform to excel.

Challenge Name	Public Health and Wellbeing
Indicator	Increase in walking and cycling in and around areas of interventions
Challenge No.	9
KPI ID	19
Common KPI	Yes ☒ No ☐
Unit	No of people / %
Procedure	1. Pre-Intervention data collection through questionnaire or acquisition of benchmark value from relevant sources. 2. Post-Intervention data collection by asking the same questions as in the pre-intervention questionnaire or source. 3. Compare data

Table 134: Novo Mesto KPI 9.19 Methodology

Description of Methodology for KPI 9.19

At various locations within Pilot Novo Mesto, people counters have been installed. For the methodology, we used the total sum of all entries in the Pilot Novo Mesto area. We captured the data through an IoT platform.

Challenge Name	Public Health and Wellbeing
Indicator	Improved motor skills among the youth
Challenge No.	9
KPI ID	22
Common KPI	Yes ☐ No ☒
Unit	N/A ☒
Procedure	1. Pre-Intervention data collection through questionnaire or acquisition of benchmark value from relevant sources. 2. Post-Intervention data collection by asking the same questions as in the pre-intervention questionnaire or source. 3. Quantify data (if applicable) 4. Compare data

Table 135: Novo Mesto KPI 9.22 Methodology

Description of Methodology for KPI 9.22

This indicator measures the effectiveness of swimming training interventions by comparing pre- and post-intervention data. The objective is to assess improvements in motor skills and overall swimming proficiency among children participating in the swimming courses at Bazen Novo mesto, including participants from the Municipality of Novo mesto and neighbouring municipalities.

The methodology is based on the national program “*Naučimo se plavati*” (Let's Learn to Swim), which demonstrates how structured training enhances motor skills such as water adaptation, coordination, and swimming technique in youth aged 6–7 years and 9–10 years.

Pre-Intervention Assessment

Before starting the course, each child undergoes an initial evaluation of motor skills and swimming proficiency. The assessment focuses on five key criteria:

- Head submersion
- Gliding
- Swimming movements – arm strokes
- Swimming movements – leg kicks
- Coordination and overall swimming technique

Each criterion is rated on a scale from 1 (lowest ability) to 5 (full proficiency).

Intervention

- Children aged 6–7 years participate in a 10-hour swimming course.
- Children aged 9–10 years participate in a 20-hour swimming course.
- Courses are conducted for non-swimmers from kindergartens and primary schools.
- Training sessions follow a structured progression, starting with basic water adaptation and advancing to coordinated swimming techniques.

Post-Intervention Assessment

At the end of the course, participants are reassessed using the same five criteria as in the pre-intervention phase. This allows for direct measurement of improvements in motor skills and swimming ability.

Children are classified into proficiency levels and awarded diplomas:

- **Sea Horse (Morski konjiček)** – Bronze, Silver, Gold
- **Dolphin (Delfin)** – Blue

A participant is recognized as a swimmer upon achieving the **Bronze Dolphin (Bronasti Delfin)** level, which requires:

- Swimming 50 meters continuously.
- Performing a safety maneuver: transition from horizontal front → vertical position → horizontal back → return to starting position while continuing to swim.

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Challenge 10 KPIs - Novo Mesto pilot

Challenge Name	Potential for New Economic Opportunities and Green Jobs
Indicator	Number of Jobs Created
Challenge No.	10
KPI ID	1
Common KPI	Yes ☒ No ☐
Unit	No. of new employment
Procedure	1. Record keeping of internal and external employees involved in the implementation of VSs (Ex: Subcontractors/freelancers, staff employed for implementation and maintenance of interventions and others) 2. Specify in which VS they were involved in and employment type

Table 136: Novo Mesto KPI 10.1 Methodology

Description of Methodology for KPI 10.1

This indicator assesses the project's capacity to generate new employment linked to green infrastructure, sustainable tourism, and nature-based solutions (NBS). It reflects how urban greening initiatives can support the local economy by creating environmentally focused job opportunities across various sectors.

In the Novo Mesto pilot, a total of 40 new jobs were created through the implementation and operation of green infrastructure and services. These roles span multiple areas:

- Design and Planning: 1 urban/landscape designer contributed to planning eco-friendly public spaces.
- Environmental Oversight: 1 environmental expert oversaw NBS implementation and monitoring.
- Maintenance and Care: 1 horticulturist, 5 lifeguards/maintenance workers, 2 infrastructure maintenance staff, and 4 cleaners supported the operation and sustainability of green and recreational facilities.

- Community and Tourism Services: 19 swimming instructors promoted health and wellbeing; 1 event coordinator and 1 camp manager organized and managed green space activities; 4 receptionists facilitated eco-tourism services at the green campsite.
- Energy Management: 1 energy efficiency manager ensured sustainable operation of the pool and related facilities.
- These jobs not only supported the successful functioning of the pilot site but also contributed to long-term green growth, capacity-building, and the promotion of sustainable lifestyles within the community.

Challenge Name	Potential for New Economic Opportunities and Green Jobs
Indicator	Definition of parameters for (re)designing of green public spaces based on the well-being of users
Challenge No.	10
KPI ID	5
Common KPI	Yes ☒ No ☐
Unit	N/A ☒
Procedure	1. Design parameters being developed based on lessons learnt from implementation of VSs and health and wellbeing data. 2. Co-evaluate results with expert stakeholders

Table 137: Novo Mesto KPI 10.5 Methodology

Description of Methodology for KPI 10.5

The data is derived from the analysis of health and well-being metrics, along with the evaluation of the design and implementation processes for all NBS interventions in Pilot Novo Mesto. WP leaders and experts will combine these findings to establish a benchmark of parameters for designing and implementing public urban green spaces that support well-being and sustainable urban living.

- Geographical Size: N/A
- Sample Size: N/A
- Questions: N/A
- Visual Media: N/A

- Detailed Information on Data Collection in Practice: N/A
- Challenges Encountered on Site: Some interventions are still in the process of implementation, making full evaluation not yet possible.
- Purpose of Data Collection - The purpose of collecting data is to ensure that the lessons learned throughout the implementation of VARCITIES in Pilot Novo Mesto are translated into a replicable toolkit of best practices that can be applied by other cities in the future, fostering sustainable urban development and enhancing citizen well-being.

Challenge Name	Potential for New Economic Opportunities and Green Jobs
Indicator	Replication of Solutions
Challenge No.	10
KPI ID	6
Common KPI	Yes ☒ No ☐
Unit	N/A ☒
Procedure	1. A common strategy for replicability will be established between WP leaders and pilot leaders/experts 2. Determine the replicability of the VSs 3. Determine which VSs were most successful in terms of replication

Table 138: Novo Mesto KPI 10.6 Methodology

Description of Methodology for KPI 10.6

KPI 10.6 measures the replication potential of Visionary Solutions. All the Visionary Solutions are being considered in the data collection of this KPI, and a quantitative survey questionnaire was the method of choice across all pilot sites. The questionnaire was distributed in two main events; the GoGreenRoutes Final Clustering event which had an audience composed of various other municipalities, Universities, non-profit and commercial entities involved in sister EU projects, and the Partner Cities Webinar organised as part of WP9 dissemination activities to engage other European Cities with the intention of receiving feedback and potentially replicating Visionary Solutions.

The structure of the questionnaire was set by first showing information about every Visionary Solution, followed by a question. Each question had a scale of 1 – 5, 1 being not replicable at all and 5 being highly replicable.

The following responses were supplemented by information to guide the respondents in making better informed decisions;

- 5 – Highly replicable (minimal to no barriers)
- 4 – High replicability (minor barriers/challenges to be addressed)
- 3 – Moderate replicability (both strength and limitations)
- 2 – Low replicability (there is some potential but also significant challenges)
- 1 – No replicability at all (significant barriers to replication)

Challenge Name	Potential for New Economic Opportunities and Green Jobs
Indicator	Public & private investments during/after the project
Challenge No.	10
KPI ID	9
Common KPI	Yes ☒ No ☐
Unit	Euros
Procedure	1. Data collection on internal public/private investment. 2. Assess and calculator 5-Year Investment Projection 3. Replication Funding Potential Forecast

Table 139: Novo Mesto KPI 10.9 Methodology

Description of Methodology for KPI 10.9

Private and public investments related to the Novo Mesto pilot Visionary are being calculated following the guidance and supervision of the WP8 leaders (INCLECOM). The main aim of this data collection is to consider a 5-year timeframe to show the pilot investments, both through EU and internal funding, and how the pilot VS projects can be implemented again in other sites through diverse funding mechanisms after the project.

A forecast of the external private and public investment is then being projected below to show the total amount of investment that the Visionary Solutions could potentially finance to replicate the implementation.

A1.7 Skellefteå Methodology Manual

Challenge Name	Green Space Management
Indicator	No. of sensory elements
Challenge No.	4
KPI ID	21
Common KPI	Yes ☒ No ☐
General methodology	Experimental ☐ Simulation ☐ Statistical/surveys ☒
Expected data deliverable	Numeric ☒ Survey ☐ Qualitative ☐ Map ☐
Unit	No. of sensors
Required data processing	Yes ☐ No ☒
Procedure	1. Record number of sensors installed in pilot site

Table 140: Skellefteå KPI 4.21 Methodology

Description of Methodology for KPI 4.21

Geographical scale: mesoscale

Sample size: tbc

The number of sensors installed in the pilot site was recorded.

Challenge 6 KPIs - Skellefteå pilot

Challenge Name	Urban Regeneration
Indicator	Reclamation of contaminated land
Challenge No.	6
KPI ID	4

Common KPI	Yes ☒ No ☐
Unit	Km2 / %
Procedure	1. Developed areas within the community are identified and their combined surface area is calculated using maps. This is done yearly and the percentage change in the area is reported, as well as the actual area remaining. 2. Post-Intervention data collection by analysing data 3. Compare data to calculate percentage of the increase in open space in relation to built-form

Table 141: Skellefteå KPI 6.4 Methodology

Description of Methodology for KPI 6.4

The area reclaimed is approximately 25 hectares. All contaminated areas close to the pilot were reclaimed as housing areas. There are still contaminated areas on the opposite side of Klockenberg Road. Approximately 50 % of a total of 50 hectares (both sides of the road) was reclaimed.

Challenge 10 KPIs - Skellefteå pilot

Challenge Name	Potential for New Economic Opportunities and Green Jobs
Indicator	Replication of Solutions
Challenge No.	10
KPI ID	6
Common KPI	Yes ☒ No ☐
Unit	N/A ☒
Procedure	1. A common strategy for replicability will be established between WP leaders and pilot leaders/experts 2. Determine the replicability of the VSs 3. Determine which VSs were most successful in terms of replication

Table 142: Skellefteå KPI 10.6 Methodology

Description of Methodology for KPI 10.6

While the replication of Visionary Solutions is not currently under consideration, the project actively seeks collaboration opportunities with other municipalities. The focus is on fostering partnerships and sharing insights, experiences, and best practices with other local entities. This collaborative approach allows for the exchange of knowledge and the potential adaptation of successful strategies to suit the unique contexts and challenges faced by different municipalities. By exploring collaborative opportunities, the project aims to contribute to a broader network of sustainable initiatives and collectively work towards creating positive impacts in diverse communities. This open approach to collaboration reflects a commitment to scalability, adaptability, and the collective advancement of sustainable practices beyond the project's initial scope.

Challenge Name	Potential for New Economic Opportunities and Green Jobs
Indicator	Public & private investments during/after the project
Challenge No.	10
KPI ID	9
Common KPI	Yes ☒ No ☐
Unit	Euros
Procedure	1. Data collection on internal public/private investment. 2. Assess and calculator 5-Year Investment Projection 3. Replication Funding Potential Forecast

Table 143: Skellefteå KPI 10.9 Methodology

Description of Methodology for KPI 10.9

Private and public investments related to the Skellefteå pilot Visionary are being calculated following the guidance and supervision of the WP8 leaders (INCLECOM). The main aim of this data collection is to consider a 5-year timeframe to show the pilot investments, both through EU and internal funding, and how the pilot VS projects can be implemented again in other sites through diverse funding mechanisms after the project.

A forecast of the external private and public investment is then being projected below to show the total amount of investment that the Visionary Solutions could potentially finance to replicate the implementation.

Annex II - KPI Results and Evaluation for Each Pilot Site

The KPI results that have been measured by the pilot sites' representatives throughout the 10 monitoring periods are analysed and evaluated in this section per VS. A documentation of the KPI results is presented for every pilot site, and thoroughly discussed in the context of specific VSs that have been implemented in the pilot sites. Each KPI result includes the following details; the relevant challenges associated with the KPI, KPI titles, expected impacts, relevant VS(s), evaluation method(s) and ultimately the visualised results.

A2.1 Castelfranco

Challenge 1

KPI 1.3 Measures of human comfort

Expected Impact: Increased temperature data on human comfort (Added value)

VS(s): 2,3

Evaluation Method: Benchmarking

PET in the Castelfranco pilot is calculated with the following constants: metabolic rate of 1.4 met, body weight/height of 75 kg/1.75 m for male body, clothing level of 0.9, standing position. The outdoor thermal comfort for Castelfranco is based on the heat mitigation strategy to reduce rising temperatures developed in Milan, a northern Italian city. The strategy specifies that the range of thermal neutrality is that of 24°C – 29°C which is taken as a benchmark.

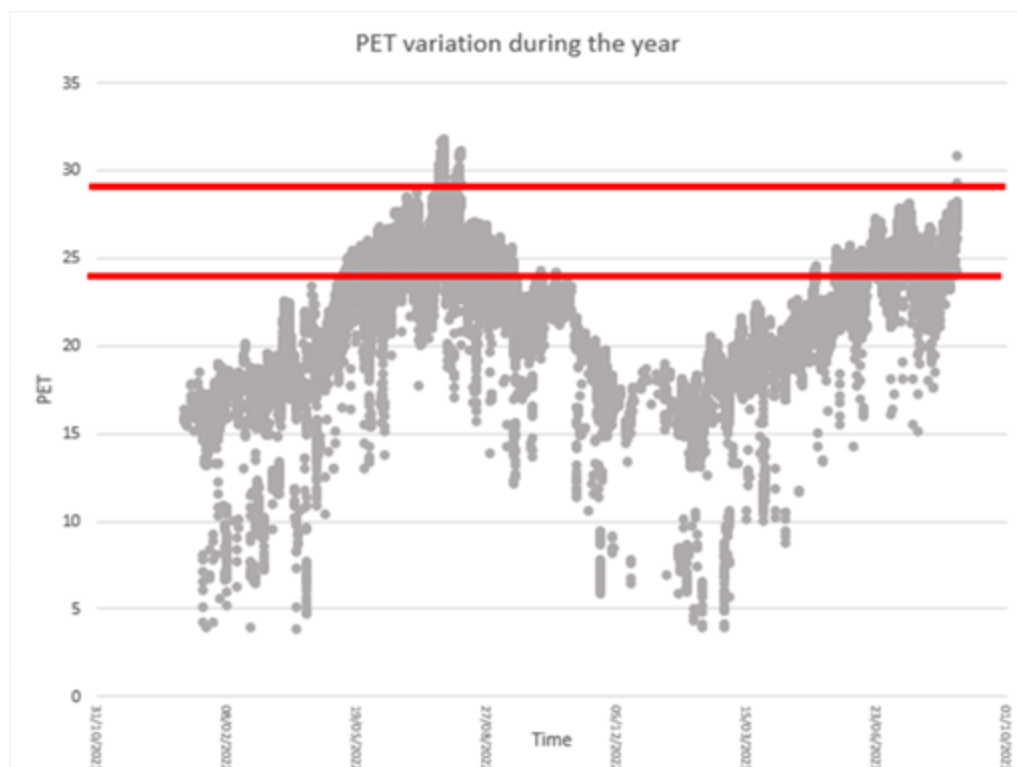


Figure 36: Thermal Comfort in Castelfranco

According to data provided by the pilot city representatives, the first figure below shows that 9,711 of the measurements show incidences of PET temperatures lower than 24°C, while 6,154 measurements are that of 24°C or above. Measurements in Castelfranco have been collected at the average frequency rate of 30 minutes between 5/2022 and 7/2023. The following figure shows 90 measurements that are higher than 29°C and 15,775 measurements which are of 29°C or lower. The approximate percentage of values below 24°C is that of 61.2% while the values over 29°C are equivalent to 0.57%, meaning that 38.23% of the measurements fall within the outdoor thermal comfort bracket.

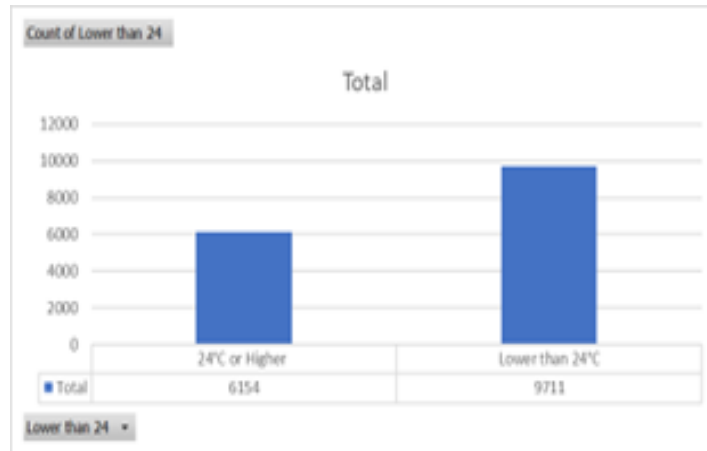


Figure 37: PET temperatures lower than 24°C in Castelfranco

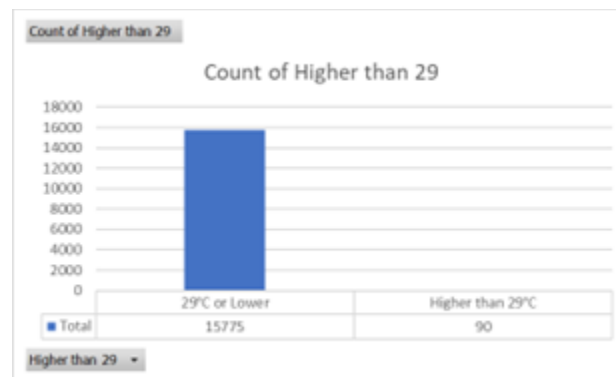


Figure 38: PET temperatures higher than 29°C in Castelfranco

KPI 1.8 Number of temperature and humidity data

Expected Impact: Number of temperature and humidity data added (Direct Impact)

VS(s): 2,3

Evaluation Method: Pre & Post

This indicator measures the amount of data collected on temperature and humidity in the framework of the project. The data are obtained through environmental sensors with different sampling frequencies to ensure an accurate analysis of climatic conditions.

The sampling frequency varies according to the type of data, with records every 15 minutes for solar radiation, air pressure, and humidity, while air temperature is measured every 30 minutes both in Celsius and Fahrenheit.

To date, values collected on the number of samples taken include:

Type of Data	Sample	Sample Rate
Solar Radiation	71120	10 mins
Air Pressure	39287	15 mins
Humidity	39287	15 mins
Air Temperature (Celsius)	74792	30 mins
Air Temperature (Fahrenheit)	74792	30 mins

Table 144: Number of temperature and humidity data in Castelfranco

Challenge 4

KPI 4.3a Recreational or cultural value of green spaces (number of visitors)

Expected Impact: Increased recreational and cultural value of green spaces (Direct Impact)

VS(s): 1,4

Evaluation Method: Pre & Post

The data provided by the Castelfranco pilot site representatives and experts indicates that 7 activities were organised within the green space including those events which were organised by the VARCITIES pilot site and other event organisers until Nov 2023. Yearly measurements are being taken by keeping a track record of these events through the personnel in charge of events management. In the line graph below, one may notice the increase in visitors to such events throughout 2020 and 2022 reported by the same office and management. The baseline measurement in 2020 is 9,255 visitors. This figure was increased by 1,780 in 2021, showing an improvement from the previous year, and changed drastically in 2022 with a 6,214 increase in the total visitor count.

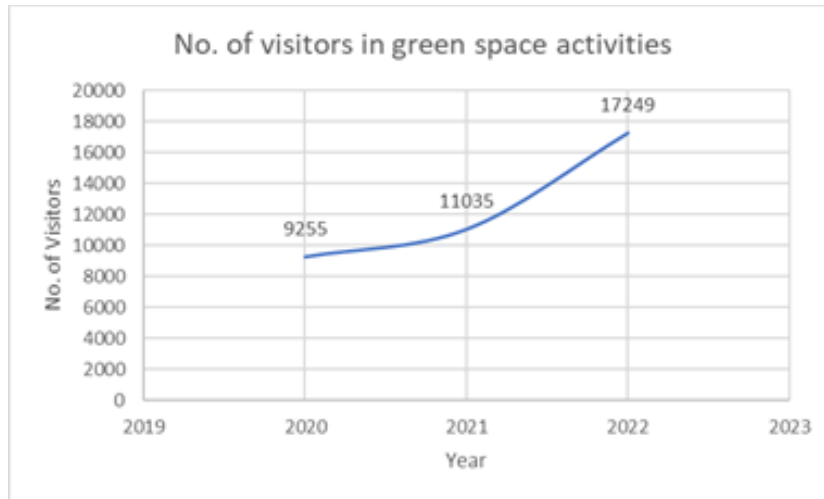


Figure 39: No. of visitors in green space activities in Castelfranco

KPI 4.3b Recreational or cultural value of green spaces (activities in green spaces)

Expected Impact: Increased recreational and cultural value of green spaces (Direct Impact)

VS(s):1,4

Evaluation Method: Pre & Post

The number of activities organised in the pilot site within the VARCITIES Framework were 9 including:

- Workshop 1
- Press release for workshop 1
- Workshop 2
- SROI
- Press release for the townhall
- Townhall + cultural event
- OMNE Festival
- Cultural event 2
- Cultural event 3

KPI 4.9 Effectiveness of seating locations

Expected Impact: Increased use of green public space facilities (Direct Impact)

VS(s): 2,5

Evaluation Method: Co-evaluation

The bar chart below indicates the total number of times people visiting the pilot site have sat on 4 ergonomic benches. Sensor devices were attached to the benches to collect this data automatically at the 3 given periods above. The location of the benches was carefully selected to measure the effectiveness of the specific position of the bench, as seen in the image below. This data will be collected throughout the duration of the project and the results presented here include the measurements until April 2023.

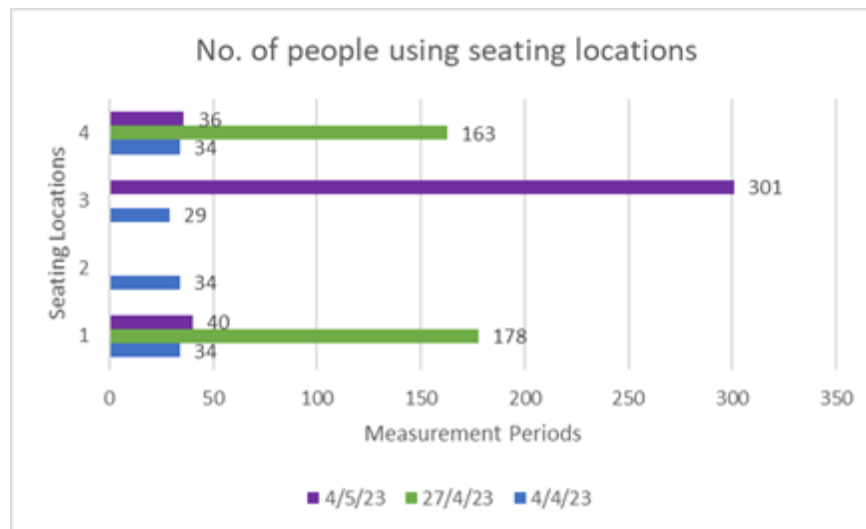


Figure 40: No. of people using seating locations in Castelfranco

When compared, seating location 3 is the most effective seating location up until November 2023, with a total of 330 people. The second most effective location is 1 with 252 recorded measurements, followed by location 4 having 233 measurements, and lastly seating location 2 with 34 measurements. However, the latter achieved a much lower value due to measurements being only taken in the period starting 4/4/23.

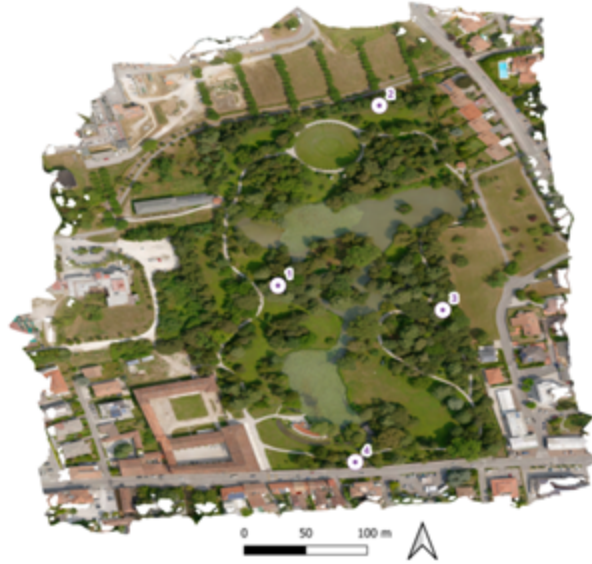


Figure 41: Seating location of benches at Castelfranco

KPI 4.19 Increased data on singing birds in green zones

Expected Impact: Increased data on singing birds in green zones (Added value)

VS(s): 3

Evaluation Method: Pre & Post

The analysis of Acoustic Indexes are quantitative measures derived from audio recordings to characterise various aspects of sound, particularly in the context of environmental and ecological studies. These indexes provide objective metrics for analysing acoustic data, enabling researchers to extract meaningful information about the environment, biodiversity, and other ecological phenomena. In the realm of bird diversity and soundscape analysis, acoustic indexes play a crucial role in monitoring and understanding avian populations and their habitats. The main acoustic indexes used for bird diversity and soundscape analysis are included in the following charts for measurements taken in May 2022:

Acoustic Complexity Index (ACI):

Purpose: ACI is designed to capture the complexity of the acoustic environment by considering the variety of sound frequencies, amplitudes, and temporal patterns.

Calculation: ACI typically involves analysing the spectrogram of an audio recording, assessing the diversity and distribution of acoustic energy across different frequency

bands and time intervals. A higher ACI value indicates a more complex acoustic environment.

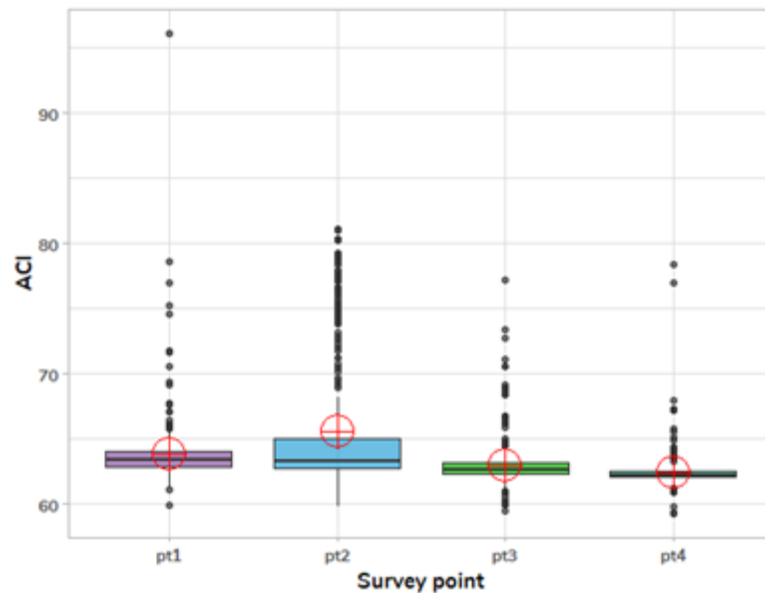


Figure 42: Acoustic Complexity Index in Castelfranco



Figure 43: Acoustic Complexity Index Histogram in Castelfranco

Bioacoustic Index (BI):

Purpose: BAI is designed to quantify the biological activity in an acoustic environment, often focusing on the prevalence of vocalisations from specific taxa, such as birds.

Calculation: BAI considers the frequency and intensity of biologically relevant sounds, providing a measure of the overall biological significance of the acoustic environment.

BI Boxplot

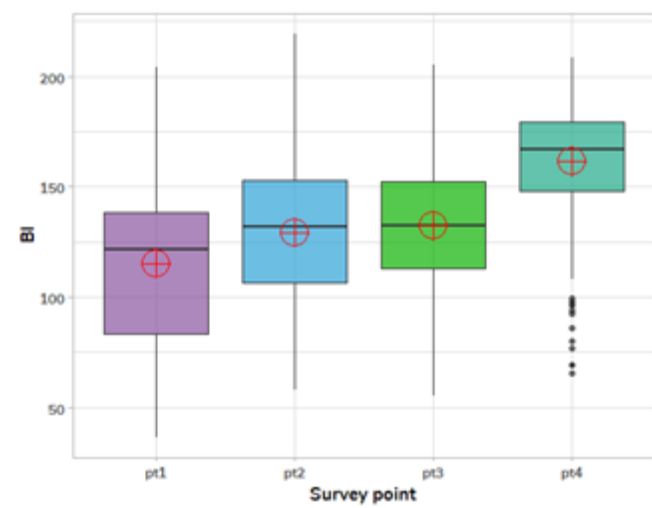


Figure 44: Bioacoustic Index in Castelfranco

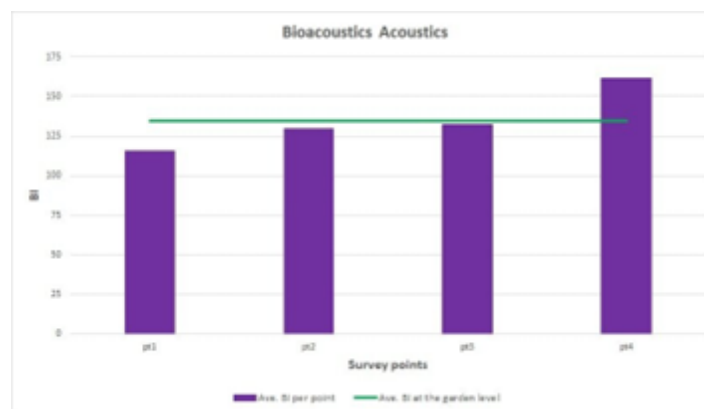


Figure 45: Bioacoustic Index Histogram in Castelfranco

Normalised Difference Soundscape Index (NDSI):

Purpose: NDSI compares the acoustic energy in different frequency bands, helping to identify changes in the composition of soundscapes.

Calculation: It involves computing the normalised difference between the energy in low and high-frequency bands, offering insights into the balance between natural and anthropogenic sounds.

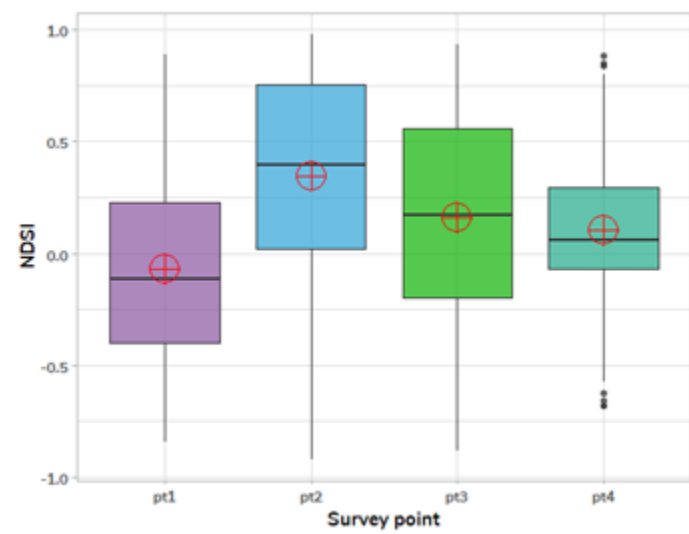


Figure 46: Normalised Difference Soundscape Index in Castelfranco

NDSI Histogram

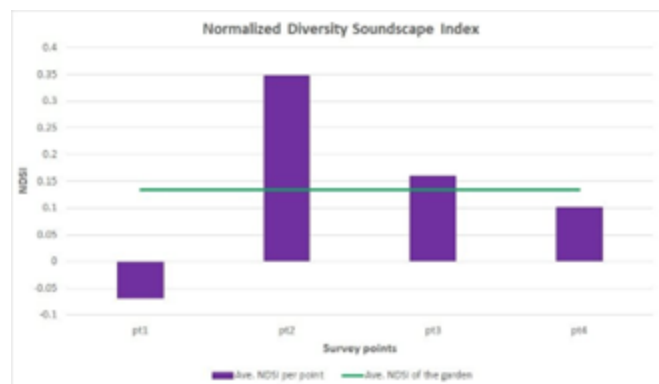


Figure 47: Normalised Difference Soundscape Index Histogram in Castelfranco

Acoustic Diversity Index (ADI):

Purpose: ADI measures the variety of acoustic elements in a sound recording, reflecting the diversity of species or vocalisations present.

Calculation: It is often calculated based on the richness and evenness of acoustic features, such as frequency or temporal patterns.

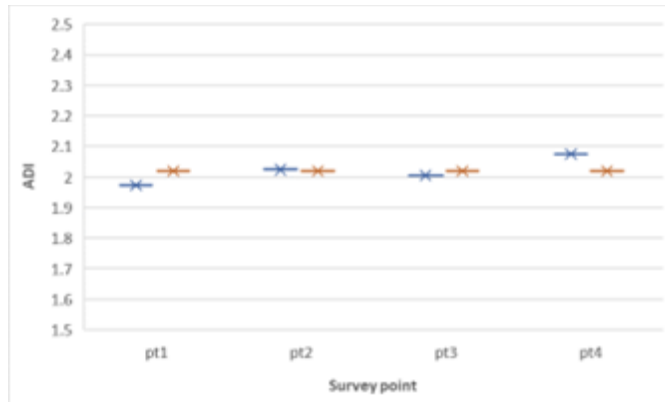


Figure 48: Acoustic Diversity Index in Castelfranco

Acoustic Evenness Index (AEI):

Purpose: AEI assesses the balance or even distribution of different acoustic components in a recording.

Calculation: It considers the proportional representation of different sound sources, helping identify situations where a few dominant sounds may overshadow others.

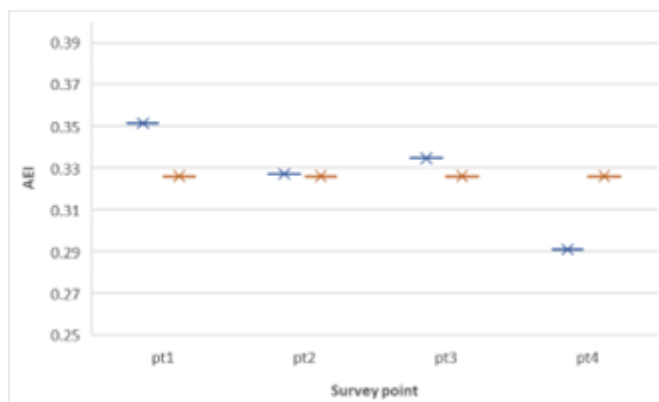


Figure 49: Acoustic Evenness Index in Castelfranco

KPI 4.21 No. of Sensory Elements

Expected Impact: Increased data from sensors (Direct Impact)

VS(s): 3,5

Evaluation Method: Pre & Post

Initially, there were no sensors installed at the pilot site in Castelfranco. After implementation, a total of 21 IoT sensors were installed to measure the KPI.

Challenge 5

KPI 5.5 Physical air quality indicators

Expected Impact: Increased (physical) air quality data (Added value)

VS(s): 3

Evaluation Method: Benchmarking

Mean air temperature patterns showed a constant seasonal variation across all sensors from July 2022 to November 2024. Temperatures dropped significantly during the winter months (especially in January 2023 and January 2024), with the lowest averages recorded at sensors 06 and 07, with values close to 0 °C. In contrast, temperatures peaked during the summer months of each year. Sensor 10 consistently recorded the highest values, reaching up to 30 °C.

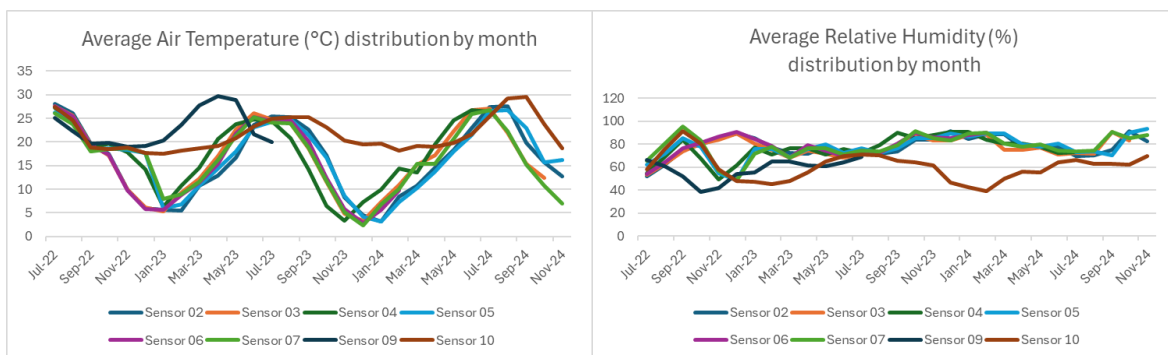


Figure 50: Castelfranco average air temperature (°C) distribution by month

The average relative humidity showed moderate fluctuations over the monitoring period from July 2022 to November 2024. Most sensors recorded values between 60% and 90%, with occasional peaks and dips. Sensor 10 consistently recorded lower humidity levels than the others, dropping below 50% in early 2023 and again in early 2024. In contrast, sensors 06 and 07 showed the highest readings, with peaks above 90% in several months.

KPI 5.6 Chemical air quality indicators

Expected Impact: Increased (chemical) air quality data (Added value)

VS(s): 3

Evaluation Method: Benchmarking

The graph presents the daily average concentrations of PM2.5 and PM10 (in micrograms per cubic metre, $\mu\text{g}/\text{m}^3$) recorded by Sensor 15 and Sensor 16. It also displays NO₂ and O₃ measurements from the same sensors. Between 15 August 2023 and 21 January 2025, Sensor 15 recorded a total of 172,503 entries. During the period from 8 July 2024 to 1 January 2025, Sensor 16 registered 145,247 entries.

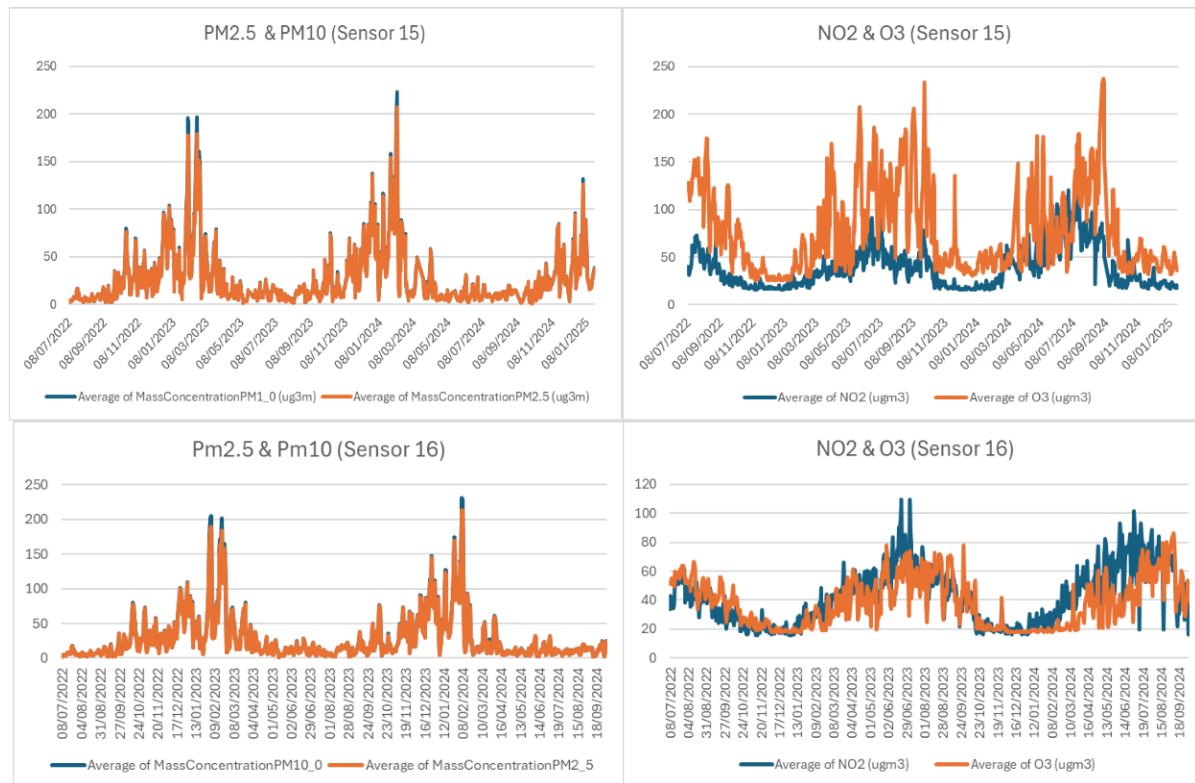


Figure 51: Air Quality data in Castelfranco

Challenge 6

KPI 6.7 Road surface dedicated to pedestrians

Expected Impact: Increased share of pedestrian areas (Direct Impact)

VS(s): 1

Evaluation Method: Pre & Post

Before intervention, the road surface dedicated to pedestrians was 0%. After the renovation of access routes and internal paths, the share of pedestrian areas increased to 72%

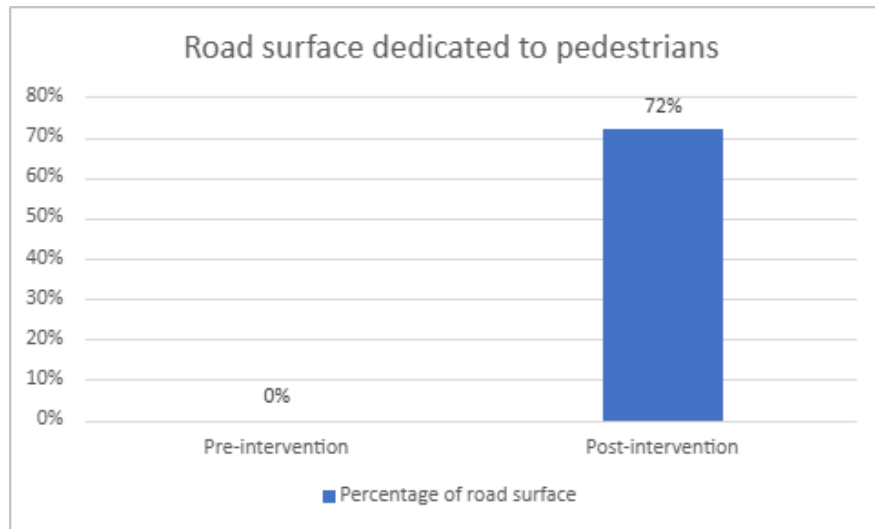


Figure 52: Castelfranco road surface dedicated to pedestrians

Challenge 7

KPI 7.1 Openness of participatory processes

Expected Impact: Increased and improved participation (Direct Impact)

VS(s): 4

Evaluation Method: Co-evaluation

The data provided by Castelfranco pilot leaders reflects the number of people who took part in the co-creation workshops during the pre-implementation stage of VARCITIES. The chart below illustrates the different totals numbers of participants. In the Town Hall, 180 participants have contributed to decisions, with a mixed social background and field expertise. The co-creation workshops which were organised before had the following attendance; 8 people in WS1, while in the 2 sessions related to WS2 the total number reached 27. This portrays that the total number of participants relevant to this category of data collection is 215.

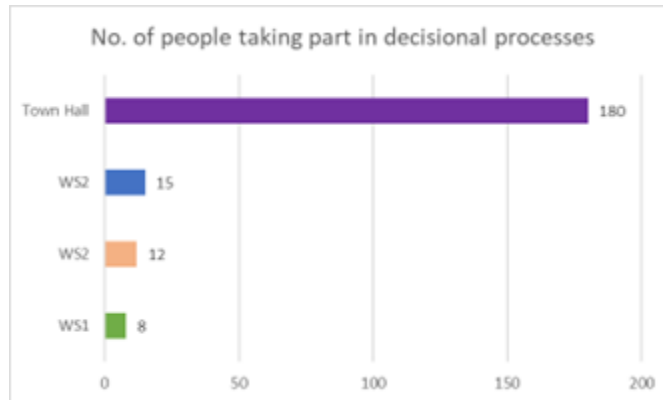


Figure 53: No. Of People Taking Part in Decisional Processes in Castelfranco

The co-evaluation was made by a total of 16 participants, who evaluated the effectiveness of the actions developed in the pilot site using a scale from 0 to 6, and getting a rating of 4.1.

After the voting, a space for open comments was provided: among the points highlighted were the need to improve the visibility of the park from the outside, to broaden and diversify the channels of communication and participation, and to involve a wider public, including local associations and educational centres at different levels. The importance of sharing the results of the project more widely, especially through social networks and in collaboration with other municipalities in the area, was also underlined.

KPI 7.3 Social learning concerning urban ecosystems and their functions/services

Expected Impact: Increased awareness of urban ecosystems (Direct Impact)

VS(s): 4, 6

Evaluation Method: Co-evaluation

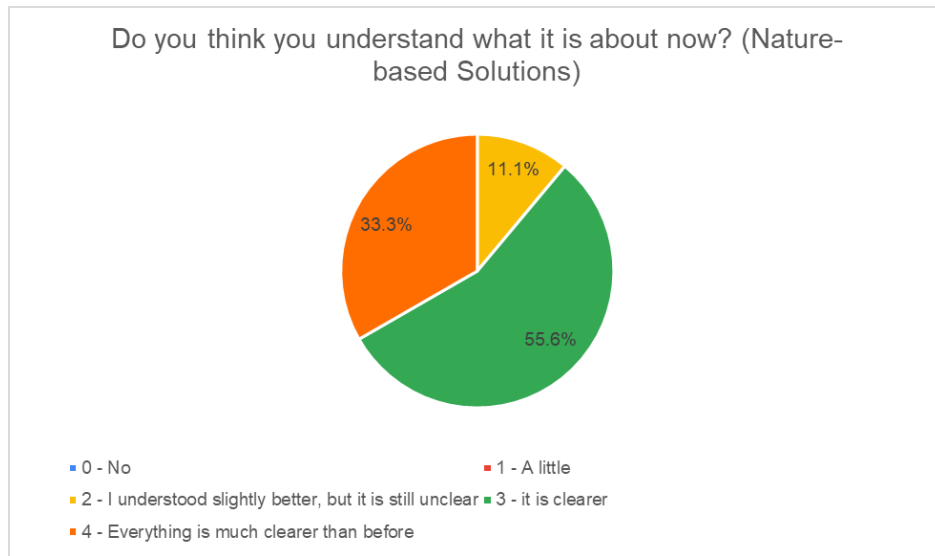


Figure 54: Social Perception of urban ecosystem in Castelfranco 1

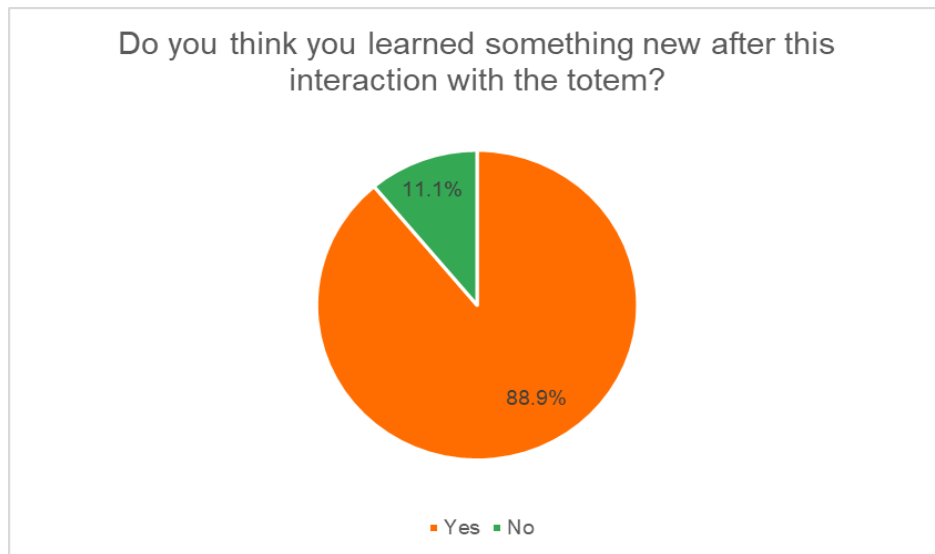


Figure 55: Social Perception of urban ecosystem in Castelfranco 2

The results from the totem-integrated questionnaire indicate a positive educational impact on participants. A substantial 88.9% of respondents reported learning something new following their interaction with the totem, suggesting that the tool effectively conveyed new information. In terms of understanding Nature-based Solutions, 55.6% of participants stated that the concept was clearer to them after the interaction, and an additional 33.3% noted a slight improvement in their understanding, though some

aspects remained unclear. Only 11.1% felt they understood only slightly better, with no respondents indicating a complete lack of understanding. These findings suggest that the totem was largely successful in enhancing both awareness and comprehension of the topic among users.

KPI 7.4 Perceptions of citizens on urban nature

Expected Impact: Increased awareness of urban ecosystems (Direct Impact)

VS(s): 4

Evaluation Method: Co-evaluation

3 Focus groups were conducted by the Castelfranco pilot leaders and experts to discuss the perception of urban nature with a mixed attendance from various association representatives. The different participants involved shared their thoughts about opportunities to increase awareness and significance of enhancing and regenerating urban public spaces. The tools used to track the amount of people were surveys, registration forms, attendance lists and distribution of dissemination material for participation. The total number of participants reported in the methodology description (Section 6) was over 200, of which 29 took part in the focus groups indicated below. The following are some results emerging from the engagement activities related to perception of urban ecosystems, mainly Nature-based Solutions.

This KPI was evaluated by 15 participants with an average score of 4.6 out of 6. Among the suggestions, the importance of communicating the research in a clear and accessible way and involving local stakeholders from the early stages of the project was highlighted. The need to not limit the actions to Villa Bolasco, but to extend them to other green spaces in the city, promoting a broader and systemic approach, was also underlined.

It was also proposed to develop immersive experiences and workshops for children, to directly involve schools, including secondary school levels, and to encourage the active participation of young people in research activities to raise their awareness. Finally, the key role of local associations as multiplier agents was highlighted, suggesting their involvement through training and information meetings to replicate the model in other contexts.

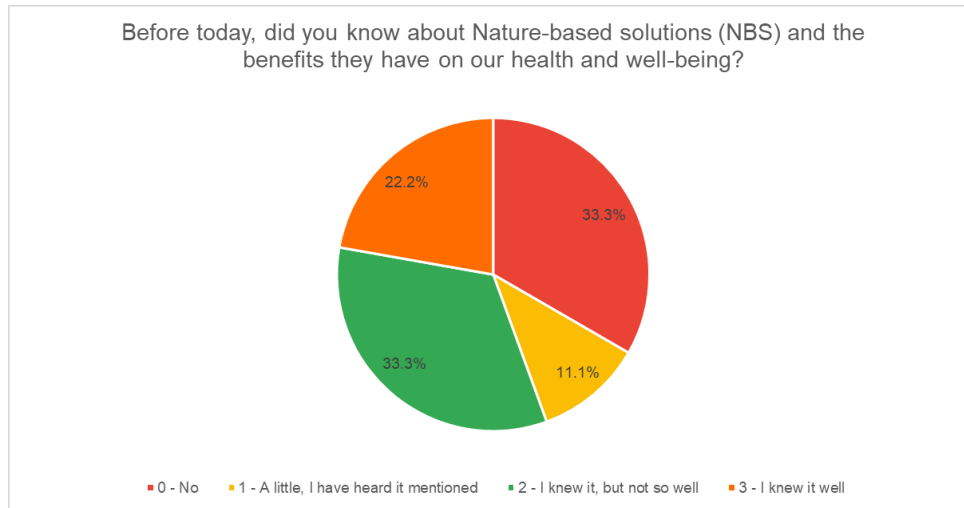


Figure 56: Social Perception of urban ecosystem Castelfranco 3

KPI 7.5 Social values for urban ecosystems and biodiversity

Expected Impact: Increased awareness of urban ecosystems (Direct Impact)

VS(s): 4

Evaluation Method: Co-evaluation (SROI)

Social values for urban ecosystems and biodiversity are based on 3 main engagement methods, each with a workshop and focus group included for every method. These engagement activities are divided as follows; fragile visitors, non-fragile visitors and informal and professional caregivers in the relevant field. Attendance was most prevalent in the non-fragile visitors of the park with a total of 22 people; however, the participation of fragile workers is rather significant by involving 18 people from this disadvantaged group. For the remaining category, 11 representatives from different organisations provided important feedback on the SROI process employed in the pilot site.

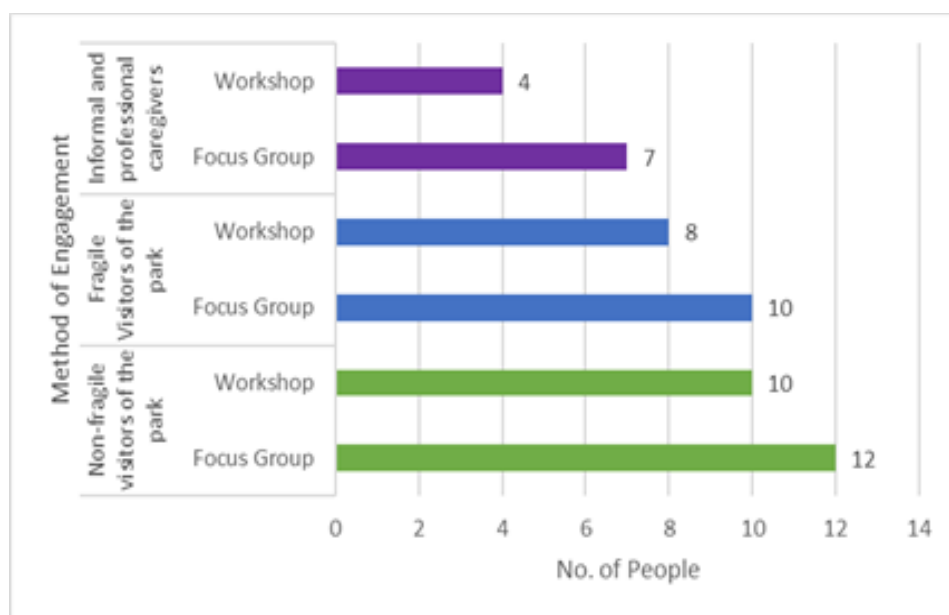


Figure 57: Social Values for Urban Ecosystems and Biodiversity in Castelfranco

KPI 7.6 Inter-departmental collaboration leading to NBS designs for multi-functionality

Expected Impact: Increased governance coordination for NBS (Direct Impact)

VS(s): 4

Evaluation Method: Co-evaluation

Results and Outcomes for KPI 7.6 will be reported in D7.5 - SROI Evaluation for the Castelfranco pilot site.

KPI 7.8 Citizen participation in and co-creation of the design, implementation and evaluation of project interventions

Expected Impact: Increased and improved participation (Direct Impact)

VS(s): 4

Evaluation Method: Co-evaluation

While the Castelfranco pilot leaders have organised several co-creation activities until the end of 2023, the number of the last one, which is the Town Hall event, have been reported

below. The citizen participation in this category was relatively high, amounting to a total of 66 citizens who contributed to the co-creation process.

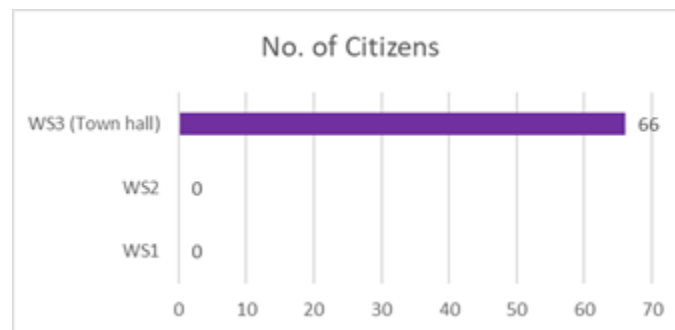


Figure 58: Total no. of Citizens in activities in Castelfranco

This KPI was evaluated by 14 participants, with an average score of 3.5 out of 6. No additional comments were received from participants.

KPI 7.9 Institutional learning concerning acquisition of knowledge and understanding

Expected Impact: Increased institutional capacity (Direct Impact)

VS(s): 4

Evaluation Method: Co-evaluation

Results and Outcomes for KPI 7.9 will be reported in D7.5 - SROI Evaluation for the Castelfranco pilot site

KPI 7.11 Number of individuals that is aware of the project's objectives, content and processes

Expected Impact: Increased and improved participation (Direct Impact)

VS(s): 4

Evaluation Method: Co-evaluation

In Castelfranco, the numbers reported for people who are aware of the project are also those organised for co-creation activities. The number of people for additional activities organised within the pilot site will be reported in 2024. Currently, the total number is 198 people. From this total, 175 people are attendees of the Town Hall event.

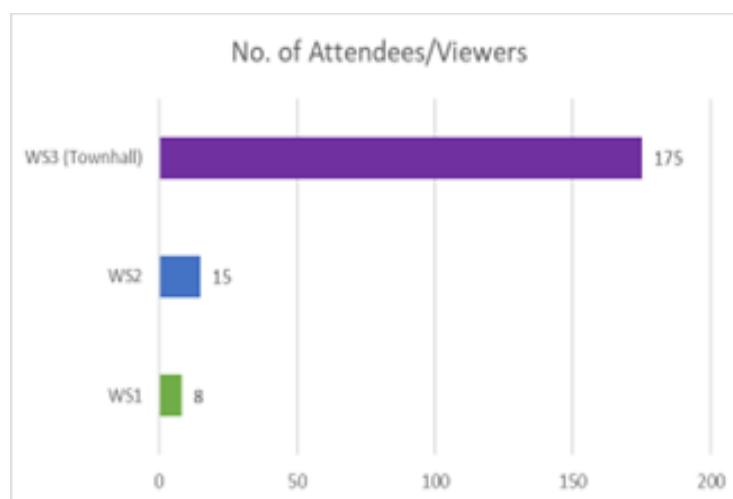


Figure 59: Total no. of people aware of the project in Castelfranco

This KPI was evaluated by 14 participants, with an average score of 4.4 out of 6. Suggestions included publishing the data on the municipality's website, organising a final closing event with the participation of the local community, and using multi-channel communication, incorporating different languages such as art to reach diverse audiences.

Challenge 8

KPI 8.5 Personal and social background of people who participated in the project's activities

Expected Impact: Fair participation to project activities (Direct Impact)

VS(s): 2,4,5

Evaluation Method: Co-evaluation

In the events organised by the Castelfranco representatives, one may observe that the highest participation was achieved in the age bracket of 31-50 years of age, forming 40% of the feedback received. The other categories are showing a similar amount of representation in general, although it is worth noting that people of 18-30 years of age double that of 51-65.

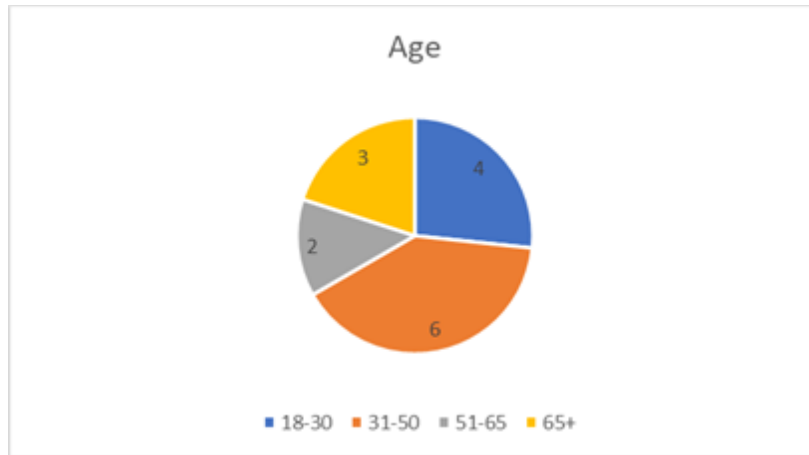


Figure 60: Age groups in Castelfranco activities

When considering the results below, male and female have been engaged equally, both having a percentage of 46.7%. The only other response submitted is coming from a participant who was not comfortable in disclosing gender data about oneself.

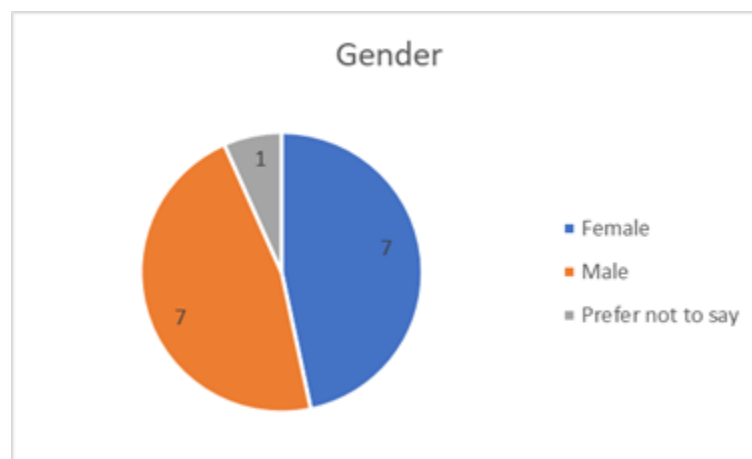


Figure 61: Genders in Castelfranco activities

A large proportion of responses below indicate that representation from the 'heterosexual/straight' category have mostly participated and provided feedback. This is the dominant category with the percentage of 80%. Further engagement from the remaining groups can be improved further with the upcoming activities at the pilot site.

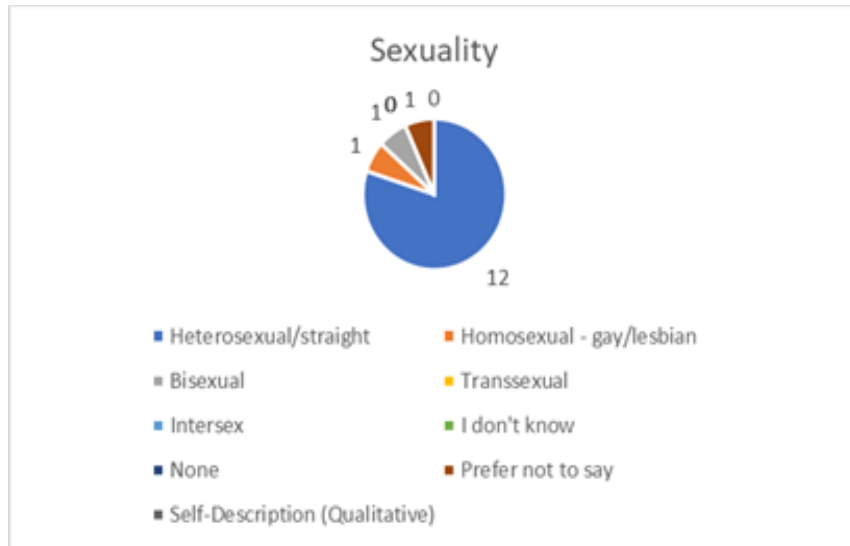


Figure 62: Sexual orientation in Castelfranco activities

Overall, an almost even representation was achieved in the Castelfranco activities from the responses reported. A slight discrepancy is noted in the percentages of the 'privileged' and 'underprivileged' categories. The former is equal to 46.7% while the latter is 53.3%.

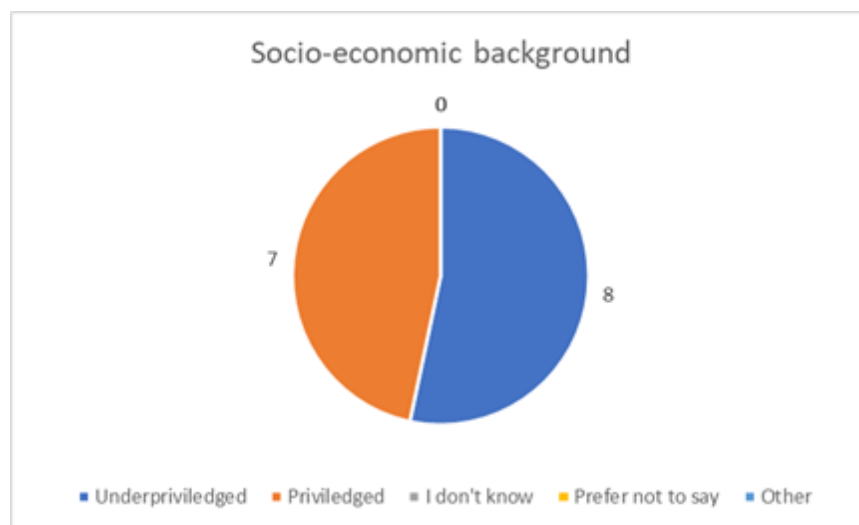


Figure 63: Socio-economic background in Castelfranco activities

Upon analysing the education background of the participant data recorded, persons with a High School qualification stand at 36.4%. This is double the amount of people from those with a master's and 'Part of high school' level of education.

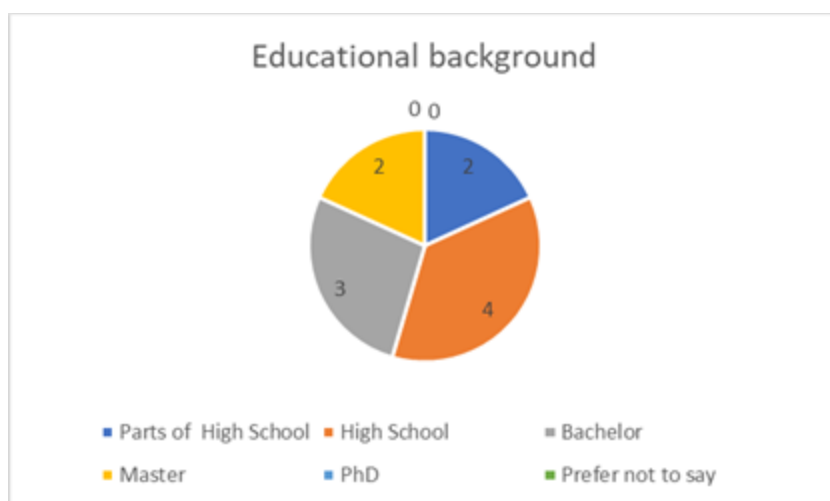


Figure 64: Educational background in Castelfranco activities

The chart below shows that 36.4% of the participants reported being in full-time employment. It also indicated that half of these participants belong to other categories such as, 'self-employed' or 'student', while the number of participants who are retired is in between these values.



Figure 65: Employment status in Castelfranco activities

In the self-description category of the evaluation forms, participants have reported their ethnicity in terms of nationality. Italian participants were clearly the most engaged social group, adding up to 90.9%. The only other response came from a participant of a Romanian nationality.

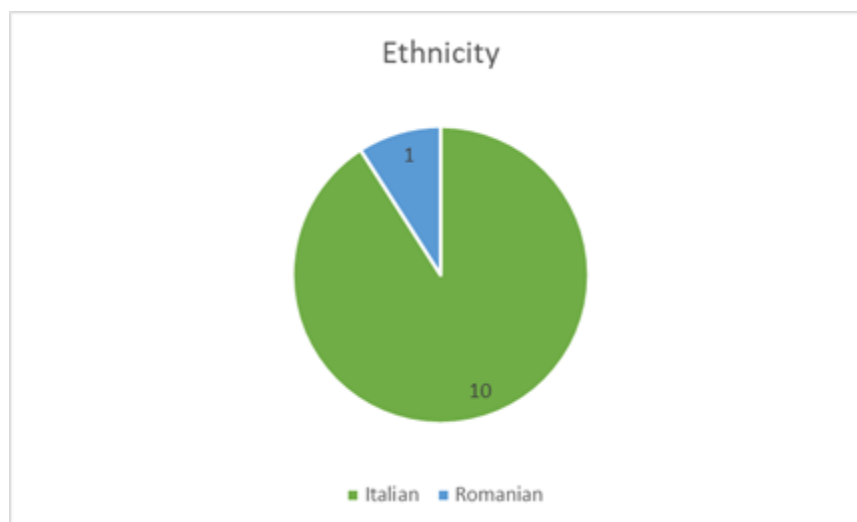


Figure 66: Ethnicity in Castelfranco Activities

The majority of the participants do not suffer from any of the disability categories included below, being 87.5%. The two other responses have reported to suffer from auditory and visual impairment, both at 6.25%.

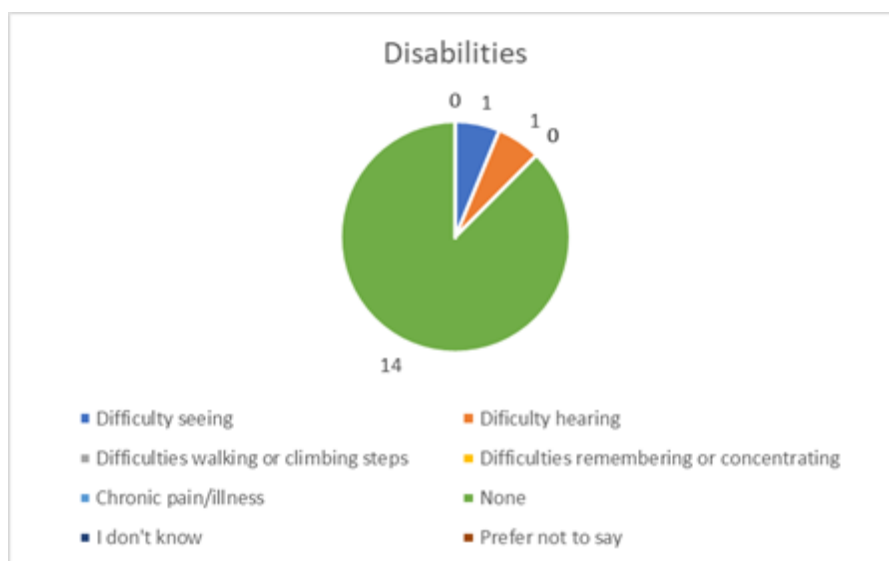


Figure 67: Disabilities in Castelfranco Activities

According to the chart below, the largest share of participants is of a Christian Catholic faith, with 54.6%. The rest of the responses indicate that other participants are part of the 'no religion' category, while one respondent is part of the Christian Orthodox community.

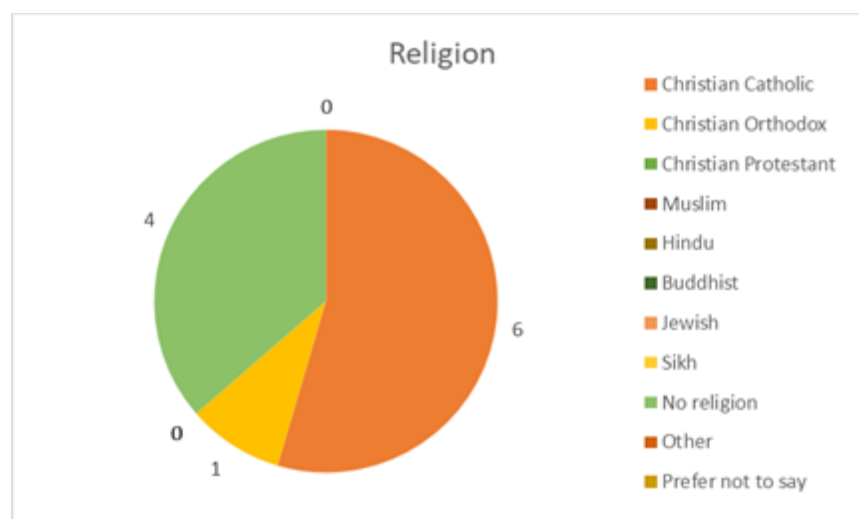


Figure 68: Religions in Castelfranco Activities

This KPI was assessed by 11 participants, obtaining an average score of 2.9 out of 6, the second lowest among the indicators assessed. The only comment received suggests the need to involve more young people in the activities related to this KPI.

KPI 8.8 Participation of individuals with functional disabilities

Expected Impact: Greater inclusion of people with functional disabilities (Direct Impact)

VS(s): 2,4

Evaluation Method: Co-evaluation

The Castelfranco pilot representatives were particularly focusing on people who suffer from dementia during the last years as shown below. The percentages highlight 2023 as the year in which 100% of the people suffering from this disorder have been part of their activities. The other value was reported in 2022 with 7% of the participants being part of this group, while none were reported in 2021.

Year	Number and Percentage	Healthcare Category
2021	0 patients (0%)	Dementia
2022	5 out of 81 patients (7%)	Dementia
2023	8 out of 8 patients (100%)	Dementia

Table 145: Participation of Individuals with Functional Disabilities in Castelfranco

KPI 8.10 Accessibility of open public spaces and buildings for families with baby carriages and individuals with restricted mobility

Expected Impact: Greater inclusion of families with babies and individuals with restricted mobility (Direct Impact)

VS(s): 1,5

Evaluation Method: Pre & Post

Before the intervention, the total open space area accessible to families with baby carriages and individuals with impaired mobility was reported as 0m², whereas the post-implementation measurement recorded 5,000m².

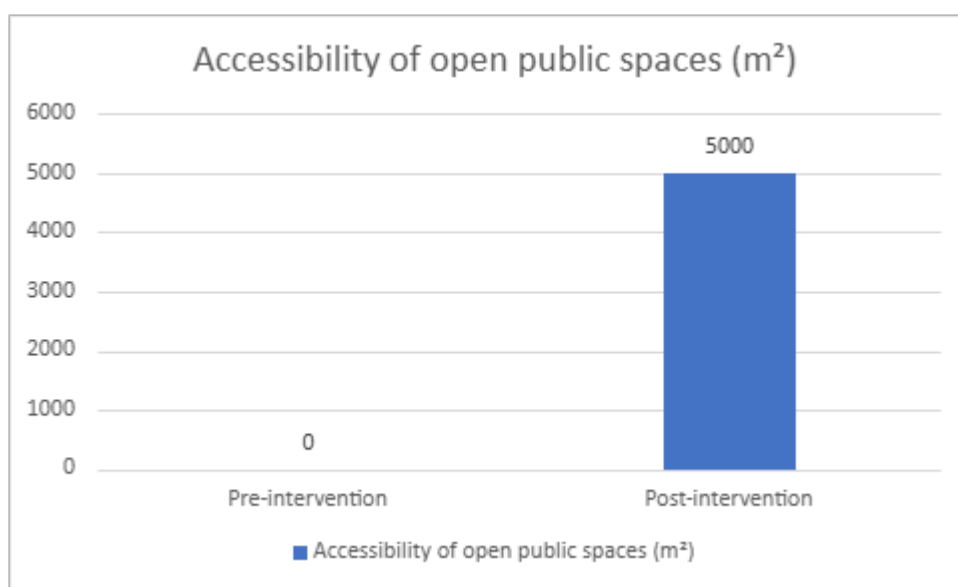


Figure 69: Accessibility of open spaces in Castelfranco

Challenge 9

KPI 9.4 Noise reduction rates (or exposure to noise pollution)

Expected Impact: Increased data on noise pollution exposure (Added value)

VS(s): 3

Evaluation Method: Benchmarking

The following data is from a LoRaWAN IoT noise sensor installed at the garden. This sensor analyses the surrounding ambient sound A-weighted, in the audible frequency

spectrum for the human ear, showing the collected data in dBA. This allows more meaningful data collection in areas saturated by noise.

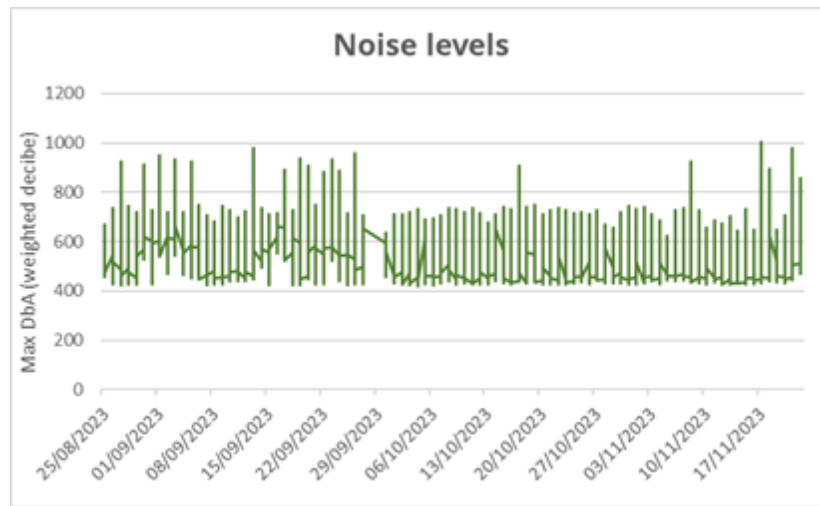


Figure 70: Noise reduction rate in Castelfranco

The A- weighting gives more significance to sounds which register highly to human ears, and research indicates that regular exposure to noise louder than 85 Db(A) is likely to result in hearing loss. Thus, the sound in the garden appears very high according to EU standards from this sensor data.

KPI 9.6 Perceived well-being before and after the visit of green space

Expected Impact: Improved health and wellbeing (Direct Impact)

VS(s): 2,3,5

Evaluation Method: Pre & Post

The data shows a comparison of positive and negative emotions before and after a walk in the garden. All three participants showed a significant increase in positive emotions after the intervention. Participant 1 increased from 10 to 11, Participant 2 from 9 to 14, and Participant 3 from 8 to 15. An increase in negative emotions was noted in Participant 1 and Participant 2, while a decrease in negative emotions was noted in Participant 2.

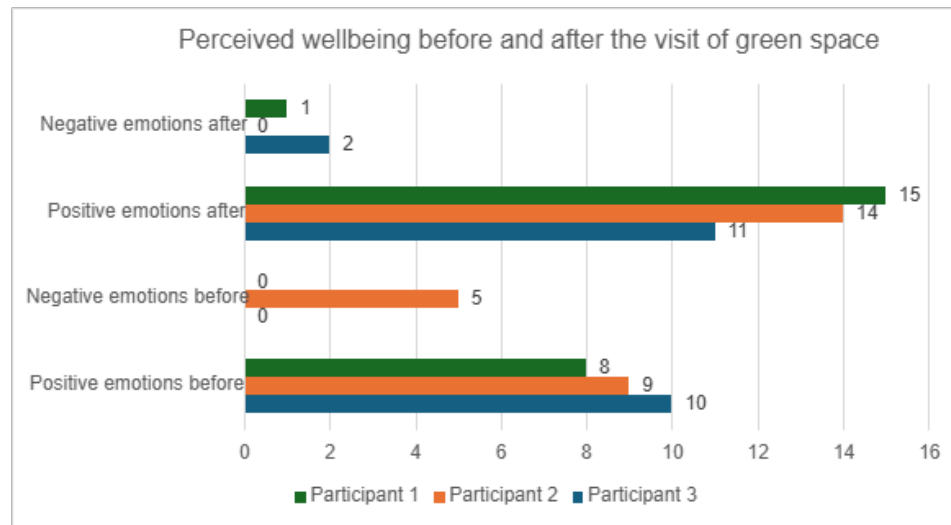


Figure 71: Perceived wellbeing before and after the visit of green space in Castelfranco

KPI 9.7 Assessment of the personal satisfaction about life, emotional competences (ability to understand one's own and other's emotions) and coping strategies regarding everyday problems in healthy older adults (Direct Impact)

Expected Impact: Increased data on health and wellbeing

VS(s): 2

Evaluation Method: Co-evaluation



Figure 72: Psychological Wellbeing Scores in Castelfranco

The BEN-SSC—Questionario Ben-essere Psicologico (“Psychological Well-being Questionnaire”) (De Beni et al., 2008) is a 37-item questionnaire used in Italy to assess psychological well-being in older adults. The overall score, which is calculated as the sum of all item scores, is 86. Older participants completed this questionnaire before visiting the garden.

KPI 9.8 Feeling of improved quality of life

Expected Impact: Increased data on health and wellbeing (Direct Impact)

VS(s): 2

Evaluation Method: Benchmark

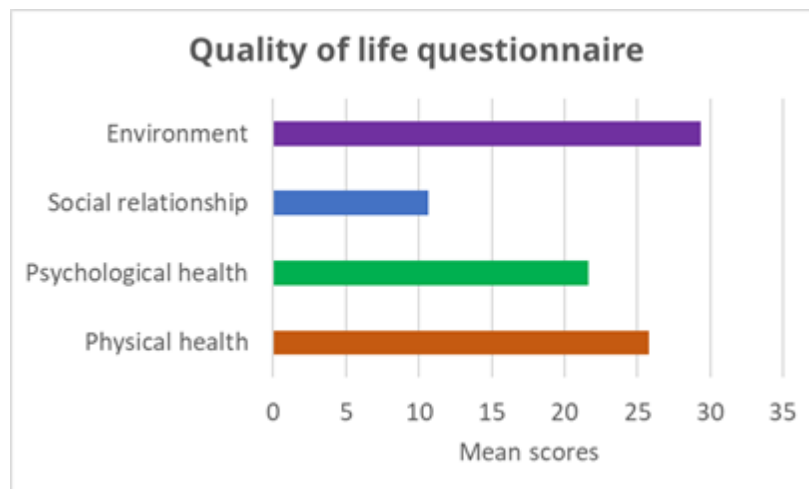


Figure 73: QoL Questionnaire in Castelfranco

The bar chart presents the mean scores from a Quality-of-Life Questionnaire, assessing four key domains: environment (29), social relationships (11), psychological health (22), and physical health (26). The total score is 88, which is slightly below the average total score of approximately 90 for healthy populations.

KPI 9.9 Social and Emotional Loneliness perception

Expected Impact: Increased data on health and wellbeing (Direct Impact)

VS(s): 2

Evaluation Method: Benchmark

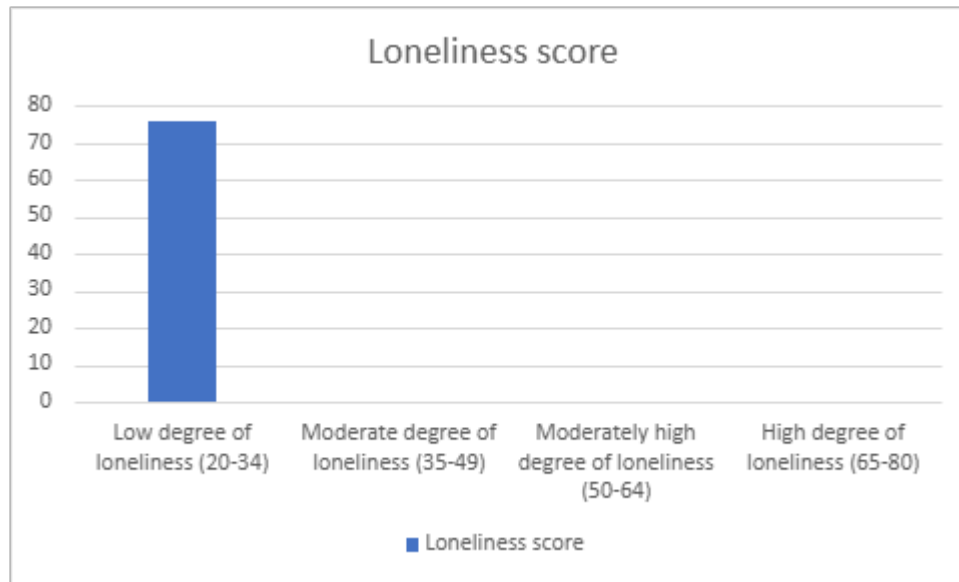


Figure 74: Loneliness score in Castelfranco

The Jong Gierveld loneliness scale ranges from 20 to 80. Higher scores indicate higher loneliness. The most commonly used categorization is the following: 20-34 denotes a low degree of loneliness, 35-49 a moderate degree of loneliness, 50-64 a moderately high degree of loneliness, and 65-80 a high degree of loneliness. The participants in the survey all scored between 20-30, indicating a low degree of loneliness.

KPI 9.10 Cognitive abilities

Expected Impact: Improved cognitive abilities (Direct Impact)

VS(s): 2

Evaluation Method: Pre & Post

Castelfranco administered the Forward and Backward Digit Span tasks (De Beni et al., 2008) for assessing short-term memory and working memory. Memory benefits were calculated as follows: FDS and BDS – scores after walking in the garden minus scores before walking in the garden. A group of 80 young adults and 74 older adults completed the memory tasks before and after visiting the garden.

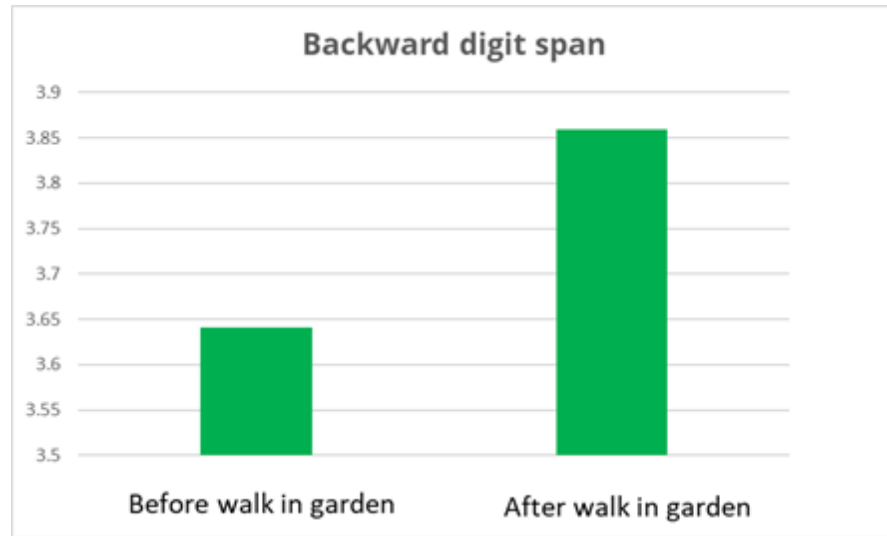


Figure 75: Backward Digit Span in Castelfranco

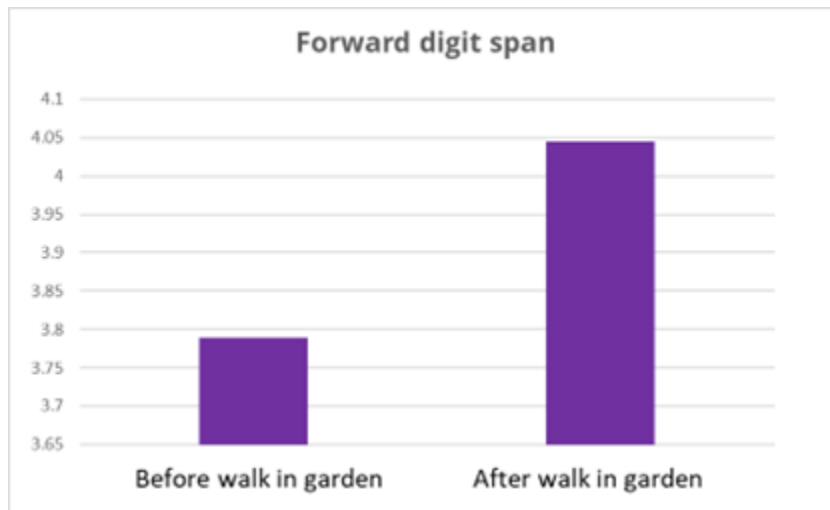


Figure 76: Forward Digit Span in Castelfranco

Interestingly, an increase in both forwards and backwards digit span was observed after the sample population had taken a walk in the garden. This increase in digit span indicates an increase in the short term and working memory after the exposure to the greenery of the NBS.

KPI 9.12 Sense of place and perceived restorativeness

Expected Impact: Enhanced sense of place and restorativeness (Direct Impact)

VS(s): 2

Evaluation Method: Benchmarking

The Perceived Restorativeness Scale is an 11-item questionnaire used for assessing the perceived restorativeness of an environment in terms of four subscales: “being away”, “fascination”, “coherence”, and “scope”. Young and older participants completed this questionnaire after visiting the garden. The questionnaire is designed to consider both physical and psychological restorativeness in a space.

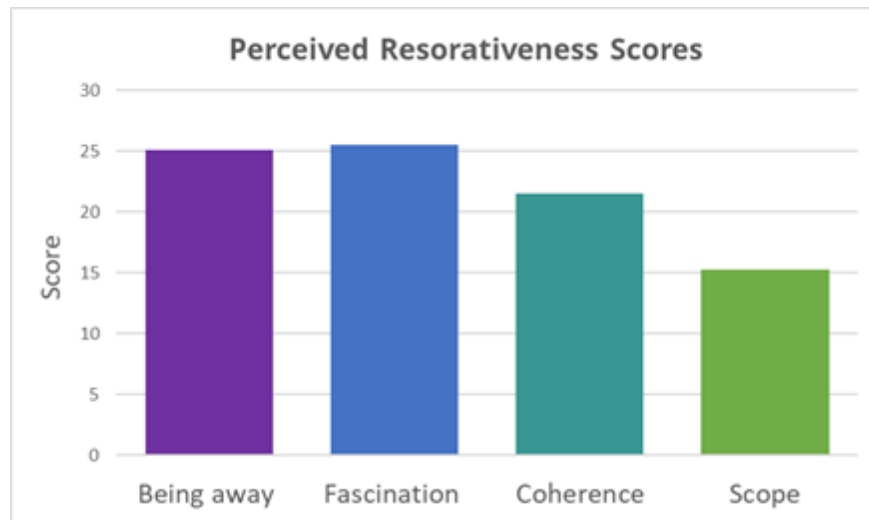


Figure 77: Perceived Restorativeness Scores in Castelfranco

The measurement values refer to the perceived stress scale, with the ranges 0-13 considered as low stress, ranges 14-26 as moderate stress and 27-40 as high stress. The results are positive, with no value above 26 hence keeping the stress at a moderate level, and the Scope remaining as low stress.

The results indicate that the sample population perceived the garden as a restorative space. The participants rated the garden lowest in terms of “Being away” a measure which captures the sense of being free from demands on directed attention, and “Fascination”, which captures the sense of concentrating on something with ease and enjoyment.

KPI 9.13 Residential attachment and residential satisfaction

Expected Impact: Increased residential attachment and satisfaction (Direct Impact)

VS(s): 2

Evaluation Method: Co-evaluation

Castelfranco created an ad hoc 6-item questionnaire for assessing residential attachment (3 items) and residential satisfaction (3 items). A group of 74 older participants completed this questionnaire after visiting the garden. The items involve respondents indicating their agreement on a 5-point Likert scale from 1 (“not at all”) to 10 (“completely”). The scores were considered for each of the two domains (residential attachment, residential satisfaction).

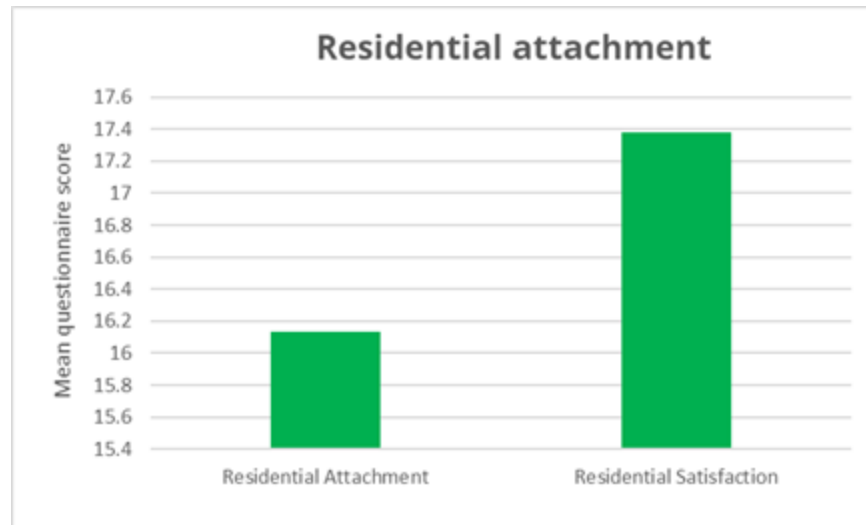


Figure 78: Residential Attachment in Castelfranco

A residential attachment score of 16.1 was observed, and a slightly higher score of 17.4 for residential satisfaction. Residential attachment and satisfaction are frequently influenced by factors such as socio-economic status and inequality. Thus, seeing how these figures correspond to other types of data can provide interesting insight into how these perspectives may vary within a population.

This KPI was evaluated by 12 participants, with an average score of 4.6 out of 6. It was suggested to make the park more open and accessible, as well as to collect life testimonies from residents to reinforce the emotional attachment to the space.

KPI 9.14 Increased data on behavioural and psychological symptoms in dementia

Expected Impact: Increased data on behavioural and psychological symptoms in Dementia (Direct Impact)

VS(s): 2

Evaluation Method: Pre & Post

Participants with neurocognitive disorders were involved in collaboration with the residential care home "Domenico Sartor" near Villa Bolasco, which is a partner of Castelfranco within VARCITIES. To examine the effects of nature exposure on psychophysiological well-being, psychophysiological sensors (EEG, eye tracker, ECG, SC), were applied to participants while they were exposed to nature for ten minutes and derived metrics were correlated with cognitive tests. The number of fixations the eyes of the participants found, as well as the theta power from EEG sensor measures (a measure which is directly linked to Alzheimer's), were assessed and the data is shown here.

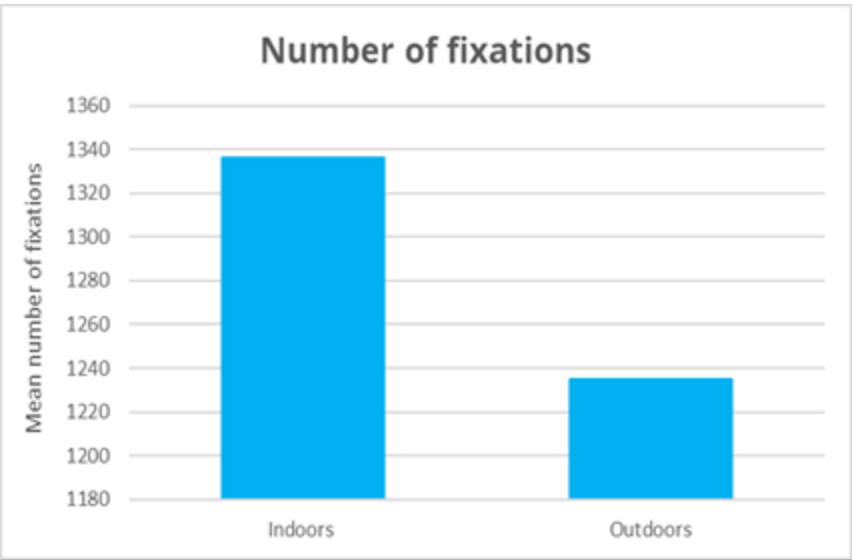


Figure 79: Number of Fixations in Castelfranco



Figure 80: Theta power of EEG measures of participants in Castelfranco

These data show that both the number and duration of fixations were notably higher when the participants were indoors compared to when the participants were outdoors in the garden. This is an indication that the outdoor environment facilitated a greater degree of focus than the indoor environment, reducing the dementia symptoms of the participants

KPI 9.21 Level of physical activity in distances covered and average calories burned

Expected Impact: Increased (physical) health and wellbeing data (Direct Impact)

VS(s): 5

Evaluation Method: Benchmarking

A GPS tracking App on the rugged phones that will be delivered to the visitors to the garden will also record the distances walked by each visitor and an equation to estimate the average calories burned will be applied. The period of data collection lasted from June to the end of October 2023, during weekends, corresponding to the opening season to the public of the garden and to the willingness to participate in the study of the visitors.

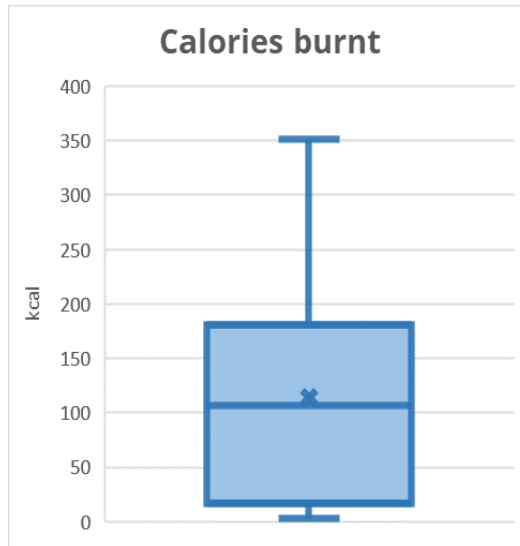


Figure 81: Calories Burnt in Castelfranco

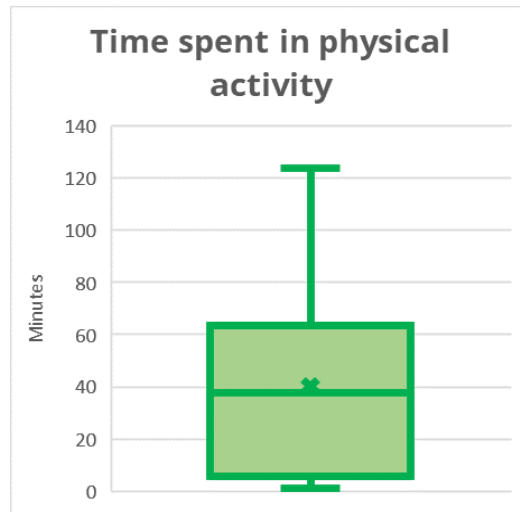


Figure 82: Time Spent Doing Physical Activity in Castelfranco

A wide range of physical activity, both in terms of calories burnt and time spent, was observed over the data collection period. The highest level of calories burnt was 350 from one participant, whereas the longest amount of time spent in physical activity by any participant was 120 minutes.

KPI 9.27 Anxiety levels

Expected Impact: Reduction in anxiety levels (Direct Impact)

VS(s): 2

Evaluation Method: Pre & Post

The Castelfranco pilot administered the State-Trait Anxiety Inventory Y1 and Y2 (STAI-Y1 and STAI-Y2; Spielberger, 2010) for assessing state anxiety (STAI-Y1) and trait anxiety (STAI-Y2) levels. Young and older participants completed STAI-Y2 (20 items) before visiting the garden. Older participants also completed STAI-Y1 (20 items) before and after visiting the garden.

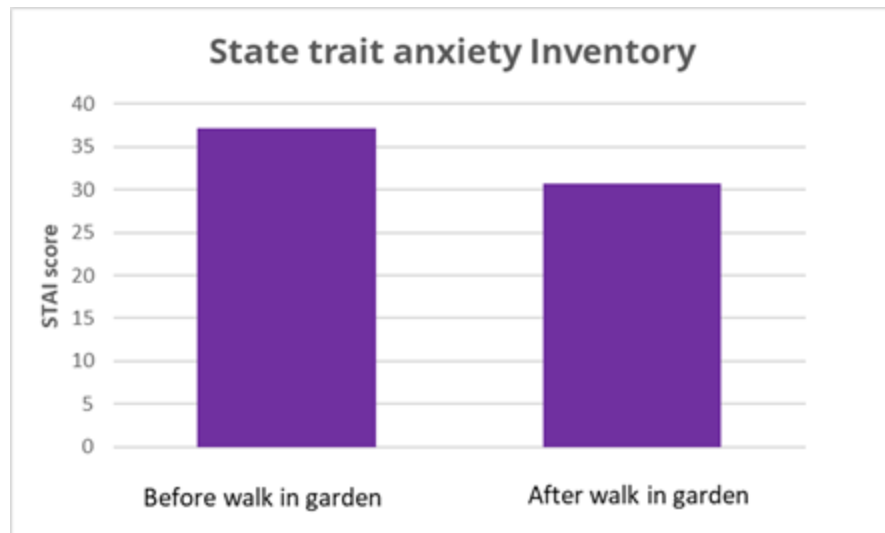


Figure 83: State Trait Anxiety Inventory in Castelfranco

Interestingly, a reduction in anxiety was reported following a walk in the garden (the mean STAI scores dropped from 37 to 31).

KPI 9.28 Affective status

Expected Impact: Increased psychological well-being and/or quality of life: improved positive emotions; reduced negative emotions (Direct Impact)

VS(s): 2

Evaluation Method: Pre & Post

Castelfranco used the Positive and Negative Affective Status (PANAS; Watson et al., 1988). This is a 20-items questionnaire for assessing positive (10 items) and negative effects (10 items). Affective benefits were considered in terms of each domain (positive and negative domain), as follows: PANAS 'post-test' scores after walking in the garden minus PANAS

'pre-test' scores. Young and older participants completed STAI-Y2 (20 items) before visiting the garden.

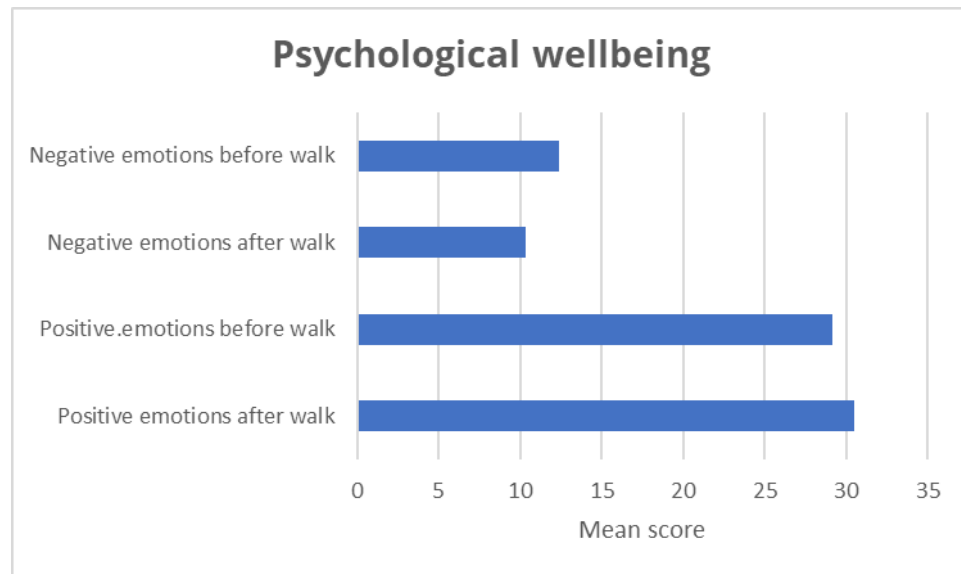


Figure 84: Psychological Wellbeing in Castelfranco

Following a walk in the garden, the participants reported a slight reduction in negative emotions and a slight increase in positive emotions. This data is in line with a small improvement in psychological wellbeing following exposure to the NBS.

Challenge 10

KPI 10.5 Definition of parameters for (re)designing of green public spaces based on the well-being of users

Expected Impact: Increased parameters for (re)designing green public spaces

VS(s): 3,4

Evaluation Method: Co-evaluation

This KPI was not measured.

KPI 10.6 Replication of solutions

Expected Impact: High replication potential of Visionary Solutions (Direct Impact)

VS(s): 4

Evaluation Method: Co-evaluation

The graphs below present the number of responses regarding the replicability of various solutions.

- Blue and green areas for citizens' H&WB

The majority of respondents rated replicability as high (21 responses) followed closely by those who rated it as moderate (18 responses),

- Analysis and monitoring of psychological and physiological WB for elderly & people affected by Alzheimer

This solution received an equal number of responses for low and moderate replicability (19 responses each), suggesting a more divided perception of its scalability and transferability.

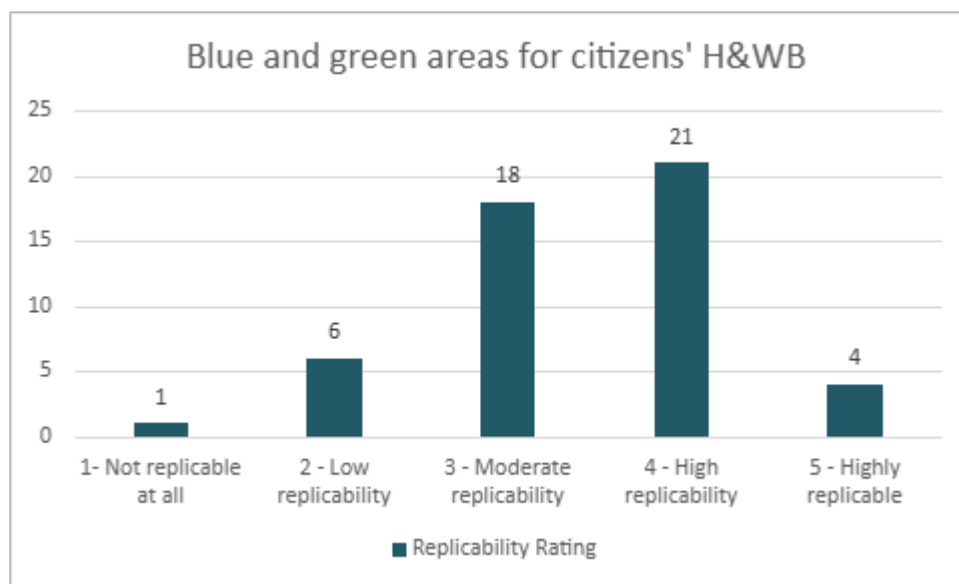


Figure 85: Castelfranco VS Group 1 replication potential

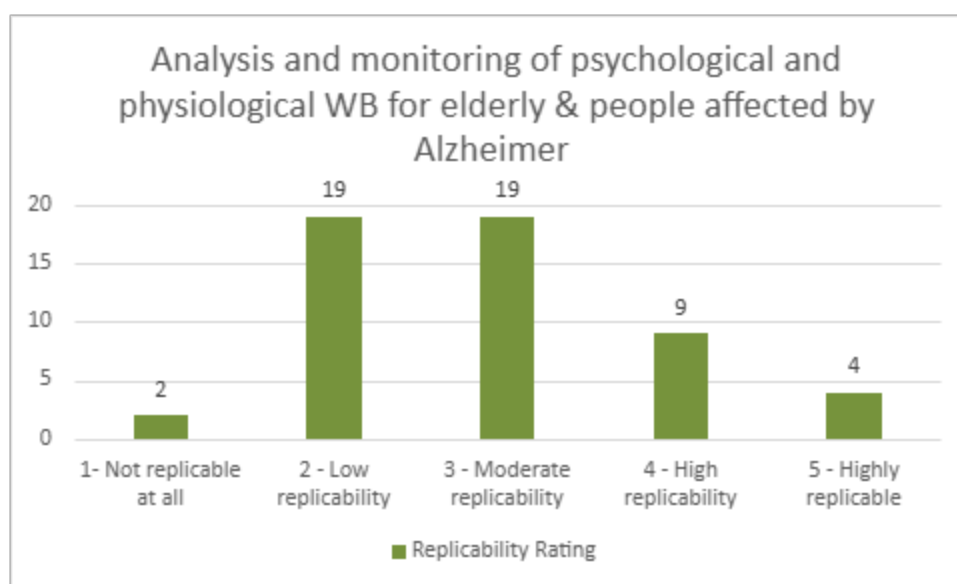


Figure 86: Castelfranco VS Group 2 replication potential

KPI 10.7 Number of elderly health care institutions involved in 5 years

Expected Impact: Increased elderly health care institutions involved (Direct Impact)

VS(s): 2,4

Evaluation Method: Co-evaluation

The total number of elderly healthcare institutions involved in the pilot site was 7. Below is a table listing the name, type of each institution, and the year the institution was involved:

Year	Name of institution	Type of institution
2021, 2023	Centro Residenziale per Anziani "Domenico Sartor"	Residential care unit for elderly
2021	Casa di Cura "Madonna del Buoncammino" S.r.l.	Services for elderly
2021	Opera Immacolata Concezione (OIC) Padova ONLUS	Services for fragile elderly people
2021	Istituto Oncologico Veneto (IOV)	Diagnosis and treatment of cancer
2021	Federazione Veneta Solidarietà Alzheimer	Services for Alzheimer's patients

2021	Centro polifunzionale "Casa Madre Teresa di Calcutta"	Servizi "Casa Madre Teresa di Calcutta"	Services and residential care unit for people with cognitive disabilities
2021	Centro Servizi per Anziani di Monselice		Services for elderly

Table 146: Elderly institutions in Castelfranco activities

This KPI was assessed by 14 participants, with an average score of 2.8 out of 6, the lowest of all. On this occasion, no additional comments were received.

KPI 10.9 Public & private investments during/after the project

Expected Impact: Increased public & private investments (Direct Impact)

VS(s): 4

Evaluation Method: Pre & Post

Castelfranco Veneto secured a total investment of €5,117,492.00, driven predominantly by substantial in-kind contributions, notably local government support of €416,984.00 and funding from the Ministry of Economy and Finance (MEF) amounting to €380,491.00. EU funding (€37,001.00) covered infrastructure (€32,365.00) and community engagement (€4,636.00). Future funding opportunities for Castelfranco aim to support the expansion of green infrastructure and the integration of sustainable urban solutions. Local Sustainability Grants could facilitate the development of additional green spaces, with the potential to add more public benches and shaded areas to enhance community well-being. European Green Deal Funding offers the potential to enhance health monitoring technologies, providing opportunities to scale pilot projects through the integration of advanced tech solutions. Furthermore, the LIFE Programme focuses on improving integrated urban and energy planning, with specific opportunities for Castelfranco to participate in the PLENTY-LIFE project. This involvement would promote stakeholder-based, holistic approaches to spatial and energy planning, fostering more sustainable and resilient urban environments.

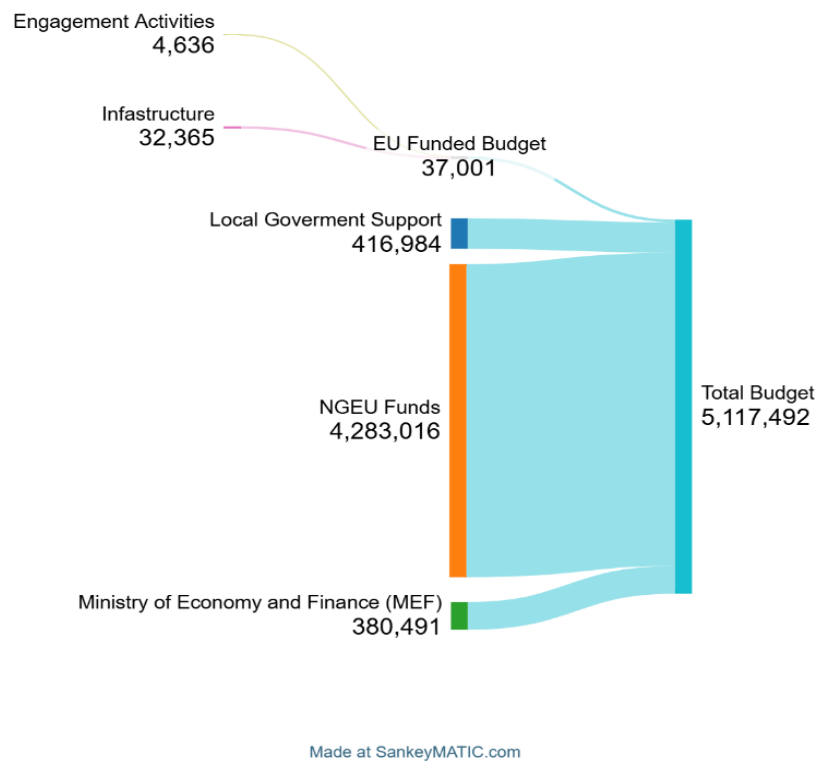


Figure 87: Current public & private investment in Castelfranco

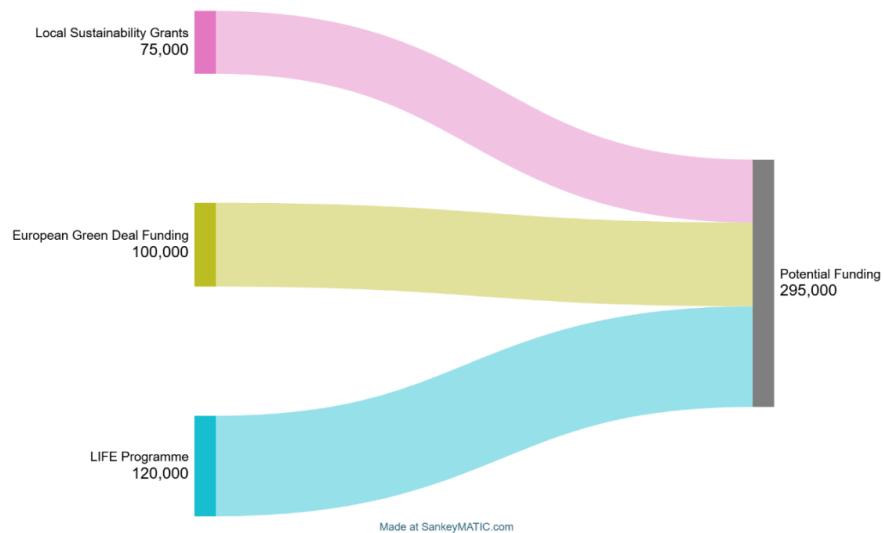


Figure 88: Future public & private investment in Castelfranco

A2.2 Chania

Challenge 1

KPI 1.1 Carbon removed/stored by vegetation

Expected Impact: To develop and apply a health-relevant, indicator-based approach for assessing urban green spaces, examining how specific characteristics of two parks in Chania—such as greenness, air quality regulation, and thermal comfort—relate to human health and well-being, in order to inform evidence-based urban planning (Added value)

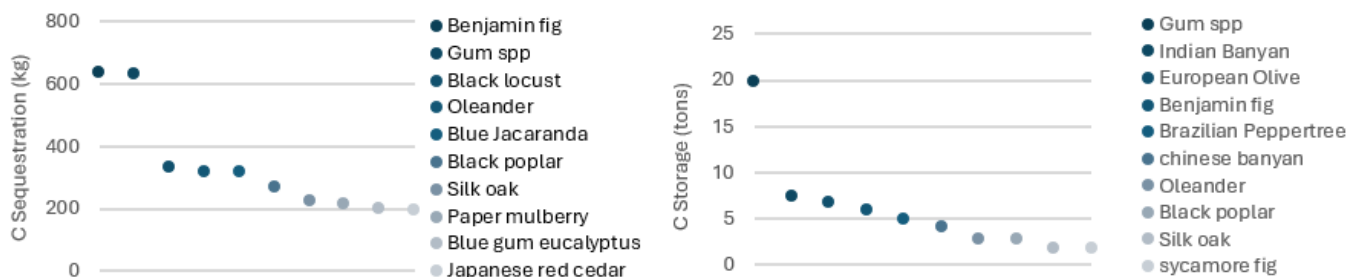
VS(s): 1

Evaluation Method: Benchmarking (*See discussion section of research publication: Lilli, A., Tsekeri, E. & Kolokotsa, D. A health relevant approach for assessing urban green spaces. Discover Cities 1, 37 (2024). <https://doi.org/10.1007/s44327-024-00029-z>*)

The bar charts below present the amount of carbon sequestered and stored by different tree species in two Chania parks—Municipal Garden (MGC) and Agioi Apostoloi Park (SAP)—based on 2023 data. Details for each site are provided below.

MGC sequesters 5.73 tons of carbon annually and stores 77.3 tons, with Gum spp contributing to approximately 25.6% of the total carbon stored and Benjamin fig being the most effective at sequestration.

In contrast, SAP sequesters 21.64 tons of carbon and stores 1,107 tons, with Blue gum eucalyptus accounting for about 80.1% of the total carbon stored and Aleppo pine sequestering around 46% of all sequestered carbon.



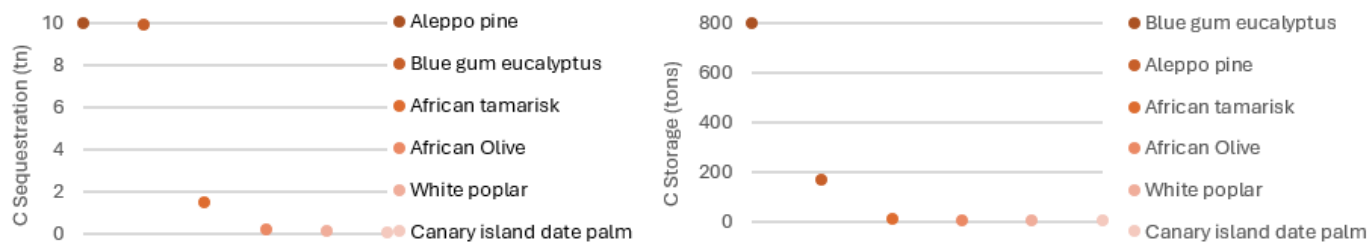


Figure 89: Annual carbon sequestration (left) and storage (right) in vegetation calculated for most common species in MGC (up) and SAP (down) in Chania

KPI 1.2 Decrease in mean or peak daytime local temperatures

Expected Impact: To develop and apply a health-relevant, indicator-based approach for assessing urban green spaces, examining how specific characteristics of two parks in Chania—such as greenness, air quality regulation, and thermal comfort—relate to human health and well-being, in order to inform evidence-based urban planning (Added value)

VS(s): 1

Evaluation Method: Benchmarking (See discussion section of research publication: Lilli, A., Tsekeri, E. & Kolokotsa, D. A health relevant approach for assessing urban green spaces. *Discover Cities* 1, 37 (2024). <https://doi.org/10.1007/s44327-024-00029-z>)

The figure below compares the reduction in peak daytime local temperature recorded in 2023 at two urban green spaces in Chania: the Municipal Garden (MGC) and Agioi Apostoloi Park (SAP). MGC shows greater temperature variability and higher peak reductions, indicating a stronger cooling effect compared to SAP.

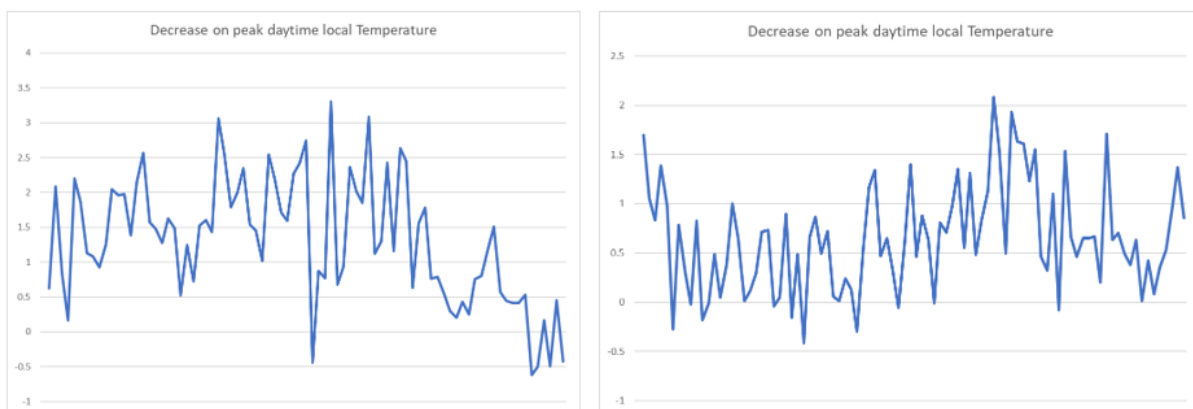


Figure 90: Reduction in peak daytime local temperature in MGC (left) and SAP (right), based on 2023 measurements in Chania

KPI 1.3 Measures of human comfort

Expected Impact: To develop and apply a health-relevant, indicator-based approach for assessing urban green spaces, examining how specific characteristics of two parks in Chania—such as greenness, air quality regulation, and thermal comfort—relate to human health and well-being, in order to inform evidence-based urban planning (Added value)

VS(s): 1

Evaluation Method: Benchmarking (*See discussion section of research publication: Lilli, A., Tsekeri, E. & Kolokotsa, D. A health relevant approach for assessing urban green spaces. Discover Cities 1, 37 (2024). <https://doi.org/10.1007/s44327-024-00029-z>*)

Figures 87 – 94 below present a detailed comparison of maximum daily thermal stress levels between green spaces (MGC and SAP) and surrounding urban areas throughout the summer season. In MGC, the data reveal that extreme heat stress was recorded on 0.6% of days, very strong heat stress on 14.2% of days, strong heat stress on 22% of days, moderate heat stress on 59% of days, and no heat stress on 4.2% of days. In the adjacent urban area, very strong heat stress occurred on 6% of days, strong heat stress on 69.9% of days, moderate heat stress on 22.9% of days, and no heat stress was recorded on 1.2% of days.

Similarly, SAP experienced very strong heat stress on 1.4% of days, strong heat stress on 43.5% of days, moderate heat stress on 48.9% of days, and no heat stress on 6.3% of days. In the corresponding urban area, very strong heat stress occurred on 2.2% of days, strong heat stress on 58.7% of days, moderate heat stress on 34.8% of days, and no heat stress on 4.3% of days.

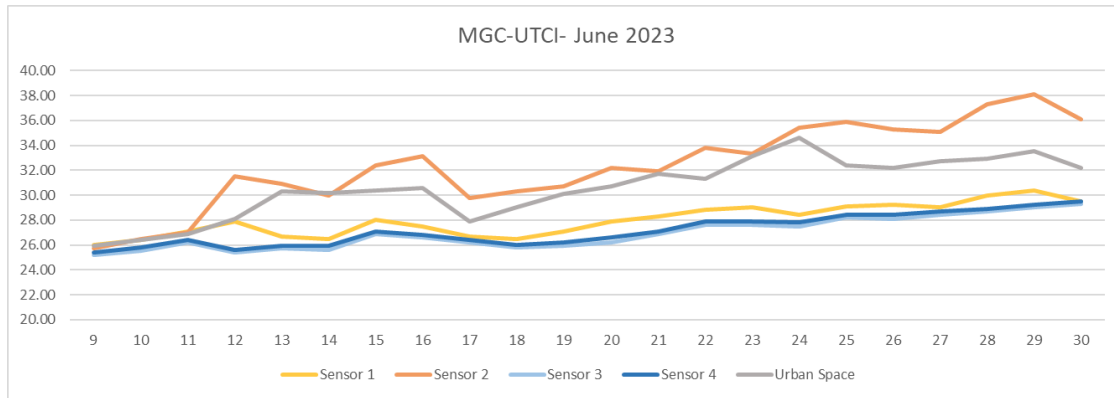


Figure 91: June UTCI Measurements in MGC in Chania

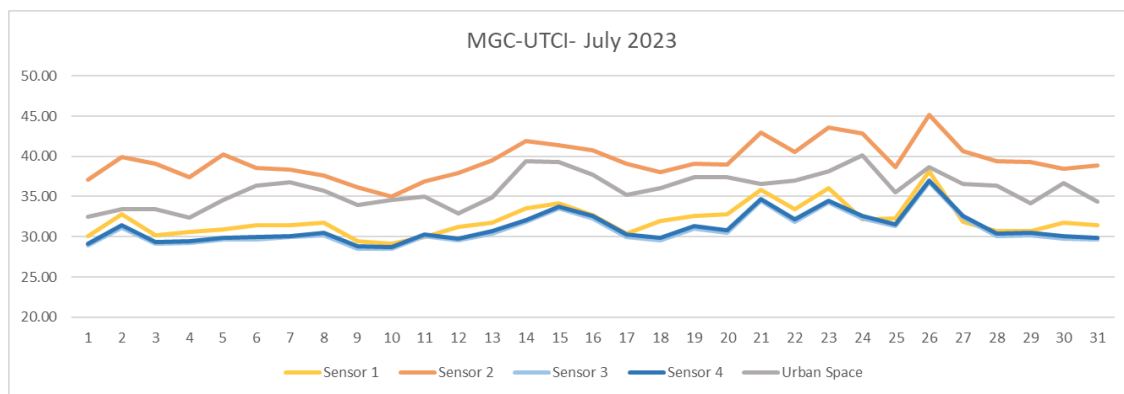


Figure 92: July UTCI Measurements in MGC in Chania

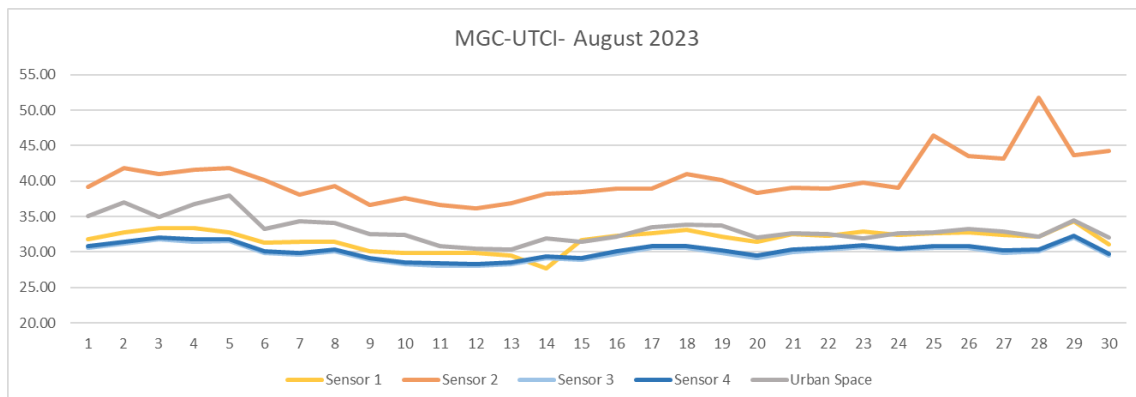


Figure 93: August UTCI Measurements in MGC in Chania

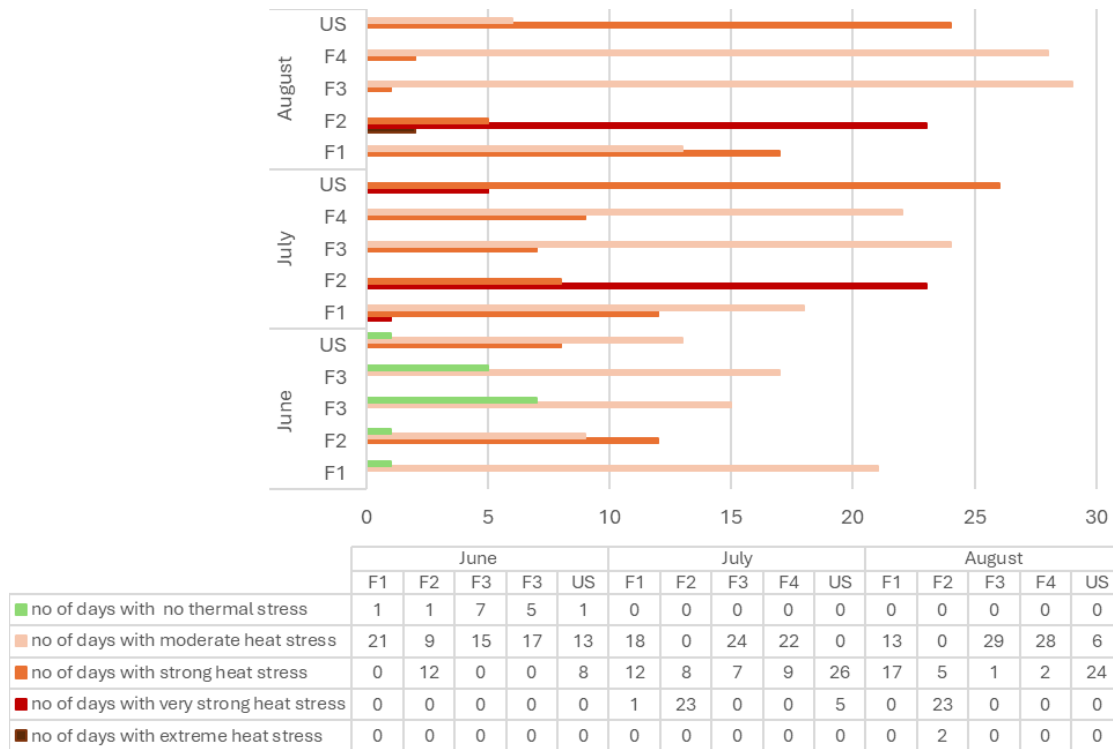


Figure 94: Maximum daily thermal stress during the summer months of 2023 as revealed by UTCI measurements. Recordings from 5 monitoring stations for MGC in Chania

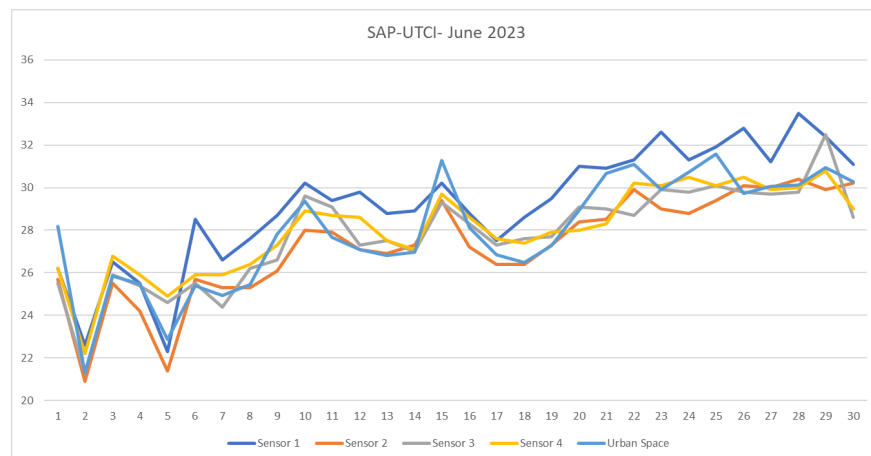


Figure 95: June UTCI Measurements in SAP in Chania

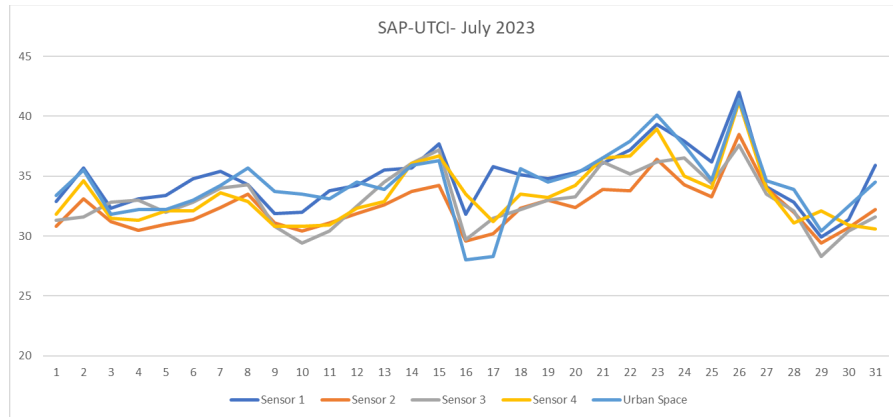


Figure 96: July UTCI Measurements in SAP in Chania

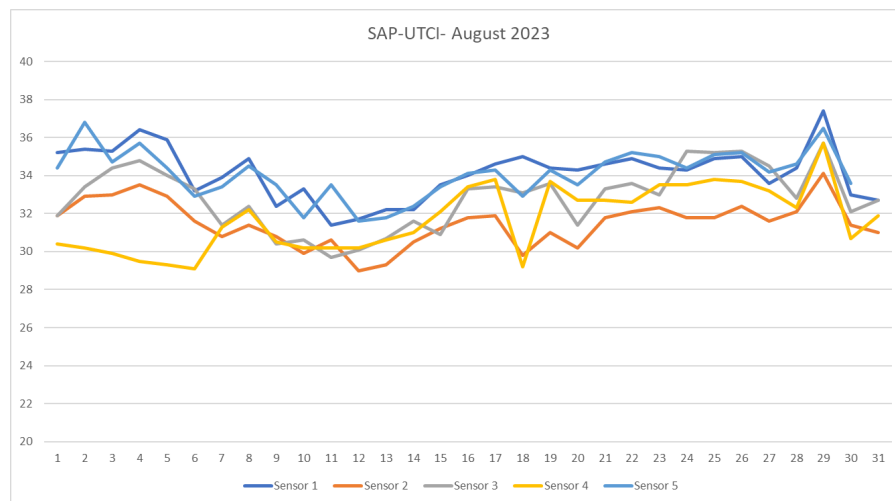


Figure 97: August UTCI Measurements in SAP in Chania

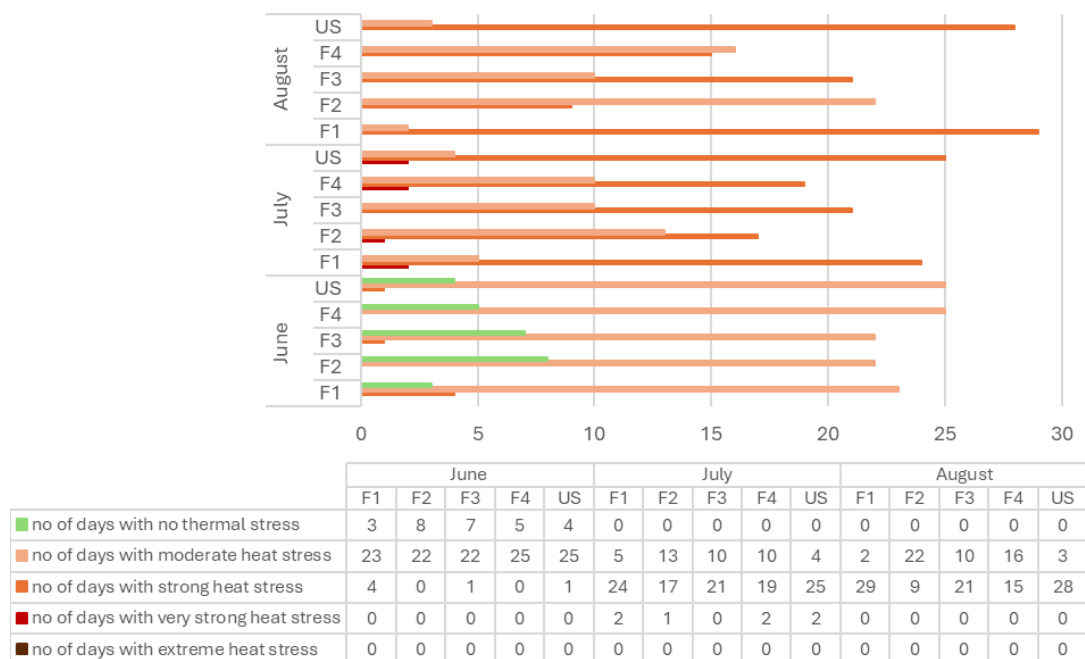


Figure 98: Maximum daily thermal stress during the summer months of 2023 as revealed by UTCI measurements. Recordings from 5 monitoring stations for SAP in Chania

Figure 95, below provides a detailed analysis of thermal stress distribution within green spaces, based on data collected from various measurement points (M) using mobile weather stations during the two days of heatwaves. The grouping of these points according to the frequency of heat stress incidents over the observed days offers significant insights into spatial variability in thermal stress and further highlights the importance of green space design. For example, certain points in MGC, such as M2 and M4, predominantly experienced moderate thermal stress, while M8 and M12 recorded higher stress levels, with a significant portion classified as very strong. In SAP, similar patterns were observed, with M7 notably recording extreme thermal stress.

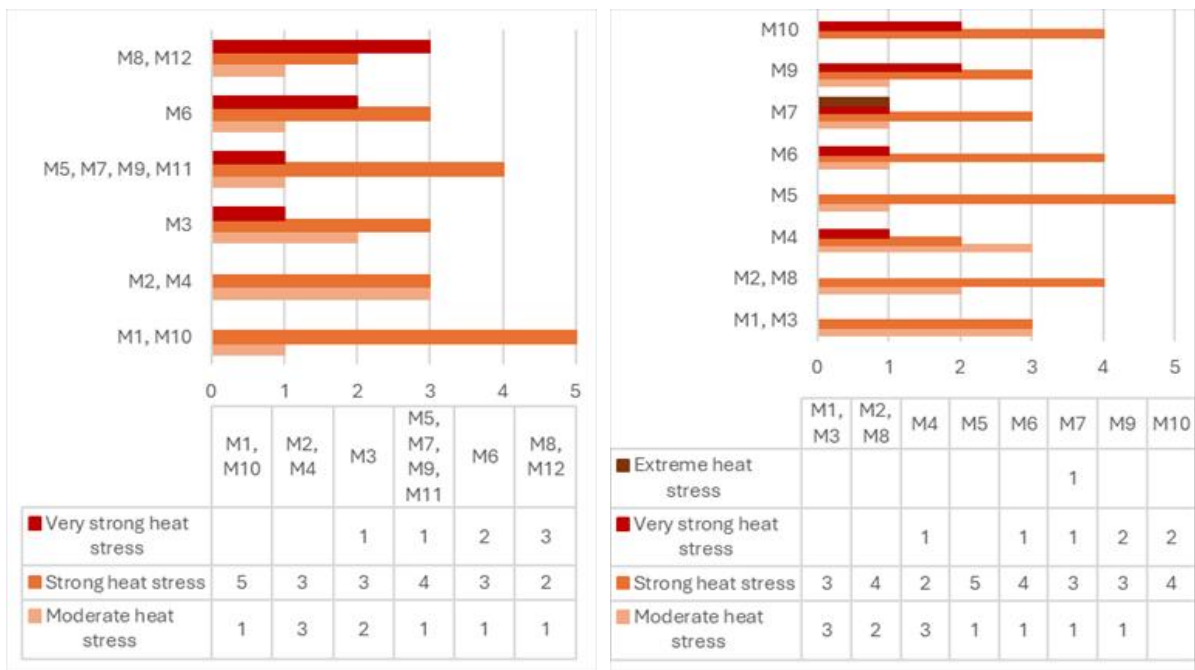


Figure 99: Maximum thermal stress distribution for two summer days of 2023. Recordings from Mobile weather station for MGC (left) and SAP (right) in Chania

KPI 1.5 Local energy production from renewable energy sources

Expected Impact: Increased energy savings (Direct Impact)

VS(s): 1

Evaluation Method: Pre-Post Intervention

The graph shows monthly photovoltaic (PV) energy production from July 2024 to June 2025 measured in kilowatt-hours (kWh). Overall, PV output remains relatively stable throughout the year, ranging from a minimum of 60.8 kWh in February to a peak of 78.8 kWh in January. Other months with high production include August (78.2 kWh) and March (74.6 kWh), suggesting strong system performance beyond the summer months. Despite seasonal variations in sunlight, the system demonstrates consistent energy generation. Notably, the high output during winter months such as January and March indicate effective system efficiency even under potentially lower solar irradiance. The lowest production in February still exceeds 60 kWh, reinforcing the reliability of the system year-round.

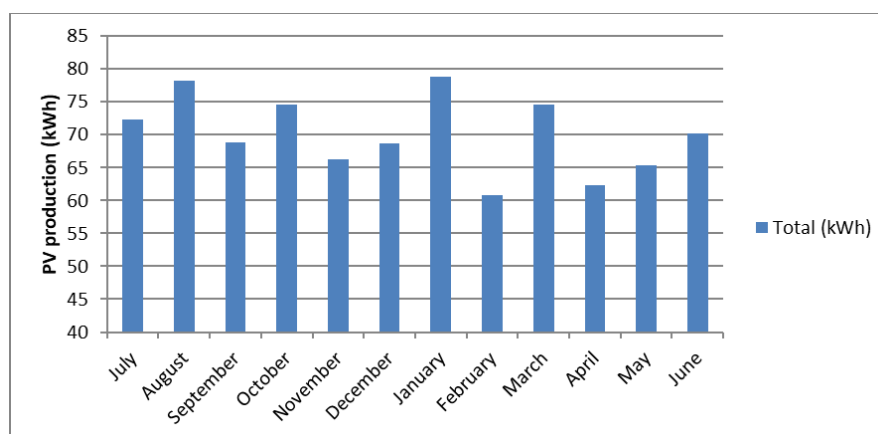


Figure 100: Chania local energy production

KPI 1.6 Monthly mean value of daily maximum temperature

Expected Impact: To develop and apply a health-relevant, indicator-based approach for assessing urban green spaces, examining how specific characteristics of two parks in Chania—such as greenness, air quality regulation, and thermal comfort—relate to human health and well-being, in order to inform evidence-based urban planning (Added value)

VS(s): 1

Evaluation Method: Benchmarking (*See discussion section of research publication: Lilli, A., Tsekeri, E. & Kolokotsa, D. A health relevant approach for assessing urban green spaces. Discover Cities 1, 37 (2024). <https://doi.org/10.1007/s44327-024-00029-z>*)

Figures 97-100 below present the monthly mean values of daily maximum temperatures for both green spaces. Temperature differences between the designated green spaces and surrounding urban areas in MGC were 2.2°C, 3.4°C, and 1°C for June, July, and August, respectively, with an average summer difference of 2.2°C. In SAP, the corresponding temperature differences were 0.68°C, 0.51°C, and 1.19°C, resulting in an average summer difference of 0.82°C. Notably, different points within MGC exhibited significant temperature variations, ranging from 3.06°C to 7.15°C, while variations within SAP ranged from 2.2°C to 2.8°C.

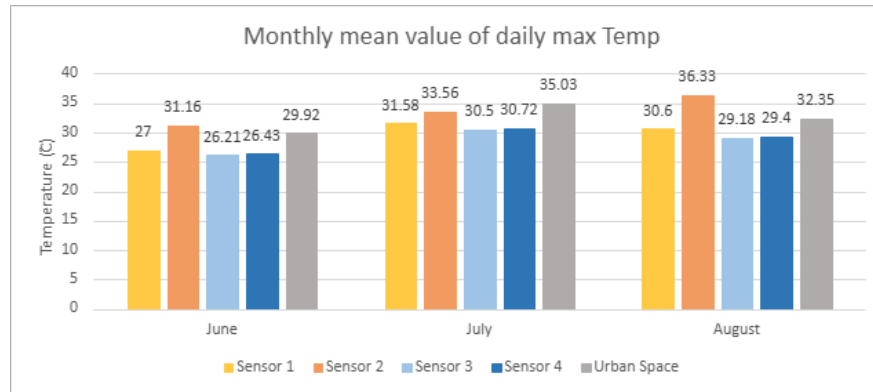


Figure 101: Monthly Mean for Daily Maximum Temperatures during the summer months of 2023. Recordings from 5 monitoring stations for MGC in Chania

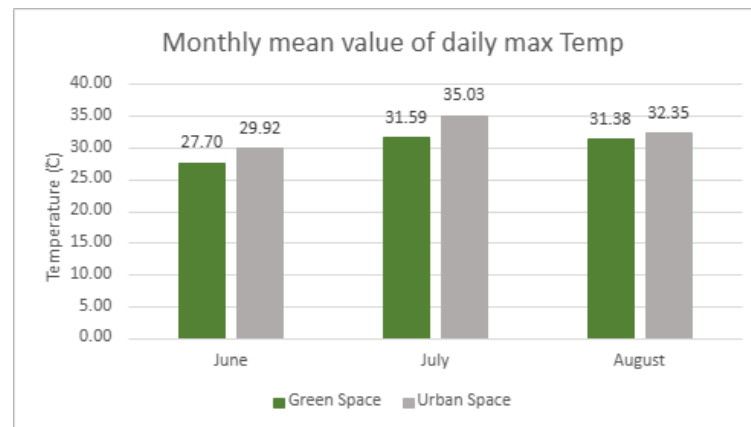


Figure 102: Monthly mean value of daily maximum temperature in MGC vs Urban Space in Chania

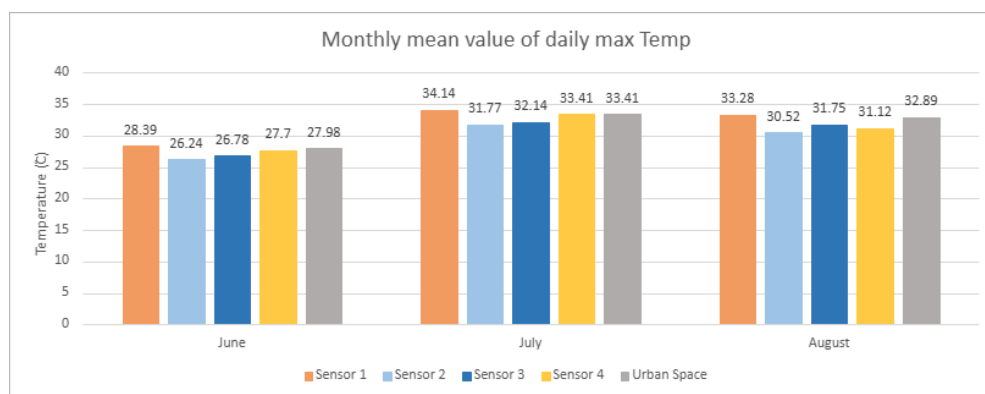


Figure 103: Monthly Mean for Daily Maximum Temperatures during the summer months of 2023. Recordings from 5 monitoring stations for SAP in Chania

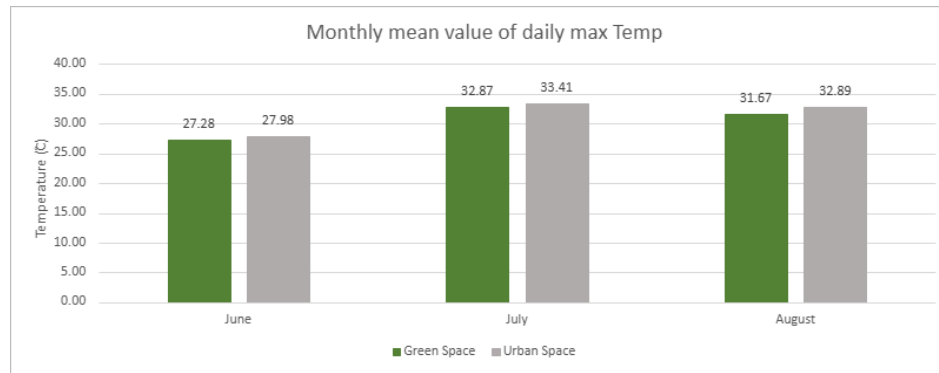


Figure 104: Monthly mean value of daily maximum temperature in SAP vs Urban Space in Chania

KPI 1.7 Cooling of ambient air

Expected Impact: To develop and apply a health-relevant, indicator-based approach for assessing urban green spaces, examining how specific characteristics of two parks in Chania—such as greenness, air quality regulation, and thermal comfort—relate to human health and well-being, in order to inform evidence-based urban planning (Added value)

VS(s): 1

Evaluation Method: Benchmarking (*See discussion section of research publication: Lilli, A., Tsekeri, E. & Kolokotsa, D. A health relevant approach for assessing urban green spaces. Discover Cities 1, 37 (2024). <https://doi.org/10.1007/s44327-024-00029-z>*)

Delving further into the analysis of variations between green spaces and surrounding urban areas, the Figure below provides details concerning the capacity for cooling ambient air for both MGC and SAP. The findings highlight the variability in cooling effectiveness between the two environments. MGC provided cooling of less than 1°C on 34.9% of summer days, while on 26.5% of days, the cooling effect exceeded 3°C, with a peak cooling of 5.4°C recorded on July 30th. In contrast, SAP provided cooling of less than 1°C on 51.6% of summer days, and only 2.2% of days saw cooling effects above 3°C, with a maximum cooling of 3.2°C on August 2nd.

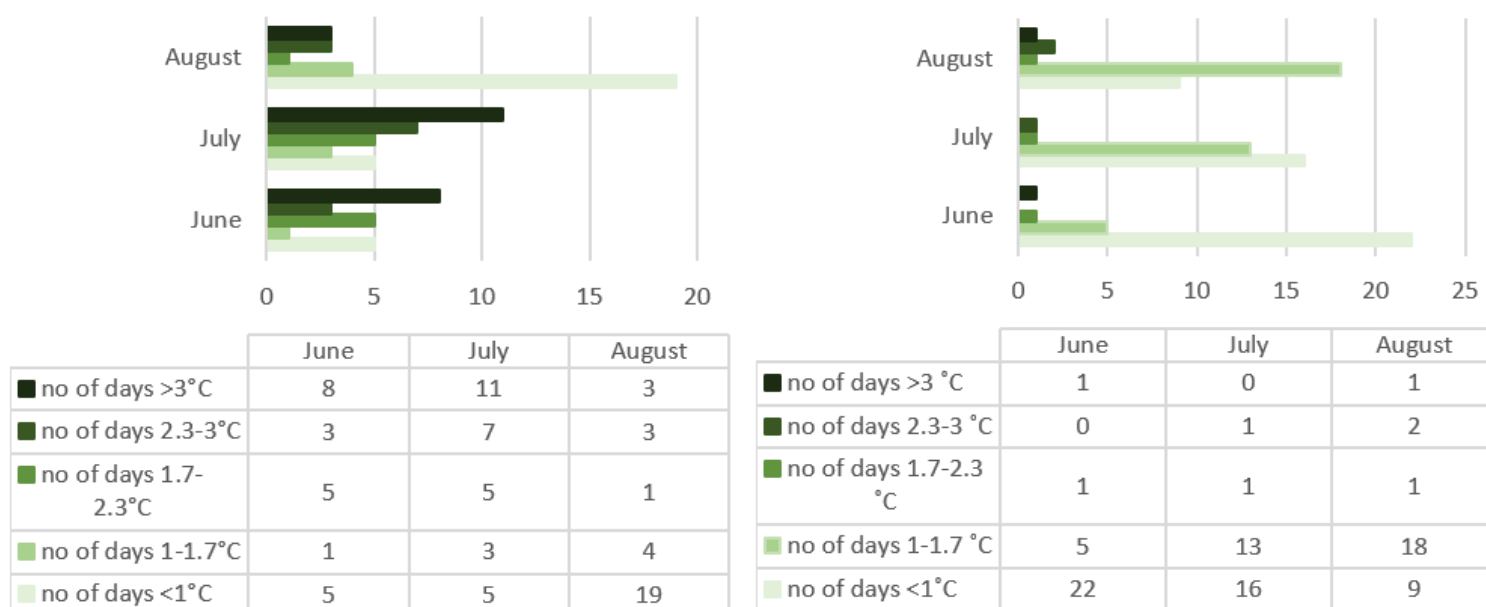


Figure 105. Cooling of ambient air during the summer months of 2023. Recordings from 5 monitoring stations for MGC (left) and SAP (right) in Chania

KPI 1.8 Number of temperature and humidity data

Expected Impact: 1)To develop and apply a health-relevant, indicator-based approach for assessing urban green spaces, examining how specific characteristics of two parks in Chania—such as greenness, air quality regulation, and thermal comfort—relate to human health and well-being, in order to inform evidence-based urban planning. 2)To develop and apply a health-relevant, indicator-based approach for assessing air quality in Chania, Greece, by analysing data from mobile environmental sensors measuring PM_{2.5}, PM₁₀, temperature, and humidity, and linking pollution levels to spatial patterns and urban morphology, in order to inform evidence-based environmental health policies and sustainable urban planning (Direct Impact)

VS(s): 1,2

Evaluation Method: Pre & Post Intervention

VS1:

- Pre-Intervention:

Prior to the implementation of VS1, there were no available records or systematic

monitoring of temperature and humidity in the city of Chania. This lack of baseline environmental data limited the city's capacity to assess local microclimatic conditions or identify areas vulnerable to thermal stress.

- **Post-Intervention:**

The deployment of fixed environmental sensors equipped in VS2, significantly improved Chania's monitoring infrastructure. This intervention generated approximately 192,128 data points for each environmental parameter, temperature and relative humidity, offering continuous, location-specific insights into local climatic conditions.

VS2:

- **Pre-Intervention:**

Similar to VS1, no temperature or humidity data had been collected prior to the rollout of VS2. The absence of spatially distributed real-time data hindered understanding of thermal exposure across various urban zones.

- **Post-Intervention:**

By integrating mobile environmental sensors on bicycles and stationary bike stations, VS2 enabled dynamic, on-the-move environmental sensing. Approximately 553,441 data points per parameter were collected, delivering high-resolution spatiotemporal data on temperature and relative humidity throughout Chania.

The post-intervention implementation of VS1 and VS2 established Chania's first integrated temperature and humidity monitoring system. The combination of fixed and mobile technologies proved both technically viable and operationally valuable, empowering local authorities, urban planners, and researchers with essential microclimate data. This foundation supports evidence-based decision-making for climate resilience, urban comfort, and public health protection.

Challenge 2

KPI 2.8 Avoided run-off

Expected Impact: To develop and apply a health-relevant, indicator-based approach for assessing urban green spaces, examining how specific characteristics of two parks in Chania—such as greenness, air quality regulation, and thermal comfort—relate to

human health and well-being, in order to inform evidence-based urban planning (Added value)

VS(s): 1

Evaluation Method: Benchmarking (See discussion section of research publication: Lilli, A., Tsekeri, E. & Kolokotsa, D. A health relevant approach for assessing urban green spaces. *Discover Cities* 1, 37 (2024). <https://doi.org/10.1007/s44327-024-00029-z>)

The bar charts below show rainfall absorption by tree species in two Chania parks—Municipal Garden (MGC) and Agioi Apostoloi (SAP)—based on 2023 data. Total absorption across both sites reached 606.000 liters. At MGC, trees absorb approximately 42000 liters annually. Benjamin Fig was the top performer (17.79%), followed by Chinese Banyan and Brazilian Peppertree (15.09% each). At SAP, total absorption was significantly higher at 564.030 liters. Aleppo Pine dominated (69.13%), with Blue Gum Eucalyptus next (26.17%).

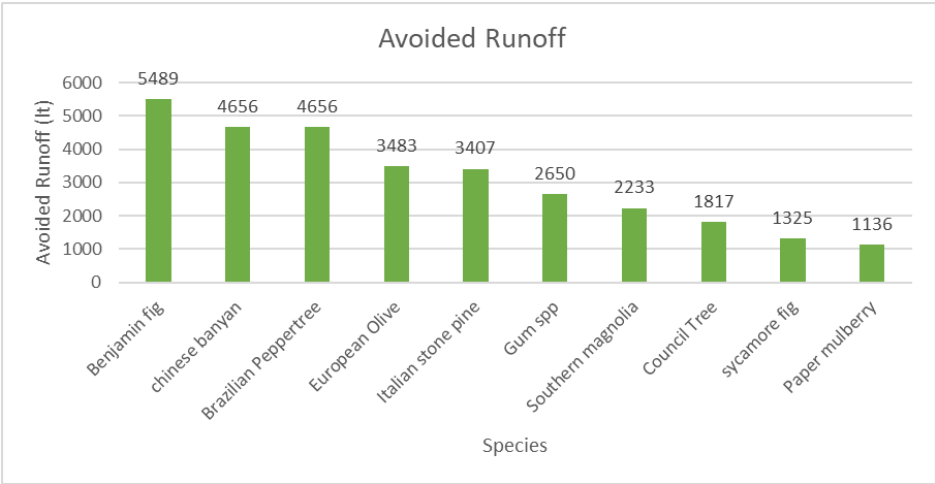


Figure 106: Annual avoided runoff (litres) by tree species in MGC, based on 2023 data in Chania

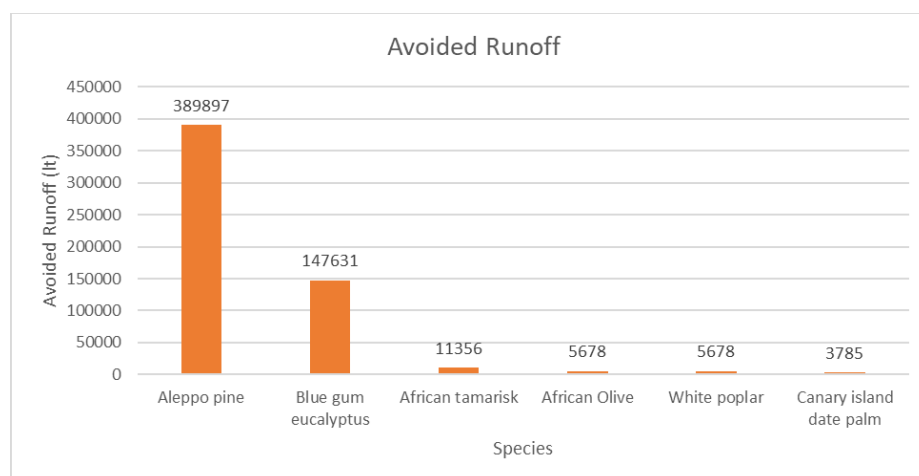


Figure 107: Annual avoided runoff (litres) by tree species in SAP, based on 2023 in Chania

Challenge 4

KPI 4.3a Recreational or cultural value of green spaces (number of visitors)

Expected Impact: Increased recreational or cultural value of green spaces (Direct Impact)

VS(s): 1

Evaluation Method: Pre & Post Intervention

The bar chart (Figure 104) compares the number of attendees at recreational and cultural events organized by the Municipality of Chania and TUC, before and after the launch of the MULaR intervention. In 2023 (pre-intervention), four cultural events were held, attracting a total of 8,150 attendees. In contrast, the post-intervention period in 2024–2025 included eight events, with total attendance reaching 12,950, marking a significant increase of 59%. The data clearly demonstrates the positive impact of the MULaR intervention (VS1) on public engagement and cultural participation in Chania. The increase in both the number of events and total attendance suggests improved outreach, enhanced visibility, and potentially more diverse or attractive programming post-intervention.

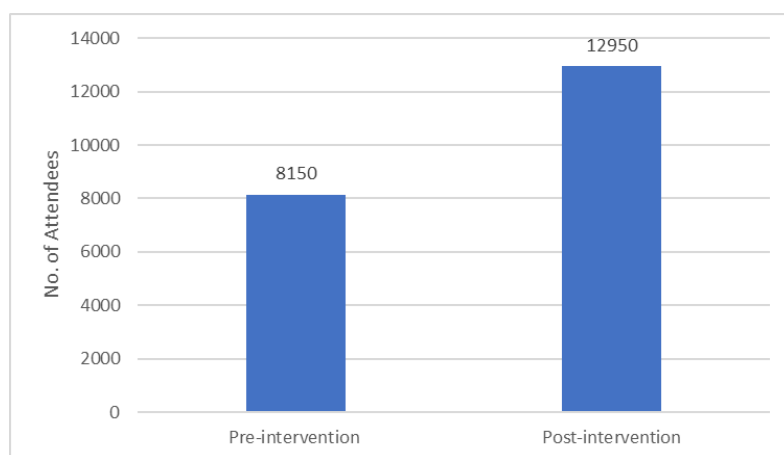


Figure 108: Chania attendees/viewers

Pre-intervention

Date	Project Activity	No. of Attendees/Viewers
6.2023	Cultural Event (Environment Day 2023)	900
6.2023	Cultural Event (Book Exhibition Week)	5000
9.2023	Cultural Event (Sports Day)	250
9.2023	Cultural Event (Chaniartoon Festival)	2000

Table 147: Chania attendees/viewers (pre-intervention)

Post-intervention

Date	Project Activity	No. of Attendees/Viewers
1.7.2024	Cultural Event 2 (Environment Day 2024)	1100
26-30.6.2024	Cultural Event 3 (Book Exhibition Week)	7500
26-27.9.2024	Cultural Event 4 (Sports Day)	400
28-29.9.2024	Cultural Event 5 (Chaniartoon Festival)	3000

15.10.2024	Cultural Event 6 (Celebrating 40 years of operation of the Technical University of Crete)	250
23.11.2024	European Week for Waste Reduction (EWWR)	100
26.02.2025	Promotion of Road and Mountain Bike Sports	500
03.07.2025	VARCITIES Closing Event	100

Table 148: Chania attendees/viewers (post-intervention)

KPI 4.3b Recreational or cultural value of green spaces

Expected Impact: Increased recreational or cultural value of green spaces (Direct Impact)

VS(s): 1

Evaluation Method: Pre & Post Intervention

The MULR intervention significantly enhanced the recreational and cultural value of GSs by organizing a wide range of community-driven activities, as presented in the Table below. These included creative and educational programming (e.g., storytelling, school documentaries, animation screenings), awareness-raising WSs on urban nature, interactive digital experiences (e.g., AR/VR games, e-sports, and mobile-based educational games), and health- and sustainability-focused events such as health data collection, herb planting, and equipment distribution. The inclusion of live media coverage, social media engagement, and participation from high-profile guests (e.g., artists, Olympians) helped foster broader visibility, cultural inclusion, and public participation across all age groups.

Date	Event	No. of Activities (BENCHMARKING)	Total No of Activities	New Activities developed in MULaR (Number & Description)
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1.7.2024	Cultural Event 2 (Environment Day 2024)	10	18	1. Storytelling Sessions for Children: Engaging storytelling sessions designed for children, focusing on themes related to nature, imagination, and environmental awareness. 2. Documentary Screenings by Local Schools: Showcasing documentaries produced by local schools, highlighting community projects, environmental topics, and local culture. 3. Animation Screenings: Special screenings of animated films, offering both entertainment and educational content focused on nature, sustainability, and creativity. 4. Awareness Workshop on Nature, Health, and Well-being: An informative session to raise awareness about the critical link between nature, health, and well-being, promoting lifestyle changes that enhance quality of life. 5. Awareness Workshop on the VARCITIES Approach: A session dedicated to introducing and explaining the VARCITIES initiative, which integrates innovative nature-based solutions to improve urban well-being. 6. Health Data Collection Activity: An interactive activity where participants can contribute health-related data to support ongoing research on the impact of green spaces and urban environments on public health. 7. Local Herb Planting and Seed Distribution Activity: A hands-on experience where participants receive flowers and seeds for planting local herbs, promoting biodiversity and the use of indigenous plants in urban areas. 8. GoNature Game Exhibition Activity: An immersive digital experience developed by VARCITIES, where users explored pilot sites across Europe in virtual reality (VR) using the HoloLens headset. This innovative tool allowed participants to interact with these locations in a dynamic, hands-on way, enhancing their understanding of urban nature-based solutions and sustainable environments.	8
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26-30.6.2024	Cultural Event (Book Exhibition Week)	3	70	76	1. Information Point: A central hub providing visitors with up-to-date information on the daily schedule of the Book Festival Week, ensuring attendees can easily navigate and participate in the event's activities. 2. Social Media Hub: A dedicated space for capturing and sharing the festival experience across social media platforms, allowing participants to engage digitally and amplify the event's reach. 3. Live Radio Station: A live broadcasting station covering the festival's events, sharing daily updates, interviews with contributors and authors, and bringing the festival's pulse to listeners throughout the city. 4. Freelance Writers from the "Grafoles" Collective: Writers from the renowned Athens-based "Grafoles" collective take part in their first-ever event outside the Greek capital, showcasing their work and engaging with festival attendees. 5. Awareness Workshop on the VARCITIES Approach: A session focused on introducing the VARCITIES initiative, which highlights nature-based solutions for enhancing urban well-being and sustainability. 6. Local Herb Planting and Seed Distribution: An interactive activity where participants receive local herb seeds and flowers to plant, promoting ecological awareness and encouraging the use of indigenous plants in urban spaces.	6
26-27.9.2024	Cultural Event (Sports Day)	4	3	9	1. Live Radio Station on SPORT FM: A live broadcast on SPORT FM featuring esteemed journalists interviewing notable local athletes, including Olympians and Paralympians, as well as representatives from key institutional bodies and authorities, highlighting the achievements and stories of our city's sports community. 2. Educational Digital Game: "On the Trail of Medals": An interactive digital game where students embark on a journey to recover the "lost medals" of our city's champions. Through virtual interactions with distinguished local athletes, participants explore the city via their mobile devices, learning about sports history and the values of athletics while solving challenges along the way. 3. Sports Activities Stations: A variety of sports stations set up around the event, offering participants the chance to engage in outdoor rowing, wheelchair basketball, and sailing, promoting inclusion and active participation in different sports. 4. AR and VR E-Sports Experience: A cutting-edge augmented reality (AR) and virtual reality (VR) activity, allowing students to immerse themselves in modern e-sports, providing a hands-on experience with the latest advancements in the world of sports technology. 5. Awareness Workshop on the VARCITIES Approach: A session designed to introduce the VARCITIES initiative, focusing on the integration of nature-based solutions to promote urban well-being, sustainability, and quality of life.	6

				6. Distribution of Physical Activity and Educational Equipment: A distribution event where participants receive equipment that encourages physical activity and education, supporting ongoing learning and engagement in healthy lifestyles.	
28-29.9.2024	Cultural Event 5 (Chaniartoon Festival)	64	67	1. Hosting Renowned Italian Comic Artist Massimo De Vita: The event featured the internationally acclaimed Italian comic artist Massimo De Vita, best known for his iconic contributions to Disney. In this welcoming space, De Vita participated in interviews with prominent national journalists and delighted fans of all ages by signing autographs, celebrating his legacy in the world of comics, also known as the 9th art. 2. A Vibrant Hub for Festival Visitors: The space became a lively gathering point for festival-goers, where visitors could unwind, admire the artwork they had purchased, engage in conversations with fellow art lovers, and enjoy live performances from invited bands, creating a dynamic and interactive atmosphere. 3. Awareness Workshop on the VARCITIES Approach: An informative session introducing the VARCITIES initiative, which emphasizes the use of nature-based solutions to enhance urban well-being, promote sustainability, and improve overall quality of life for city residents.	3
15.10.2024	Cultural Event 6 (Celebrating 40 years of operation of the Technical University of Crete)	0	1	1. Awareness Workshop on the VARCITIES Approach: An informative session introducing the VARCITIES initiative, which emphasizes the use of nature-based solutions to enhance urban well-being, promote sustainability, and improve overall quality of life for city residents.	1
23.11.2024	European Week for Waste Reduction (EWWR)	1	3	1. Info Point: A location providing all relevant campaign materials for visitors, ensuring everyone could access the necessary information. 2. Exhibition Space: Showcased household recycling bins, educating the public on recycling practices and sustainable living. 3. Outreach Platform: Featured a special broadcast by Nea TV, including a segment with a renowned chef from Chania who demonstrated creative ways to use leftover food and ingredients to create new, flavorful dishes, promoting food sustainability and reducing waste.	4
26.02.25	Promotion of Road and Mountain Bike Sports	0	3	1. Secretariat and Promotion Center: The "MULAR" serves as a central hub, providing information, registering athletes, and organizing events for cross-country and mountain biking sports. 2. Event Organization: The "MULAR" works with sports clubs to arrange events in the afternoon, ensuring smooth operations and active participation.	3

				3. Public Promotion: The "MULAR" also focuses on promoting cross-country and mountain biking sports to the wider public, fostering greater awareness and engagement.	
03.07.2025	VARCITIES Closing Event	0	2	1. Event Organization: The MULR collaborates with cultural organizations to host events featuring live music performances. 2. Incentive for Participation: Participants who complete the questionnaires are entered into a prize draw.	2

Table 149: Recreational and cultural events organised in MULR in Chania

KPI 4.7 Green-related social service provided to population

Expected Impact: Increased Green-related social service provided to population (Direct Impact)

VS(s): 1

Evaluation Method: Pre & Post Intervention

The Table below presents the specific observed environmental attributes that can attract people or, conversely, inhibit citizens' visits due to their absence (KPI 2.3). Specifically, a total of 13 out of 20 environmental attributes were observed in MGC, and 14 were observed in SAP.

	MGC -Benchmark	SAP-Benchmark	MULaR
Naturalness: Trees/ plants/ flowerbeds	.	.	.
Water feature	.	.	
Gastronomic & Sanitary Facilities	.	.	
Rest areas	.	.	.
BBQs & Tables	.	.	
Lights	.	.	.

Walking Paths and Trails	•	•	
Areas for active recreational exercises		•	•
Areas for cultural activities	•		•
Playground	•	•	
Areas with nice views outside the area		•	
Areas for laying, sunbathing, playing		•	
Nature reserve areas			
Libraries & Communication points	•		•
Areas for commercial use	•		•
Learning and working areas			•
Specific areas for energy generation			•
Dog Enclosure	•	•	•
Car Park		•	
Public transport	•	•	
Total number	13	14	9

Table 150: Chania green-related social services

KPI 4.22 Total Vegetation cover (Total leaf area)

Expected Impact: To develop and apply a health-relevant, indicator-based approach for assessing urban green spaces, examining how specific characteristics of two parks in Chania—such as greenness, air quality regulation, and thermal comfort—relate to human health and well-being, in order to inform evidence-based urban planning (Added value)

VS(s): 1

Evaluation Method: Benchmarking (See discussion section of research publication: Lilli, A., Tsekeri, E. & Kolokotsa, D. A health relevant approach for assessing urban green spaces. *Discover Cities* 1, 37 (2024). <https://doi.org/10.1007/s44327-024-00029-z>)

The species with the greatest importance values (IV) are listed in Table below. They are calculated as the sum of percent population and percent leaf area. High importance values do not mean that these trees should necessarily be encouraged in the future; rather these species currently dominate the urban forest structure.

MGC's tree cover spans about 42% of the area, providing 0.035 km² of leaf area while SAP has a more extensive forest cover, with 32% tree cover and 0.5 km² of leaf area. In MGC, the most dominant species in terms of leaf area are Benjamin fig, Brazilian peppertree and Chinese banyan. In SAP, the most dominant species in terms of leaf area are Aleppo pine, blue gum eucalyptus, and African tamarisk.

MGC				SAP			
Species Name	Percent Population	Percent Leaf Area	IV	Species Name	Percent Population	Percent Leaf Area	IV
Benjamin fig	2.2	13.3	15.5	Aleppo pine	85	70	155
Italian stone pine	4.8	8.0	12.8	Blue gum eucalyptus	9	26.7	35.7
Black locust	9.7	2.7	12.4	African tamarisk	5.2	2.5	7.7
Brazilian peppertree	0.8	11.1	12.0	African Olive	0.4	0.5	0.9
Blue jacaranda	9.7	2.2	11.9	White poplar	0.3	0.3	0.6
Chinese banyan	0.4	11.1	11.5	Canary island date palm	0.1	0	0.2
Sour orange	9.9	0.5	10.4				
European Olive	1.8	8.3	10.1				
Japanese pittosporum	7.9	1.4	9.3				
Gum spp	1.2	6.4	7.6				

Table 151: Species with the greatest important values in terms of leaf area in Chania

KPI 4.23 Tree species composition in the green space and percent of live tree population by area of native origin

Expected Impact: To develop and apply a health-relevant, indicator-based approach for assessing urban green spaces, examining how specific characteristics of two parks in Chania—such as greenness, air quality regulation, and thermal comfort—relate to human health and well-being, in order to inform evidence-based urban planning (Added value)

VS(s): 1

Evaluation Method: Benchmarking (*See discussion section of research publication: Lilli, A., Tsekeri, E. & Kolokotsa, D. A health relevant approach for assessing urban green spaces. Discover Cities 1, 37 (2024). <https://doi.org/10.1007/s44327-024-00029-z>*)

Table below consolidates additional indicators, offering deeper insights into the structure of green spaces concerning size, type, and environmental qualities. The MGC's urban forest structure is highly diverse, with 61 different species, predominantly smaller trees, with 65.3% having a DBH of less than 15.2 cm. The species diversity is bolstered by a significant presence of trees from Asia, making MGC richer in biodiversity compared to SAP. Despite having only six species, mainly from Europe and Africa, SAP's larger trees and extensive canopy significantly contribute to its high carbon storage capacity. However, SAP's biodiversity is notably lower, and its tree population is dominated by larger trees, with 34.4% having a DBH of less than 15.2 cm.

KPI	MGC	SAP
Diversity of Species [Number of trees (trees), Number of tree species (species), Tree species composition (% of tree population)]	495 trees	1991 trees
	61 trees species	6 trees species
	Sour orange (9.9%), Blue jacaranda (9.7%), Black locust (9.7%), Japanese pittosporum (7.9%), Italian stone pine (4.8%), Paper mulberry (4.0%), Queen palm (3.4%), Olive (3.0%), California palm (3.0%), Maple leaf viburnum (2.8%), Other (41.7 %)	Aleppo pine (85%), Blue gum eucalyptus (9%), African tamarisk (5.2%), Olive (0.4%), Other (0.4%)
	0-7.6cm (36%), 7.6-15.2cm (28%), 15.2-30.5cm (20%), 30.5-45.7cm (10%), 45.7-61 (4%), 61-76.2cm (2%)	0-7.6cm (13%), 7.6-15.2cm (22%), 15.2-30.5cm (37%), 30.5-45.7cm (20%), 45.7-61 (3%), 61-76.2cm (1%), >76.2 (4%)

Tree Height Class (% of tree population)]	<5m (51.9%), 5-10m (25.7%), 10-15m (14.1%), >15m (8.3%)	<5m (32%), 5-10m (32%), 10-15m (17.8%), >15m (18.2%)
Species origin (% of tree population)	Asia (27%), North America (25%), South America (15%), Europe (10%), Asia & Oceania (8%), Europe & Asia (7%), Other (8%)	Europe & Africa (90%), Oceania (10%)

Table 152: Measurements providing insights into the green space structure in terms of size, type and environmental qualities in Chania

KPI 4.24 Number of vegetation data

Expected Impact: To develop and apply a health-relevant, indicator-based approach for assessing urban green spaces, examining how specific characteristics of two parks in Chania—such as greenness, air quality regulation, and thermal comfort—relate to human health and well-being, in order to inform evidence-based urban planning (Direct Impact)

VS(s): 1

Evaluation Method: Pre & Post Intervention

A total of 2,486 trees were assessed using standardized vegetation monitoring protocols as presented in the table below. The dataset includes detailed attributes such as: tree species and origin, geographic coordinates (latitude and longitude), and multiple tree size parameters (total tree height, live tree height, height to crown base, DBH). Additional measurements cover crown dimensions (crown size, crown width in both N-S and E-W directions), percent of crown missing, crown health (dieback), and crown light exposure. These data enable in-depth analysis of vegetation structure, health, and ecological value.

	MGC	SAP
Number of Trees	495 trees	1991 trees
Through MULaR's initiatives, comprehensive data have now been collected for 2486 trees. This data is being utilized in the analysis of "Evaluation of Chania's Two Most Popular Green Spaces" (KPI 1.1, 2.8, 4.22, 4.23, 5.10, 5.11, 5.12, 6.5), significantly enhancing the project's outcomes. The specific data collected include:		

Vegetation Data	Units	Sources of Data
Tree Species	No of species	Field measurements & Observation
Species origin	dimensionless	
Tree’s Latitude-Longitude	dimensionless	
Tree Size		
Total Tree Height	m	
Live Tree Height	m	
Height to Crown Base	m	
Diameter at Breast Height (DBH)	cm	
Crown Size	m	
Crown Width N-S	m	
Crown Width E-W	m	
Percent of Crown Missing	%	
Crown Health (Dieback) (%)	%	
Crown Light Exposure	no of sides	

Table 153: No. of vegetation data in Chania

Challenge 5

KPI 5.5 Physical air quality indicators

Expected Impact: To develop and apply a health-relevant, indicator-based approach for assessing air quality in Chania, Greece, by analyzing data from mobile environmental sensors measuring PM_{2.5}, PM₁₀, temperature, and humidity, and linking pollution levels to spatial patterns and urban morphology, in order to inform evidence-based environmental health policies and sustainable urban planning (Added value)

VS(s): 2

Evaluation Method: Benchmarking

The results of this analysis is part of the Confidential Deliverable D7.6.

KPI 5.6 Chemical air quality indicators

Expected Impact: To develop and apply a health-relevant, indicator-based approach for assessing air quality in Chania, Greece, by analyzing data from mobile environmental sensors measuring PM_{2.5}, PM₁₀, temperature, and humidity, and linking pollution levels to spatial patterns and urban morphology, in order to inform evidence-based environmental health policies and sustainable urban planning (Added value)

VS(s): 2

Evaluation Method: Benchmarking

The results of this analysis is part of the Confidential Deliverable D7.6.

KPI 5.10 Modelled O₃, SO₂, NO₂ and CO capture/removal by vegetation & KPI 5.11 Total particulate matter removed by vegetation

Expected Impact: To develop and apply a health-relevant, indicator-based approach for assessing urban green spaces, examining how specific characteristics of two parks in Chania—such as greenness, air quality regulation, and thermal comfort—relate to human health and well-being, in order to inform evidence-based urban planning (Added value)

VS(s): 1

Evaluation Method: Benchmarking (*See discussion section of research publication: Lilli, A., Tsekeri, E. & Kolokotsa, D. A health relevant approach for assessing urban green spaces. Discover Cities 1, 37 (2024). <https://doi.org/10.1007/s44327-024-00029-z>*)

These KPIs measures the amount of ozone (O₃), sulphur dioxide (SO₂), nitrogen dioxide (NO₂), carbon monoxide (CO) and particulate matters (PM₁₀ and PM₂₅) removed by vegetation in MGC and SAP.

It is estimated that trees remove 106kg and 1413kg of pollutants per year for MGC and SAP respectively (O₃, SO₂, NO₂, CO, PM_{2.5} and PM₁₀). Pollution removal was greatest for ozone for both green spaces as more than 55kg and 700kg of O₃ were removed by MGC and SAP trees respectively accounting for more than 50% of total pollutants for both green spaces. Only 2kg from MGC and 23kg from SAP of PM_{2.5} was removed in 2023. Lastly, concerning removed PM₁₀, CO, NO₂ and SO₂, and SAP figures amount to 20kg, 5kg, 12kg and 12kg for MGC and 286kg, 54kg, 159kg and 143kg for SAP respectively. SAP

demonstrated about three times more pollutant removal per tree compared to MGC. Overall, SAP removed air pollutants at a rate 13 times higher than MGC.

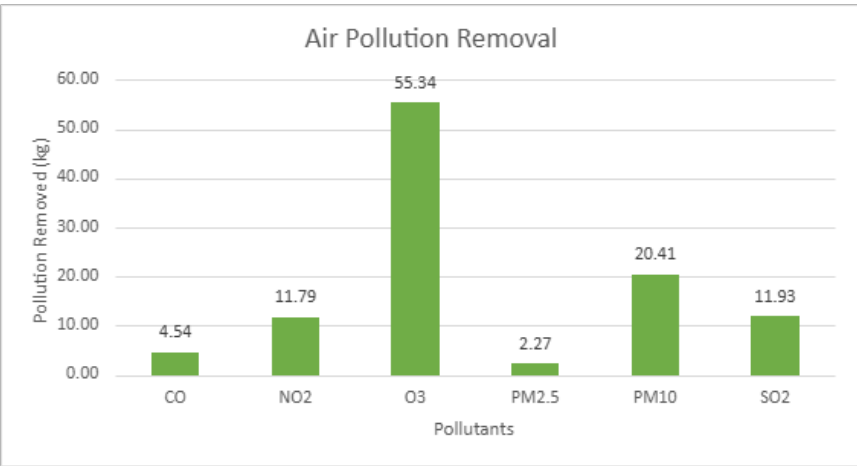


Figure 109: Air pollution removal by vegetation in the MGC in 2023, across six major pollutants in Chania

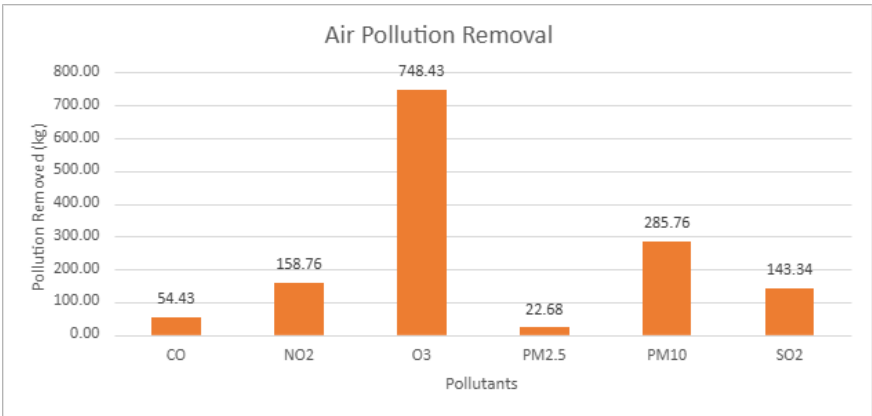


Figure 110: Air pollution removal by vegetation in the SAP in 2023, across six major pollutants in Chania

KPI 5.12 Oxygen production

Expected Impact: To develop and apply a health-relevant, indicator-based approach for assessing urban green spaces, examining how specific characteristics of two parks in Chania—such as greenness, air quality regulation, and thermal comfort—relate to human health and well-being, in order to inform evidence-based urban planning (Added value)

VS(s): 1

Evaluation Method: Benchmarking (See discussion section of research publication: Lilli, A., Tsekeri, E. & Kolokotsa, D. A health relevant approach for assessing urban green spaces. Discover Cities 1, 37 (2024). <https://doi.org/10.1007/s44327-024-00029-z>)

The graphs below show estimated oxygen production by tree species in Chania’s Municipal Garden (MGC) and Agioi Apostoloi Park (SAP). Higher oxygen output supports cleaner air, benefiting human health and ecosystem well-being.

- MGC: *Benjamin Fig* is the top producer, followed closely by *Gum spp*.
- SAP: *Aleppo Pine* and *Blue Gum Eucalyptus* dominate, with other species contributing significantly less.

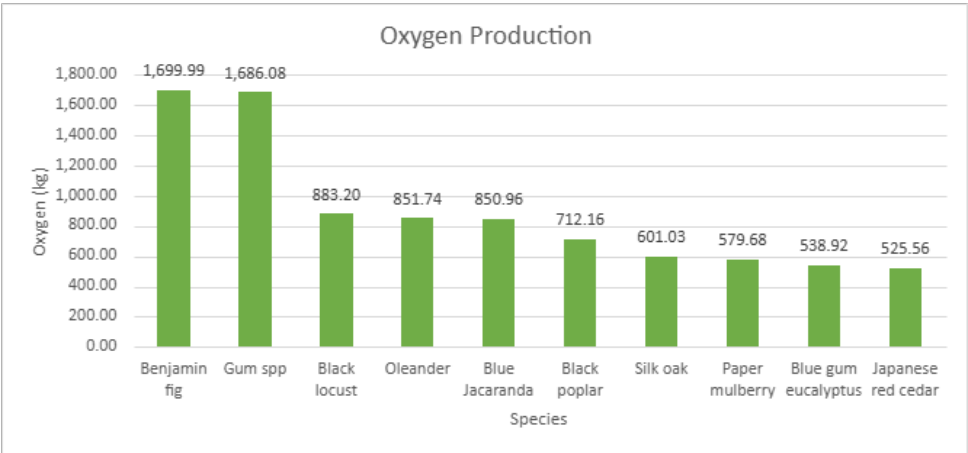


Figure 111: Estimated annual oxygen production (kg) by tree species in MGC, based on 2023 data in Chania

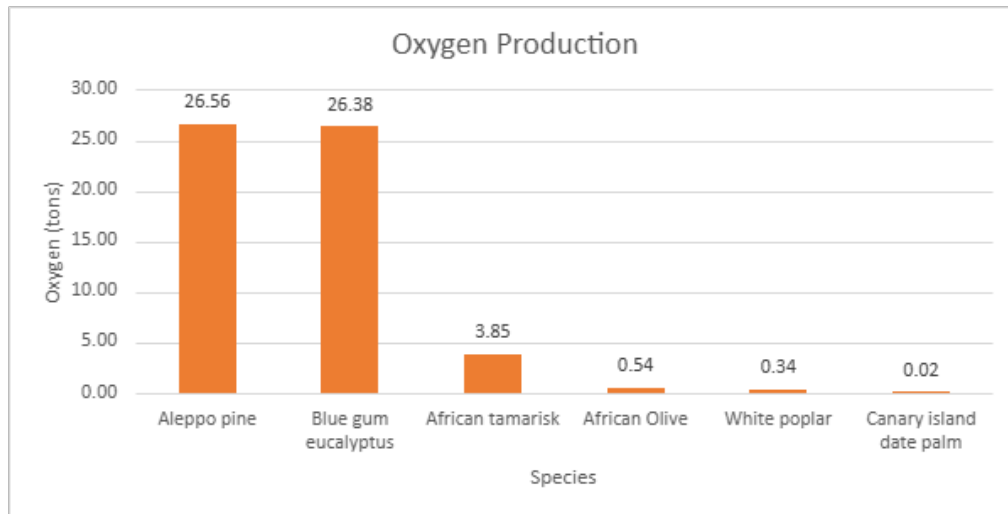


Figure 112: Estimated annual oxygen production (kg) by tree species in SAP, based on 2023 data in Chania

KPI 5.13 European Air Quality Index

Expected Impact: To develop and apply a health-relevant, indicator-based approach for assessing air quality in Chania, Greece, by analyzing data from mobile environmental sensors measuring PM_{2.5}, PM₁₀, temperature, and humidity, and linking pollution levels to spatial patterns and urban morphology, in order to inform evidence-based environmental health policies and sustainable urban planning (Added value)

VS(s): 2

Evaluation Method: Pre & Post Intervention

The results of this analysis is part of the Confidential Deliverable D7.6.

KPI 5.14 Number of days during which air quality parameters exceed threshold values

Expected Impact: To develop and apply a health-relevant, indicator-based approach for assessing air quality in Chania, Greece, by analyzing data from mobile environmental sensors measuring PM_{2.5}, PM₁₀, temperature, and humidity, and linking pollution levels to spatial patterns and urban morphology, in order to inform evidence-based environmental health policies and sustainable urban planning (Added value)

VS(s): 2

Evaluation Method: Pre & Post Intervention

Pre: No air quality monitoring data were available to assess whether PM concentrations exceeded regulatory thresholds. As a result, it was not possible to evaluate the number of days with poor air quality or assess exposure risk for the population.

Post: Following the deployment of two bike-mounted air quality monitoring stations (Stations S1 and S2), comprehensive data were collected over a one-year period.

- Station S1 recorded lower particulate matter concentrations, with no exceedance days over the one-year period. This suggests relatively clean air in the monitored microenvironment, possibly due to fewer pollution sources or better ventilation conditions.
- Station S2, in contrast, recorded 16 days where PM₁₀ levels exceeded the 40 µg/m³ limit, indicating a potential air quality concern in that area. Despite average PM₁₀ levels remaining below the annual limit, the exceedance frequency points to episodic pollution events that could affect vulnerable populations.
- The average values for PM_{2.5} at both stations remained well below the EU annual limit of 25 µg/m³, suggesting a generally acceptable level of fine particulate matter.

The introduction of bike-mounted monitoring enabled meaningful insights into local air quality trends. The observed differences between stations highlight the importance of localized air pollution monitoring, as exposure levels can vary significantly within small urban areas.

Station S1	PM25 (µg/m3) (1 Year period)	PM10 (µg/m3) (1 Year period)	No of days where PM10>40 µg/m3
	9.46	28.31	0
Station S2	10.64	29.57	16

Table 154: PMs in 1 Year period in Chania

KPI 5.15 Number of air quality data

Expected Impact: To develop and apply a health-relevant, indicator-based approach for assessing air quality in Chania, Greece, by analysing data from mobile environmental sensors measuring PM_{2.5}, PM₁₀, temperature, and humidity, and linking pollution levels

to spatial patterns and urban morphology, in order to inform evidence-based environmental health policies and sustainable urban planning (Direct Impact)

VS(s): 1, 2

Evaluation Method: Pre & Post Intervention

For VS1:

- Pre-Intervention:
Prior to the implementation of VS1, no air quality data were available for the city of Chania. This absence of baseline environmental monitoring limited the ability to assess pollution levels, identify pollution hotspots, or implement evidence-based mitigation strategies.
- Post-Intervention:
The installation of environmental sensors equipped with the MULaR marked a significant enhancement in environmental monitoring capacity. The system produced approximately 73,748 data points per pollutant over a one-year period, using a 3-minute sampling rate. The monitored parameters included:

For VS2:

- Pre-Intervention:
Similar to VS1, no prior air quality data were available before the deployment of VS2. This limited the municipality's ability to understand microclimatic pollution dynamics or assess exposure across different urban zones.
- Post-Intervention:
Through the integration of mobile environmental sensors on bicycles and bike stations, VS2 generated approximately 312,026 data points per environmental parameter, also at a 3-minute sampling rate. The same pollutant suite was monitored: PM₁₀, PM_{2.5}, PM₁, NO₂, SO₂, CO, and O₃.

The post-intervention deployment of VS1 and VS2 enabled the first air quality monitoring database in Chania, transforming the city's environmental data landscape. This database now serves as a critical resource for local authorities, urban planners, researchers, and public health stakeholders. It lays the groundwork for data-driven decision-making, environmental forecasting, and targeted interventions to improve air quality and urban wellbeing. The integration of fixed and mobile monitoring technologies demonstrated

not only the technical feasibility of urban-scale environmental sensing but also its transformative impact on local policy.

Challenge 6

KPI 6.5 Annual trend in vegetation cover in urban green Infrastructure-NDVI

Expected Impact: To develop and apply a health-relevant, indicator-based approach for assessing urban green spaces, examining how specific characteristics of two parks in Chania—such as greenness, air quality regulation, and thermal comfort—relate to human health and well-being, in order to inform evidence-based urban planning (Added value)

VS(s): 1

Evaluation Method: Benchmarking (*See discussion section of research publication: Lilli, A., Tsekeri, E. & Kolokotsa, D. A health relevant approach for assessing urban green spaces. Discover Cities 1, 37 (2024). <https://doi.org/10.1007/s44327-024-00029-z>*)

The mean monthly NDVI value calculated for the entire year is presented in Figures below. In the MGC case study area, the vegetation is denser, and carbon cycling is more active, leading to a higher mean annual NDVI of 0.21, despite lower overall carbon storage. The highest monthly NDVI values in MGC were observed in July, while the lowest occurred in November. In contrast, SAP, with a mean annual NDVI of 0.19, experiences its highest NDVI values in January, indicating a different seasonal vegetation pattern compared to MGC.

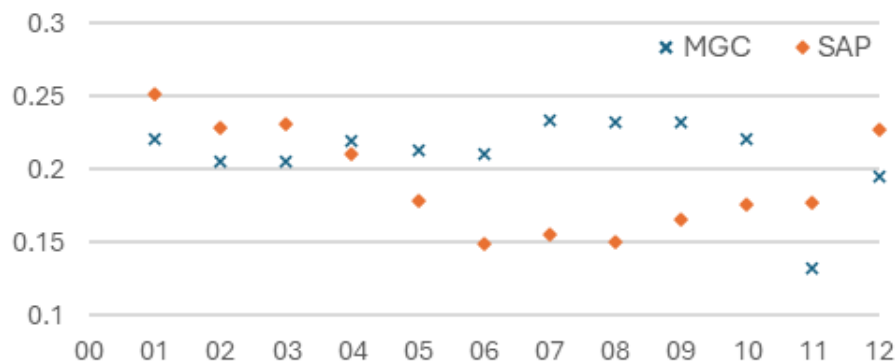


Figure 113: Mean monthly NDVI for both study areas (MGC & SAP) in Chania

KPI 6.8 Access of residents/employees by foot to open space: sports centre, recreation area, or green space

Expected Impact: Increased accessibility of sport and recreation facilities (Direct Impact)

VS(s): 1

Evaluation Method: Pre & Post Intervention

The MULR enhances access to public open spaces by bringing recreational amenities directly to various urban locations. Prior to the intervention, approximately 45,585 residents lived within a 300-meter buffer of existing recreational areas. Following spatial analysis of potential deployment sites, an additional 11,251 residents were identified as living within a 300-meter radius of underutilized or abandoned GSs that could accommodate the MULR.



Figure 114: GIS-based spatial analysis showing residents' access (within a 300m buffer zone) to recreational areas before (left) and after (right) the MULR intervention in Chania

KPI 6.9 Access of residents to cultural facilities on foot

Expected Impact: Increased accessibility of cultural facilities (Direct Impact)

VS(s): 1

Evaluation Method: Pre & Post Intervention

The MULR serves as a mobile cultural hub, enhancing community access to cultural activities by activating GSs with artistic and creative programming. Prior to the intervention, approximately 10,984 residents lived within a 300-meter buffer of existing cultural facilities. The spatial analysis identified an additional 48,678 residents who would gain walking access to cultural offerings if the MULR was deployed in underutilized GSs currently lacking such amenities.



Figure 115: GIS analysis of residents' 300m walking access to cultural facilities before (left) and after (right) the MULR intervention in Chania

KPI 6.10 Perceived quality of urban green

Expected Impact: To develop and apply a health-relevant, indicator-based approach for assessing urban green spaces, examining how specific characteristics of two parks in Chania—such as greenness, air quality regulation, and thermal comfort—relate to human health and well-being, in order to inform evidence-based urban planning (Added value)

VS(s): 1

Evaluation Method: Benchmarking (*See discussion section of research publication: Lilli, A., Tsekeri, E. & Kolokotsa, D. A health relevant approach for assessing urban green spaces. Discover Cities 1, 37 (2024). <https://doi.org/10.1007/s44327-024-00029-z>*)

The table below presents descriptive statistics (mean and standard deviation) for all variables/questions. A reliability test using Cronbach's Alpha (α) was conducted to assess internal consistency, with α values between 0.6 and 0.8 indicating acceptable reliability.

Results showed that the Municipal Garden of Chania (MGC) received an average score of 3.00, while Agioi Apostoloi Park (SAP) scored slightly higher at 3.02, suggesting that both sites were rated positively overall.

In terms of perceived accessibility, SAP received a higher-than-expected score. Green space use, including amenities and influencing factors such as perceived attractiveness, safety, and noise annoyance, was rated as “sufficient” in both parks, with scores being similar but not identical. Although the number of environmental attributes was nearly the same between the two sites, differences in these attributes significantly influenced perceived attractiveness—especially regarding amenities and facilities. These differences, however, did not appear to notably affect perceived accessibility or realized safety.

Finally, SAP’s greenness characteristics, as previously analyzed, were more positively rated in terms of aesthetics, colors, smells, sounds, and realized safety. No significant differences were observed between the two parks regarding perceived noise annoyance.

	MGC				SAP			
	Min.	Max.	Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev.
Perceived Accessibility	1	5	3.3	1.41	2	4	3.14	0.65
Perceived attractiveness in terms of amenities and facilities	1	5	2.90	1.36	2	5	3.42	0.71
Perceived attractiveness in terms of aesthetics, colors, smells, sound.	1	5	2.83	1.40	2	4	3.1	0.68
Perceived attractiveness in terms	1	5	2.87	1.26	2	4	2.6	0.63

of cleanliness and maintenance.								
Realized Safety	1	5	2.73	1.30	2	4	2.96	0.64
Perceived noise annoyance	1	5	2.93	1.42	2	5	2.94	0.64

Table 155: Descriptive statistics in Chania

Challenge 7

KPI 7.4 Perceptions of citizens on urban nature

Expected Impact: Increased awareness of urban ecosystems (Direct Impact)

VS(s): 1

Evaluation Method: Co-evaluation

The figure below demonstrates a positive shift in citizens' perceptions, awareness, and behavioral intent toward urban nature following the awareness events and workshops. This chart further supports this conclusion: the majority of participants rated the initiative as "very" or "extremely effective" in improving citizen participation, indicating not only successful outreach but also meaningful engagement. Additionally, the detailed pre- and post-workshop dataset (with 90+ individual entries) confirms a consistent upward trend in participants' scores, with average responses shifting from 2.55 before to 3.58 after the events, reflecting an average improvement of approximately one full scale point. This quantitative shift aligns with the qualitative insight that citizens became significantly more aware, knowledgeable, and motivated regarding urban nature and its benefits. In summary, the co-creation process and workshops had a measurable, meaningful impact on both public awareness and intended pro-environmental behaviour, validating the effectiveness of the intervention.

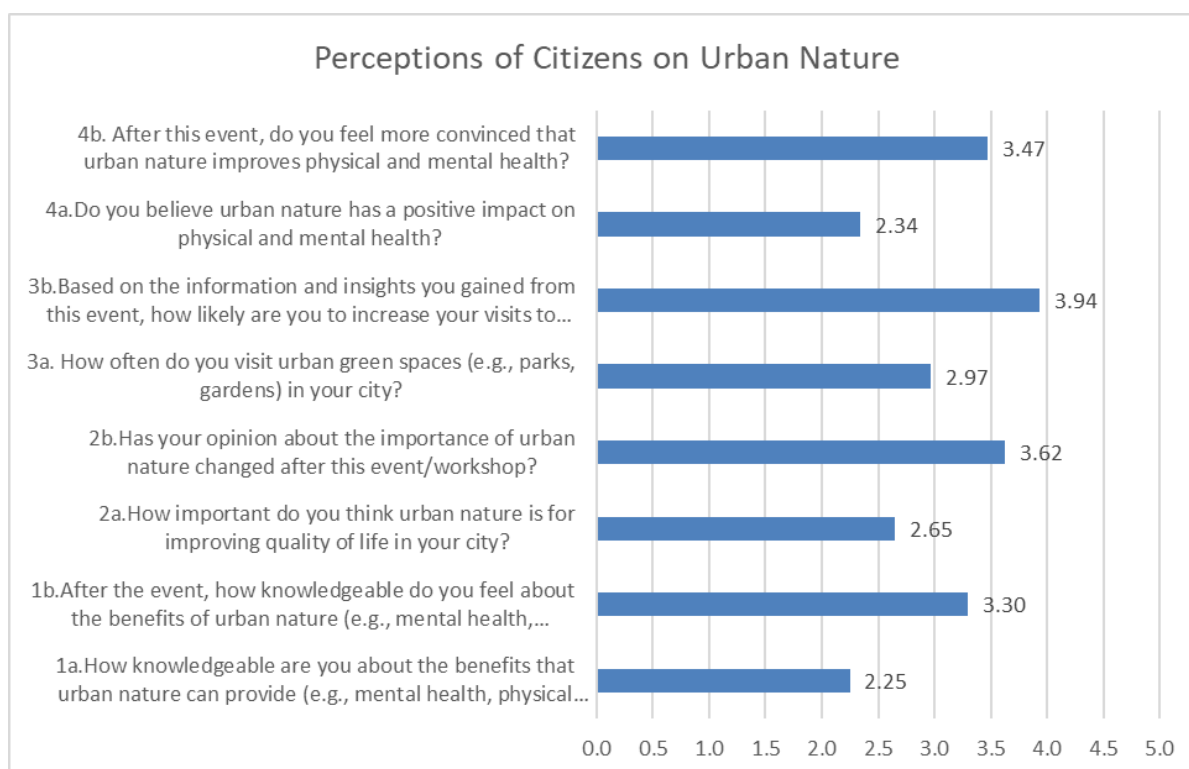


Figure 116: Perception of citizens on urban nature in Chania

KPI 7.8 Citizen participation in and co-creation of the design, implementation and evaluation of project interventions

Expected Impact: Increased and improved participation (Direct Impact)

VS(s): 1,2

Evaluation Method: Co-evaluation

The bar chart illustrates the level of citizen engagement across five co-creation workshops (WS1 to WS5) organized in Chania. The workshops represent different phases of the participatory process, ranging from initial co-identification to final co-evaluation. The co-creation process in Chania successfully engaged citizens across all key stages, with particularly high interest in large, open events like WS4. These findings underline the importance of diverse engagement formats to maximize participation and inclusivity in urban innovation projects.

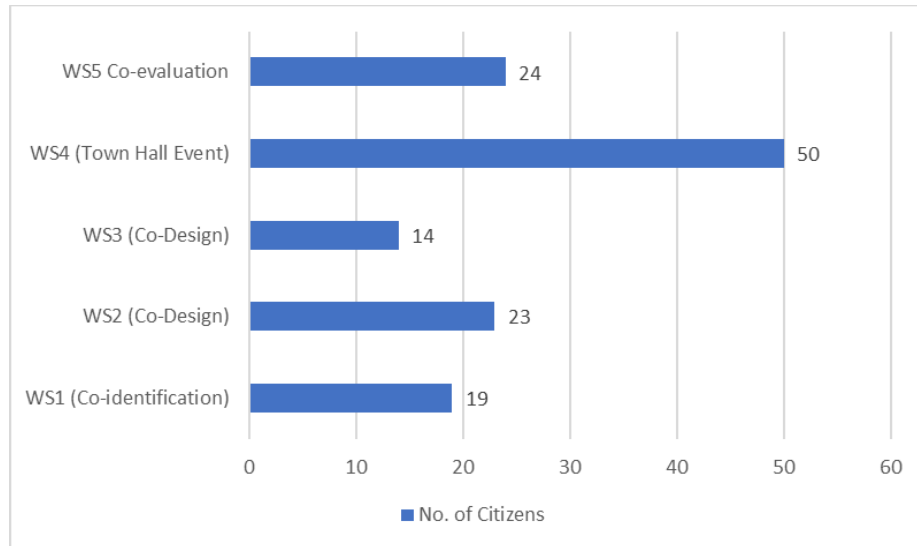


Figure 117: No. of citizens in co-creation in Chania

Figure 114 demonstrates a generally positive evaluation of the effort to improve citizen participation. With half of the participants (50%) rating it very or extremely effective, the co-creation process appears to have made a meaningful impact.

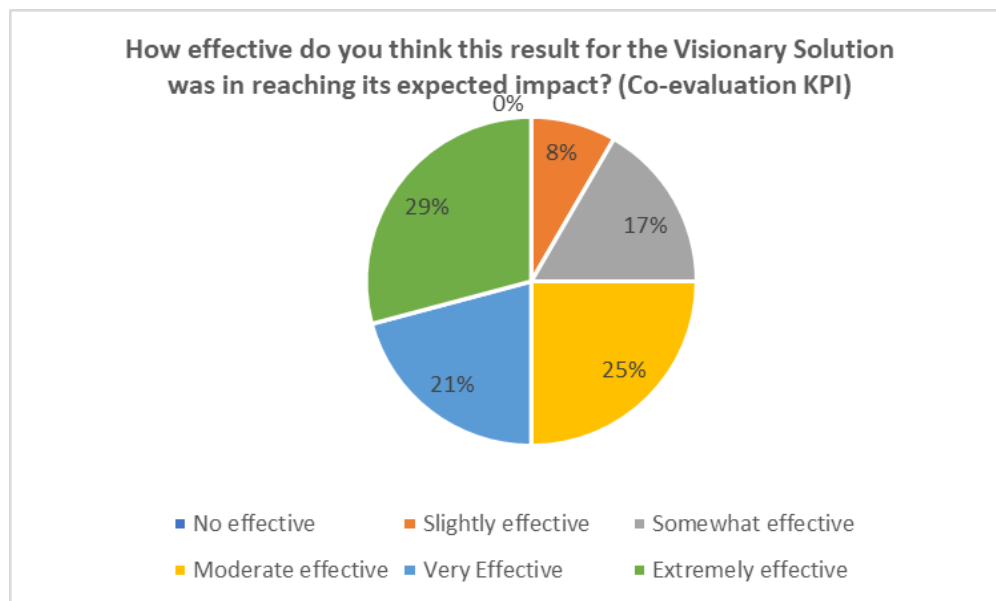


Figure 118: Co-evaluation result in Chania

KPI 7.11 Number of individuals that is aware of the project's objectives, content and processes

Expected Impact: Increased and improved participation (Direct Impact)

VS(s): 1,2

Evaluation Method: Co-evaluation

Prior to the intervention, there was no recorded public engagement. However, post-intervention activities, including five co-creation workshops (WS1–WS5), multiple cultural events, and the VARCITIES closing event, collectively engaged 13,980 direct participants. Notably, high-attendance events such as the Book Exhibition Week (7,500 attendees) and the Chaniartoon Festival (3,000 attendees) significantly boosted physical participation. Additionally, 11 press releases disseminated through 12 major local media outlets reached an estimated 100,000 individuals, massively extending the project's visibility. In total, 113,980 individuals were made aware of the project's goals and activities. This comprehensive communication and engagement effort reflects a well-executed strategy for raising public awareness and participation, transitioning from a state of zero prior involvement to broad community outreach across multiple platforms and event formats.

Project Activity	No. of Attendees/Viewers
WS1 (Co-identification)	19
WS2 (Co-Design)	23
WS3 (Co-Design)	14
WS4 (Town Hall Event)	50
Cultural Event 1 (Environment Day 2023)	900
Cultural Event 2 (Environment Day 2024)	1100
Cultural Event 3 (Book Exhibition Week)	7500

Cultural Event 4 (Sports Day)	400
Cultural Event 5 (Chaniartoon Festival)	3000
Cultural Event 6 (Celebrating 40 years of operation of the Technical University of Crete)	250
European Week for Waste Reduction (EWWR)	100
Promotion of Road and Mountain Bike Sports	500
VARCITIES Closing Event	100
10 Press Releases published in the 12 leading local media outlets.	100000

Table 156: Event attendees/viewers in Chania

No. of Attendees	13980
No. of Viewers	100000
Total No. of Individuals	113980

Table 157: Total event attendees/viewers in Chania

Figure 115 shows that the majority of respondents (42%) rated the Visionary Solution as extremely effective in reaching its expected impact, followed by 33% who found it very effective. A smaller proportion viewed it as moderately effective (17%) or somewhat effective (8%), while none considered it ineffective. Overall, the responses reflect a strong consensus on the solution's success and positive impact.

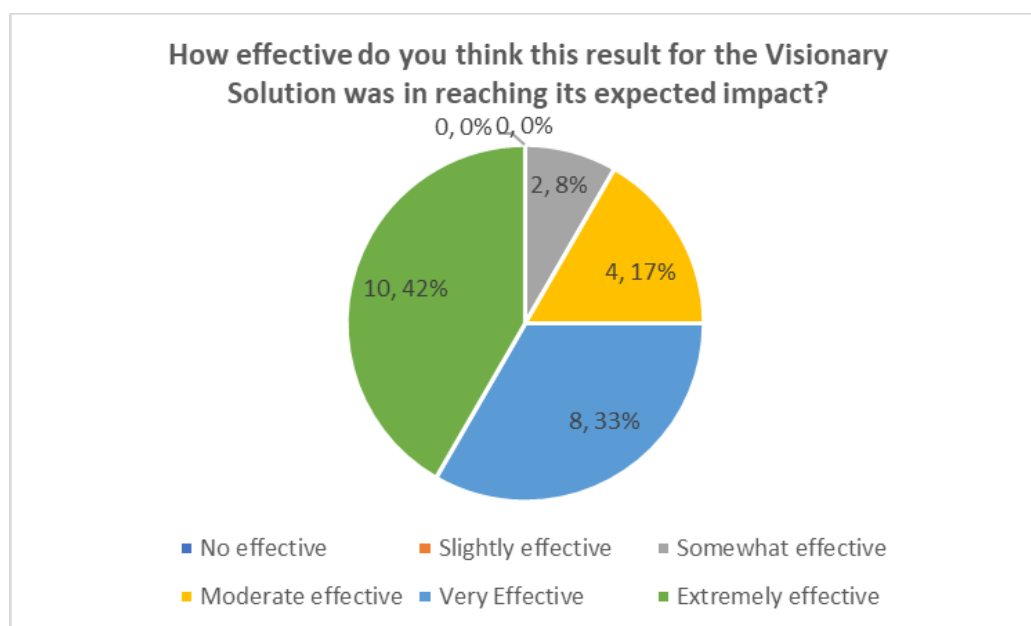


Figure 119: Co- evaluation result in Chania

Challenge 8

KPI 8.5 Personal and social background of people who participated in the project's activities

Expected Impact: Fair participation to project activities (Direct Impact)

VS(s): 1,2

Evaluation Method: Co-evaluation

Figure 116 illustrates the age distribution of individuals engaged in the project across co-creation activities, questionnaires, and public events. The highest level of participation was observed among individuals aged 31–50 (31%), followed by the 18–30 age group (27%), reflecting strong engagement from both working-age adults and younger adults. In contrast, lower levels of involvement were recorded among older adults (51–65: 17%, 65+: 9%) and minors under 18 (16%). While the project successfully engaged a diverse age range, these findings suggest that future outreach strategies could benefit from placing greater emphasis on involving senior citizens and younger participants, ensuring broader inclusivity across all age groups.

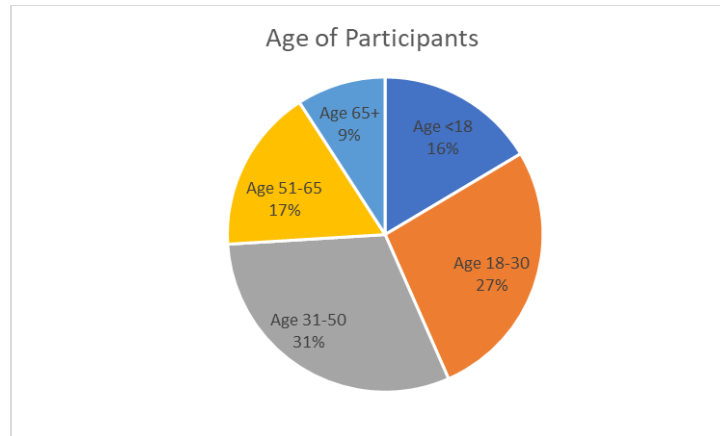


Figure 120: Age groups in Chania activities

Figure 117 presents the gender identity distribution of participants involved in the pilots' activities. A total of 8,130 participants identified as female (54%) and 6,926 as male (46%), indicating a fairly balanced gender representation with a slight majority of female respondents. A small number of participants chose "Prefer not to say" (31 individuals), while no participants identified as transgender, genderqueer/gender non-conforming, or used a self-description.

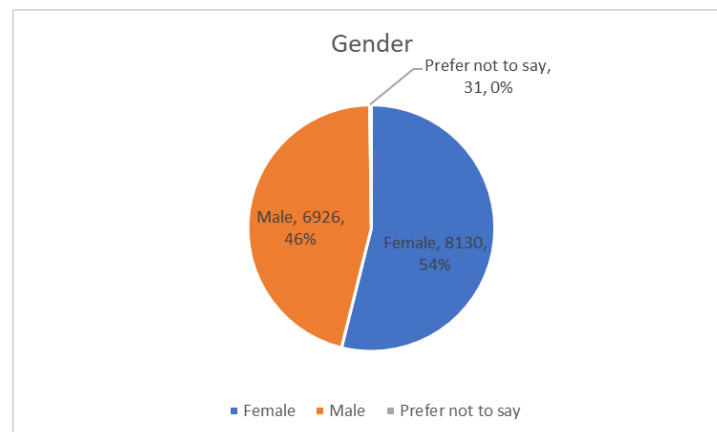


Figure 121: Genders in Chania activities

Figure 118 illustrates the sexual orientation distribution of participants. The majority identified as heterosexual/straight (58%), followed by a significant portion (32%) identifying as homosexual (gay/lesbian). A smaller percentage of participants identified as bisexual (5%) and 5% preferred not to disclose their sexuality. Notably, no participants identified as transsexual, intersex, selected "I don't know", "None", or provided a self-description, indicating limited representation or willingness to self-identify under those

categories. While the data shows a relatively diverse response, it also suggests the need for greater inclusivity and visibility for underrepresented sexual identities in future engagements.

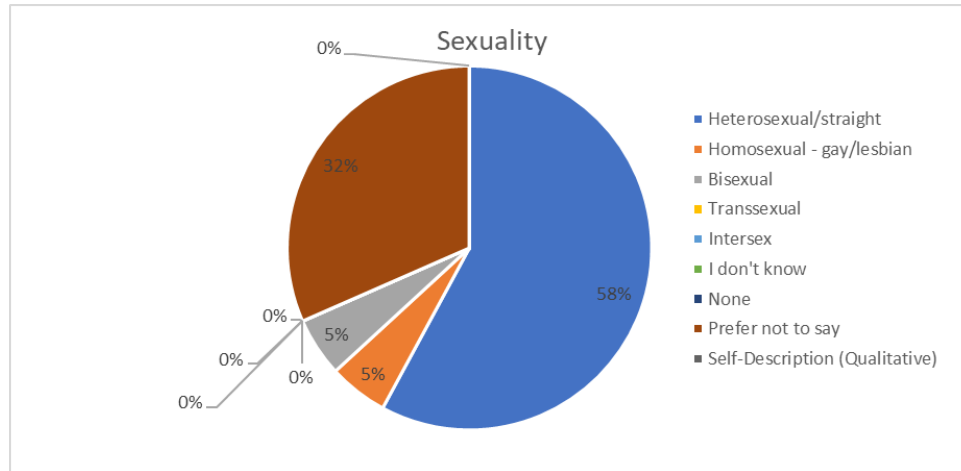


Figure 122: Sexual orientation in Chania activities

Figure 119 on socio-economic background reveals that a majority of participants (60%) identified as privileged, while 22% identified as underprivileged, indicating a moderate level of representation from economically disadvantaged groups. Additionally, 13% preferred not to disclose their socio-economic status and 5% stated they did not know, reflecting either uncertainty or discomfort in sharing such information.

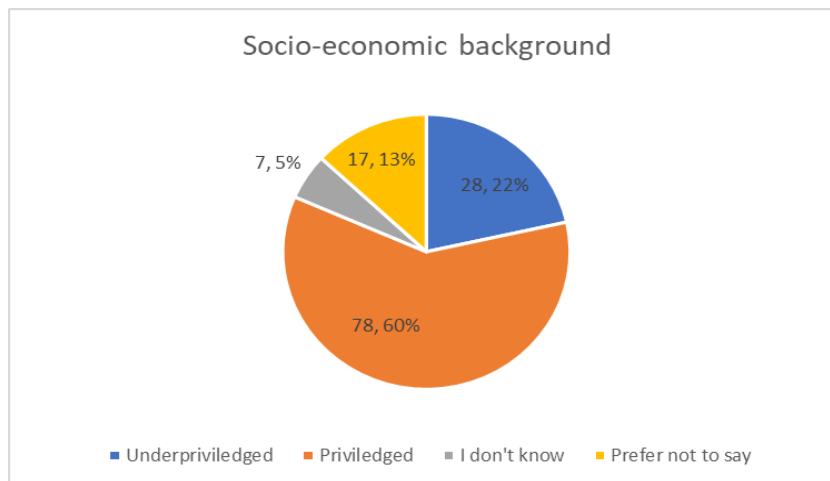


Figure 123: Socio-economic background in Chania activities

Figure 120 on educational background shows that the majority of participants held higher education degrees, with 43% having a Bachelor's, 24% a Master's, and 5% a PhD. Participants with a High School education made up 27%, while only 1% had completed only parts of high school. No participants selected "Prefer not to say," indicating a high level of disclosure. Overall, the data suggests a well-educated participant pool, though it may also point to a need for broader inclusion of individuals with lower formal educational attainment in future engagement efforts.

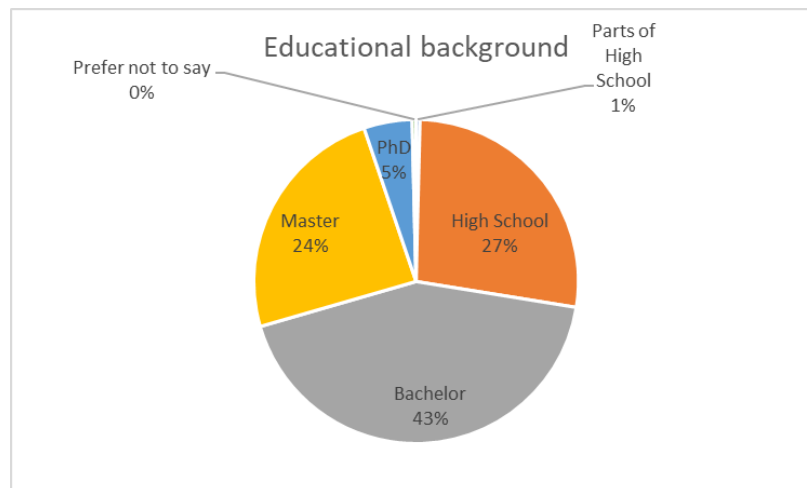


Figure 124: Educational Background in Chania activities

Figure 121 indicates that 63% of participants reported having no disability, while 37% identified with at least one type of disability. The most common conditions were chronic pain/illness (6%), difficulty hearing (6%), difficulty seeing (4%), and difficulties remembering or concentrating (3%), followed by difficulties walking or climbing steps (2%). Notably, 16% of responses fall into an unspecified category (brown section), suggesting either multiple disabilities or a classification not detailed in the legend. While the majority of participants reported no impairments, the presence of individuals with diverse physical and cognitive challenges highlights the importance of ensuring accessible and inclusive participation frameworks in future project activities.

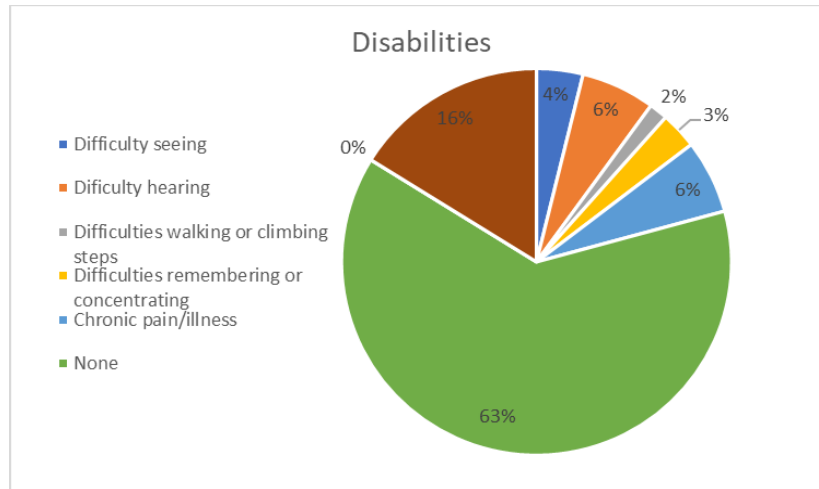


Figure 125: Disabilities in Chania Activities

Figure 122 presents respondents' perceptions of how effective the Visionary Solution was in reaching its expected impact. A majority of participants (57%) rated the impact as moderate (35%) or very effective (22%), suggesting a generally positive reception. Additionally, 17% found it extremely effective, while a smaller portion considered it only somewhat effective (13%), slightly effective (9%), or not effective at all (4%). Overall, the responses indicate that most participants perceived the solution as successful, though there remains room for improvement in maximizing its perceived impact across all groups.

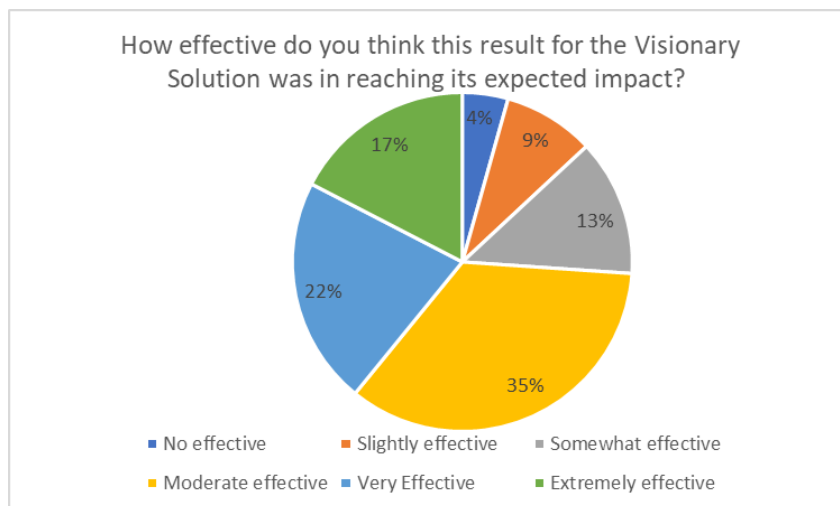


Figure 126: Co-evaluation result in Chania

Challenge 9

KPI 9.4 Noise reduction rates (or exposure to noise pollution)

Expected Impact: To develop and apply a health-relevant, indicator-based approach for assessing urban noise pollution in Chania, Greece, by analysing mobile and stationary noise measurements across time and space, examining their association with land use and population density, in order to support evidence-based strategies for healthier and more equitable urban environments (Added value)

VS(s): 2

Evaluation Method: Benchmarking

The results of this analysis is part of the Confidential Deliverable D7.6.

KPI 9.8 Feeling of improved quality of life

Expected Impact: To evaluate and apply a health-relevant, indicator-based approach for assessing quality of life in Chania, Greece, by analysing how key factors, such as human performance and wellbeing, physical and mental health, social relations, and environmental conditions like green space access and noise levels, relate to demographic characteristics, in order to inform evidence-based urban planning and policy (Added value)

VS(s): 1

Evaluation Method: Benchmarking (*See discussion section of research publication: Tsekeri, E., Lilli, A., Daras, T. et al. On the evaluation of quality of life in Chania Crete, Greece. Discov Cities 2, 1 (2025). <https://doi.org/10.1007/s44327-024-00038-y>*)

The Quality of Life (QoL) assessment was conducted using the standardized Quality of Life Score (WHOQOL-BREF) questionnaire, which evaluates multiple dimensions of well-being. Core questions addressed satisfaction with personal relationships, housing conditions, access to healthcare, transportation, proximity to parks and green spaces, and perceived noise levels in the living environment. QoL scores range from 0 (extremely poor quality of life) to 100 (perfect quality of life). The average score of 95.35 indicates a very high overall level of satisfaction across all domains assessed, suggesting that participants generally experience excellent quality of life conditions.

All the analysis is described in detail in the research publication: Tsekeri, E., Lilli, A., Daras, T. et al. On the evaluation of quality of life in Chania Crete, Greece. Discov Cities 2, 1 (2025). <https://doi.org/10.1007/s44327-024-00038-y>

KPI 9.16 Increased outdoor physical activity

Expected Impact: Increased data on health and wellbeing (Added value)

VS(s): 1

Evaluation Method: Benchmarking

The survey used to assess citizen well-being and physical activity patterns was based on the International Physical Activity Questionnaire (IPAQ). It was distributed during co-creation workshops, cultural events, and community gatherings. The primary goal of this survey was to evaluate participants' levels of physical activity across work, transport, and leisure domains, while also capturing broader insights into health, lifestyle, and urban living conditions, thus supporting data-driven planning for healthier and more inclusive public spaces.

Figure 123 presents indicative survey responses on participants' physical activity across three key domains: work-related, transport-related, and recreational/sport/leisure-time activities. Reported levels of work-related physical activity were generally low, suggesting that many respondents likely engage in sedentary or desk-based occupations. In contrast, transport-related physical activity—such as walking or cycling—was more consistent, indicating moderate engagement in active commuting. Recreational and leisure-time activity levels varied widely, with some participants reporting frequent exercise while others remained largely inactive.

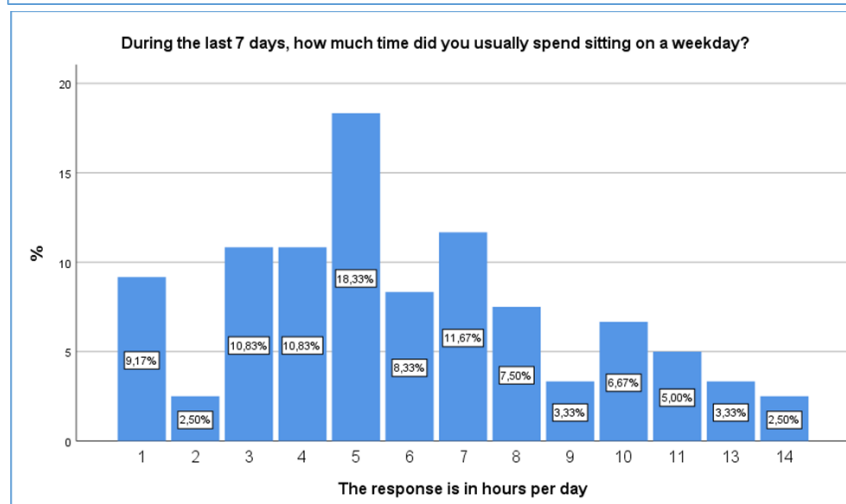
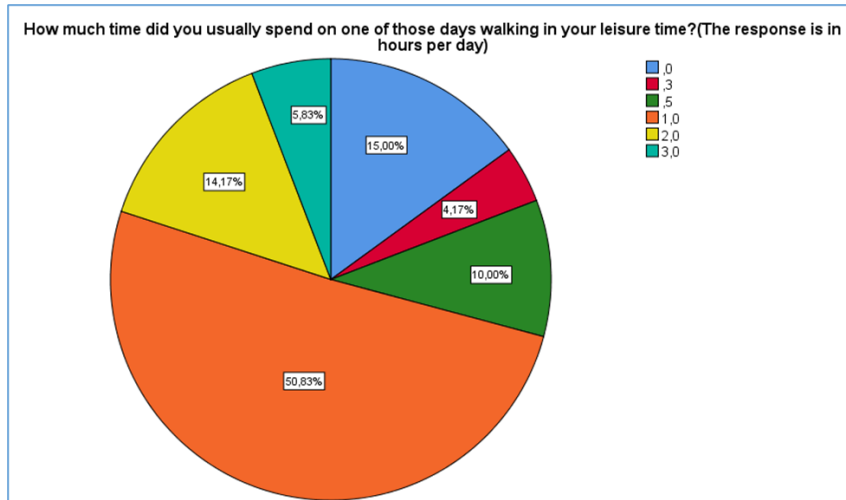
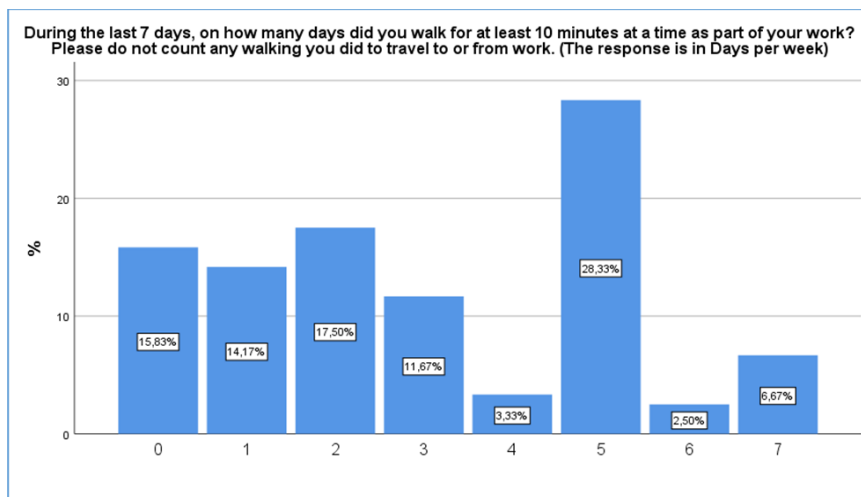


Figure 127: Self-reported physical activity in Chania

KPI 9.19 Increase in walking and cycling in and around areas of interventions

Expected Impact: Increased data on health and wellbeing

VS(s): 2

Evaluation Method: Benchmarking

	Nov	23- Dec	24- Jan	24- Feb	24- Mar	24- Apr	24- May	24- Jun	24- Jul	24- Aug	24- Sep
MGC	13	19	10	11	10	8	4	10	1	1	1
SAP	4	11	4	3	0	10	5	12	0	0	0

Table 158: Average duration of system use for each active week

Both sites function as public parks, with the primary differences being their size and location. These characteristics, in turn, influence the types of activities and uses each space supports. Dhmotikos Khpos, located in the center of Chania, spans approximately 17,000 m², making it the most significant green space within the urban core. In contrast, Agioi Apostoloi Park covers an expansive area of 456,358 m² and includes a small forest as well as three beaches. As a result, it caters to a broader range of recreational needs, offering both natural and coastal experiences to the public.

KPI 9.20 Smoke cessation due to sports activities in green areas

Expected Impact: Increased data on health and wellbeing (Added value)

VS(s): 1

Evaluation Method: Benchmarking

The Questionnaire on Smoking aimed to gather insights into participants' smoking behaviors, nicotine dependence, cessation history, and motivations to quit, while also exploring their perceived stress levels and the potential influence of green spaces on smoking reduction. It was distributed during co-creation workshops, cultural events, and community gatherings. The smoking questionnaire conducted as part of the VARCITIES pilot in Chania revealed key insights into participants' smoking habits, motivations, and perceptions. Respondents included both former and current smokers, with some reporting light smoking patterns (e.g., up to 10 cigarettes per day). Several participants

expressed a willingness to quit, including intentions to stop within the next month. Family support emerged as a significant motivator for cessation, alongside concerns about secondhand smoke and social disapproval. Stress was frequently noted, indicating that smoking may be used as a coping mechanism. Although many participants reported not frequently visiting green spaces, some believed that spending more time in nature could assist them in reducing or quitting smoking. Furthermore, many acknowledged smoking as a chronic disease, showing an awareness of its long-term health impacts.

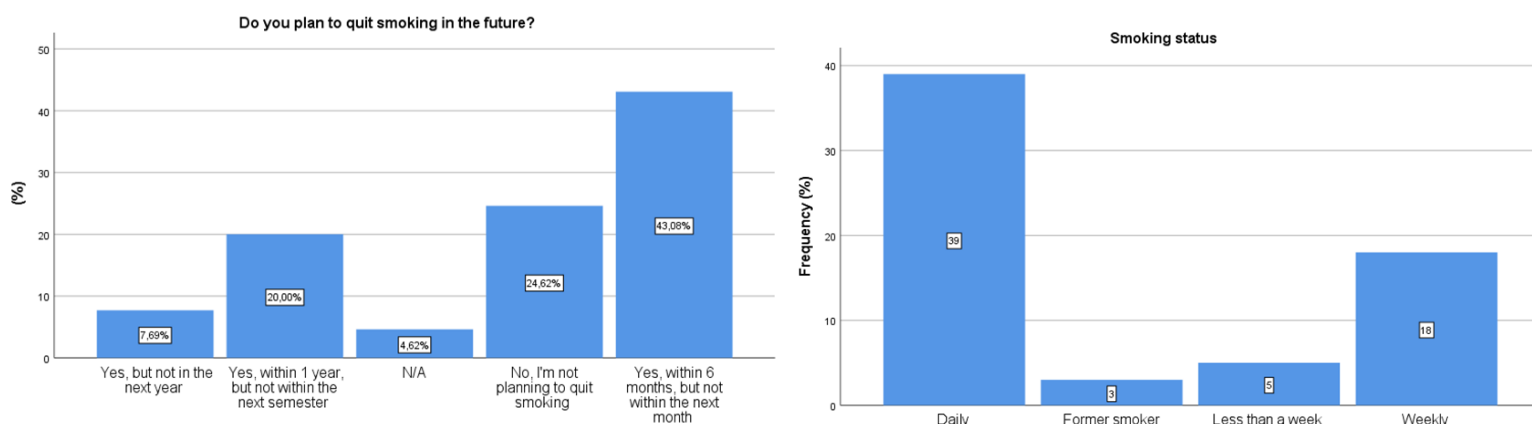


Figure 128: Indicative results from the analysis of the survey

KPI 9.29 Association between Quality of life and Human performance and well-being

Expected Impact: To evaluate and apply a health-relevant, indicator-based approach for assessing quality of life in Chania, Greece, by analysing how key factors, such as human performance and wellbeing, physical and mental health, social relations, and environmental conditions like green space access and noise levels, relate to demographic characteristics, in order to inform evidence-based urban planning and policy (Added value)

VS(s): 1

Evaluation Method: Benchmarking (See discussion section of research publication: Tsekeri, E., Lilli, A., Daras, T. et al. *On the evaluation of quality of life in Chania Crete, Greece. Discov Cities* **2**, 1 (2025). <https://doi.org/10.1007/s44327-024-00038-y>)

This indicator was developed following a Factor Analysis conducted on the QoL Survey (ID 9.8) to identify the core components that define the Health and Wellbeing (H&WB) of

citizens. Figure 125 presents generally high levels of satisfaction among participants across key aspects of wellbeing. The highest satisfaction was reported in relation to the ability to work (mean score: 4.03), followed closely by the ability to perform daily activities (3.90), access to necessary information (3.92), and self-perception (3.93). Although satisfaction with sleep was slightly lower (3.67), the lowest score was observed for having sufficient energy for daily activities (3.44), indicating a potential area for targeted support and interventions to enhance physical vitality in daily life.

All the analysis is described in detail in the research publication: Tsekeri, E., Lilli, A., Daras, T. et al. On the evaluation of quality of life in Chania Crete, Greece. Discov Cities 2, 1 (2025). <https://doi.org/10.1007/s44327-024-00038-y>

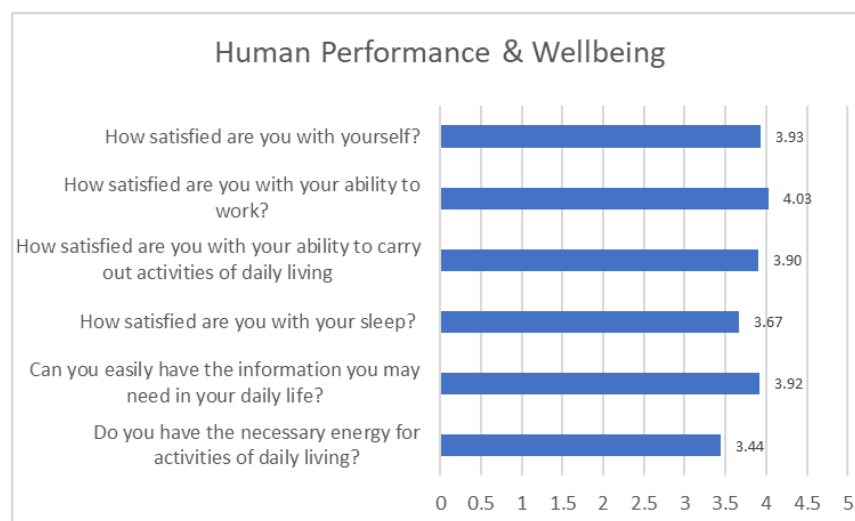


Figure 129: Human performance and well-being in Chania

KPI 9.30 Association between Quality of life and Physical Health

Expected Impact: To evaluate and apply a health-relevant, indicator-based approach for assessing quality of life in Chania, Greece, by analysing how key factors, such as human performance and wellbeing, physical and mental health, social relations, and environmental conditions like green space access and noise levels, relate to demographic characteristics, in order to inform evidence-based urban planning and policy (Added value)

VS(s): 1

Evaluation Method: Benchmarking (See discussion section of research publication: Tsekeri, E., Lilli, A., Daras, T. et al. On the evaluation of quality of life in Chania Crete, Greece. Discov Cities 2, 1 (2025). <https://doi.org/10.1007/s44327-024-00038-y>)

This indicator was derived from the Factor Analysis applied to the QoL Survey (ID 9.8) in order to identify key dimensions shaping the Physical Health of citizens. Figure 126 highlights respondents' experiences related to their health status. While satisfaction with overall health scored moderately (mean: 3.52), many participants reported experiencing recent health problems (3.67) and limitations caused by physical pain (3.98). Notably, the highest mean score (4.32) was recorded for the need for daily medical treatment, suggesting that a significant proportion of individuals live with chronic conditions requiring ongoing care. These results underscore the importance of continuous health support and access to medical services in maintaining citizens' wellbeing.

All the analysis is described in detail in the research publication: Tsekeri, E., Lilli, A., Daras, T. et al. On the evaluation of quality of life in Chania Crete, Greece. Discov Cities 2, 1 (2025). <https://doi.org/10.1007/s44327-024-00038-y>

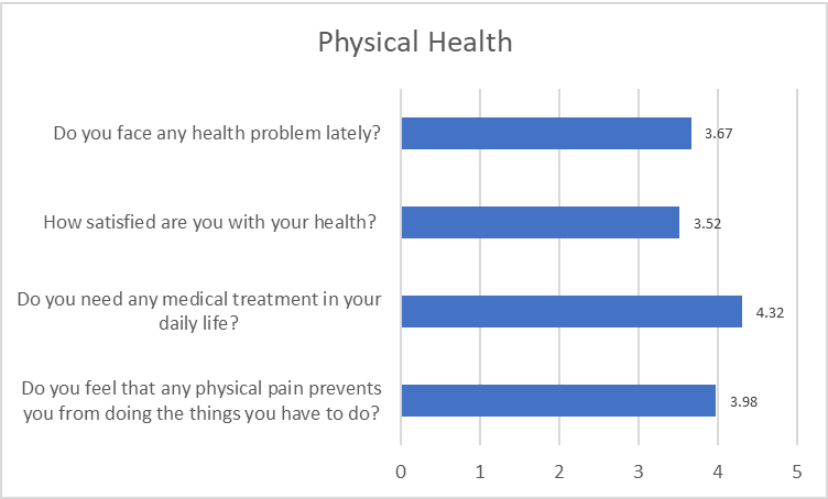


Figure 130: Physical health in Chania

KPI 9.31 Association between Quality of life and Psychological Health

Expected Impact: To evaluate and apply a health-relevant, indicator-based approach for assessing quality of life in Chania, Greece, by analyzing how key factors, such as human performance and wellbeing, physical and mental health, social relations, and environmental conditions like green space access and noise levels, relate to demographic

characteristics, in order to inform evidence-based urban planning and policy (Added value)

VS(s): 1

Evaluation Method: Benchmarking (See discussion section of research publication: Tsekeri, E., Lilli, A., Daras, T. et al. On the evaluation of quality of life in Chania Crete, Greece. *Discov Cities* **2**, 1 (2025). <https://doi.org/10.1007/s44327-024-00038-y>)

This indicator was developed based on Factor Analysis conducted on the QoL Survey (ID 9.8), aiming to identify core components contributing to citizens’ Psychological Health. Figure 128 shows that participants generally perceive their mental well-being positively, with high average scores for life meaning (3.90), overall quality of life (3.94), and enjoyment of life (3.62). Concentration ability also scored favourably (3.59). However, the lowest score was observed for the frequency of negative emotions such as anxiety or hopelessness (2.87), indicating that while overall psychological health is robust, emotional distress remains a concern for a notable portion of the population. These findings suggest the value of reinforcing mental health support systems within the community.

All the analysis is described in detail in the research publication: Tsekeri, E., Lilli, A., Daras, T. et al. On the evaluation of quality of life in Chania Crete, Greece. *Discov Cities* **2**, 1 (2025). <https://doi.org/10.1007/s44327-024-00038-y>

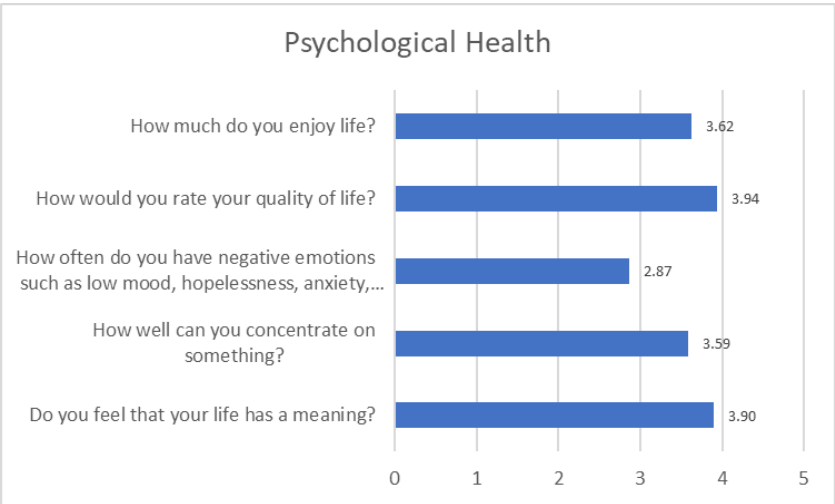


Figure 131: Association between Quality of life and psychological health in Chania

KPI 9.32 Association between Quality of life and Social Relations

Expected Impact: To evaluate and apply a health-relevant, indicator-based approach for assessing quality of life in Chania, Greece, by analysing how key factors, such as human performance and wellbeing, physical and mental health, social relations, and environmental conditions like green space access and noise levels, relate to demographic characteristics, in order to inform evidence-based urban planning and policy (Added value)

VS(s): 1

Evaluation Method: Benchmarking (*See discussion section of research publication: Tsekeri, E., Lilli, A., Daras, T. et al. On the evaluation of quality of life in Chania Crete, Greece. Discov Cities 2, 1 (2025). <https://doi.org/10.1007/s44327-024-00038-y>*)

This indicator was derived from the Social Relations component of the QoL Survey (ID 9.8) following Factor Analysis to explore interpersonal wellbeing. Figure 128 demonstrates high satisfaction with personal relationships (mean: 4.02) and support from friends (mean: 4.13), indicating strong social connectivity and perceived emotional support among participants. However, satisfaction with sex life scored lower (3.48), highlighting a potential area for further exploration or support. Overall, the results reflect positively on the participants' social well-being, with opportunities to enhance aspects of intimate and personal connection.

All the analysis is described in detail in the research publication: Tsekeri, E., Lilli, A., Daras, T. et al. On the evaluation of quality of life in Chania Crete, Greece. Discov Cities 2, 1 (2025). <https://doi.org/10.1007/s44327-024-00038-y>

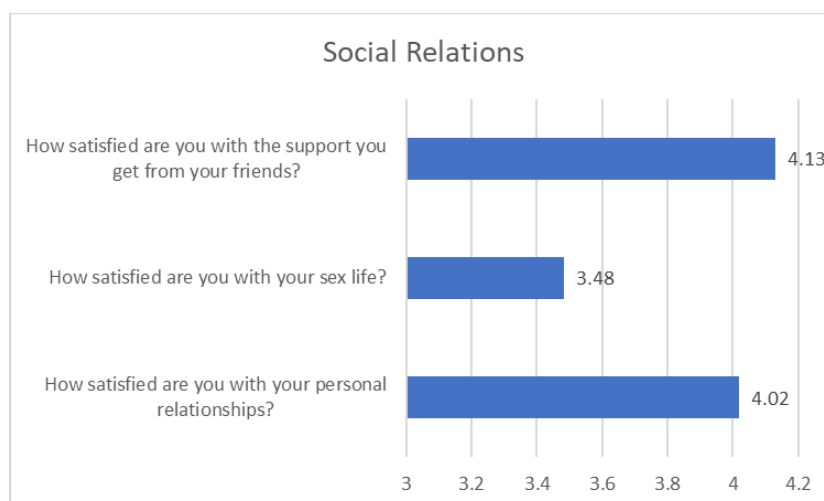


Figure 132: Association between Quality of life and social relations in Chania

KPI 9.33 Association between Quality of life and Residential Environment

Expected Impact: To evaluate and apply a health-relevant, indicator-based approach for assessing quality of life in Chania, Greece, by analysing how key factors, such as human performance and wellbeing, physical and mental health, social relations, and environmental conditions like green space access and noise levels, relate to demographic characteristics, in order to inform evidence-based urban planning and policy (Added value)

VS(s): 1

Evaluation Method: Benchmarking (See discussion section of research publication: Tsekeri, E., Lilli, A., Daras, T. et al. *On the evaluation of quality of life in Chania Crete, Greece. Discov Cities* **2**, 1 (2025). <https://doi.org/10.1007/s44327-024-00038-y>)

This indicator, focusing on the Residential Environment domain from the QoL Survey (ID 9.8), highlights generally positive perceptions among respondents. Participants expressed high satisfaction with their ability to move in and out of their homes (mean: 4.24), suggesting good accessibility and infrastructure. Perceptions of environmental health (3.88) and daily safety (3.81) were also favourable, though slightly lower, indicating that while the residential setting is mostly supportive, further improvements in safety and environmental quality could enhance residents' overall well-being.

All the analysis is described in detail in the research publication: Tsekeri, E., Lilli, A., Daras, T. et al. On the evaluation of quality of life in Chania Crete, Greece. *Discov Cities* **2**, 1 (2025). <https://doi.org/10.1007/s44327-024-00038-y>

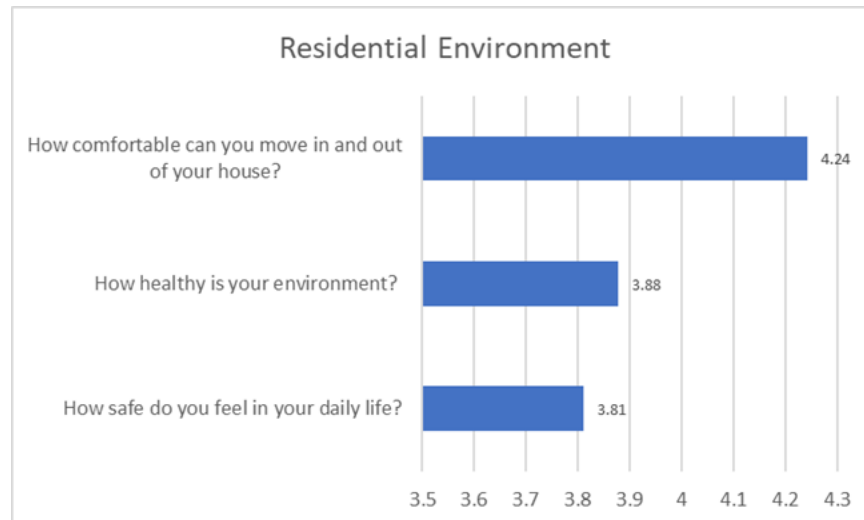


Figure 133: Residential environment in Chania

KPI 9.34 Association between Quality of life and neighbourhood environment

Expected Impact: To evaluate and apply a health-relevant, indicator-based approach for assessing quality of life in Chania, Greece, by analysing how key factors, such as human performance and wellbeing, physical and mental health, social relations, and environmental conditions like green space access and noise levels, relate to demographic characteristics, in order to inform evidence-based urban planning and policy (Added value)

VS(s): 1

Evaluation Method: Benchmarking (See discussion section of research publication: Tsekeri, E., Lilli, A., Daras, T. et al. On the evaluation of quality of life in Chania Crete, Greece. *Discov Cities* **2**, 1 (2025). <https://doi.org/10.1007/s44327-024-00038-y>)

This indicator domain from the QoL Survey (ID 9.8), captures participants' satisfaction with the neighbourhood environment. The highest rating was given to satisfaction with parks and green spaces (mean: 3.84), indicating general approval of local natural amenities. However, satisfaction with proximity to parks (3.02) and noise levels (3.20) was

lower, suggesting room for improvement in accessibility and noise management to enhance overall neighbourhood quality.

All the analysis is described in detail in the research publication: Tsekeri, E., Lilli, A., Daras, T. et al. On the evaluation of quality of life in Chania Crete, Greece. Discov Cities 2, 1 (2025). <https://doi.org/10.1007/s44327-024-00038-y>

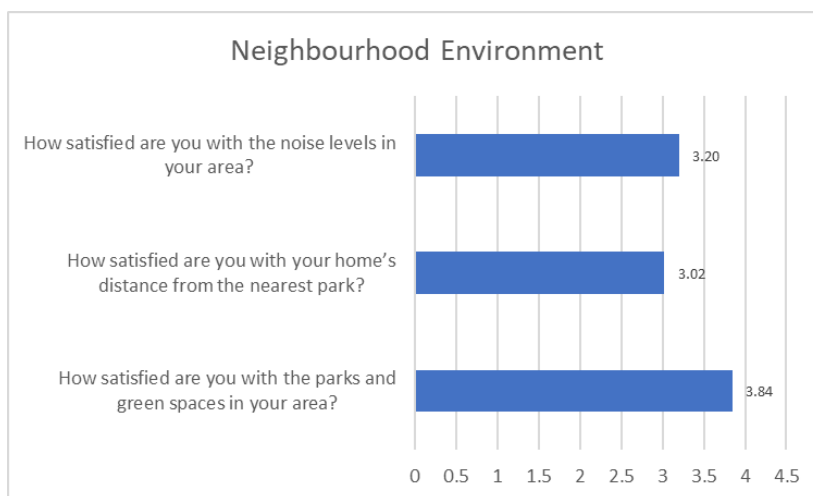


Figure 134: Neighbourhood environment in Chania

KPI 9.35 Association between Quality of life and Infrastructure/Services in the humans' living environment

Expected Impact: To evaluate and apply a health-relevant, indicator-based approach for assessing quality of life in Chania, Greece, by analysing how key factors, such as human performance and wellbeing, physical and mental health, social relations, and environmental conditions like green space access and noise levels, relate to demographic characteristics, in order to inform evidence-based urban planning and policy (Added value)

VS(s): 1

Evaluation Method: Benchmarking (See discussion section of research publication: Tsekeri, E., Lilli, A., Daras, T. et al. *On the evaluation of quality of life in Chania Crete, Greece. Discov Cities 2, 1 (2025).* <https://doi.org/10.1007/s44327-024-00038-y>)

This indicator domain from the QoL Survey (ID 9.8), reflects participants' perceptions of their living environment. Respondents expressed high satisfaction with the conditions of

their home (mean: 4.00), suggesting that most consider their immediate living conditions favourable. However, slightly lower ratings for access to health services (3.45) and transportation (3.35) highlight areas where improvements could enhance daily convenience and overall quality of life.

All the analysis is described in detail in the research publication: Tsekeri, E., Lilli, A., Daras, T. et al. On the evaluation of quality of life in Chania Crete, Greece. Discov Cities 2, 1 (2025). <https://doi.org/10.1007/s44327-024-00038-y>

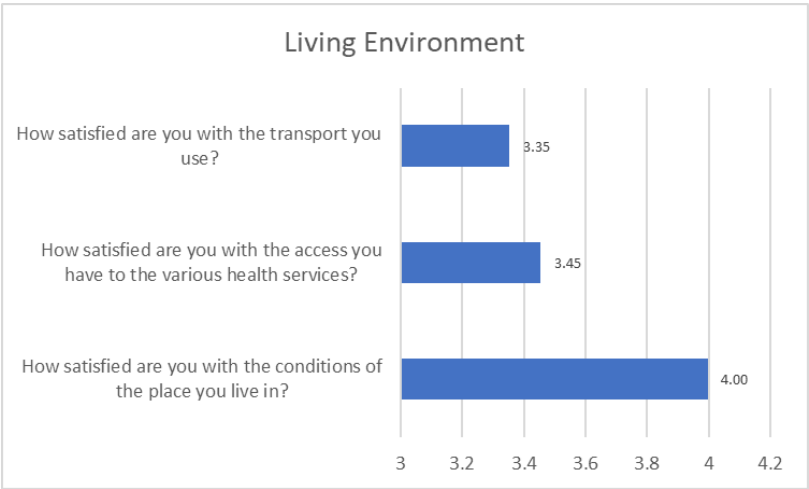


Figure 135: Living environment in Chania

Figure 132 presents the subjective scores (ranging from 0 to 100) for seven key indicators of urban quality of life (KPIs 9.29, 9.30, 9.31, 9.32, 9.33, 9.34, 9.35). Among them, "Human performance and well-being" received the highest average score (74.38), followed by "Physical health" (72.83) and "Psychological health" (71.81), indicating strong overall satisfaction in these personal domains. In contrast, "Neighborhood environment" scored the lowest (58.33), highlighting potential concerns regarding noise, green space access, or local amenities, suggesting this area may need greater attention in urban planning and policy efforts.

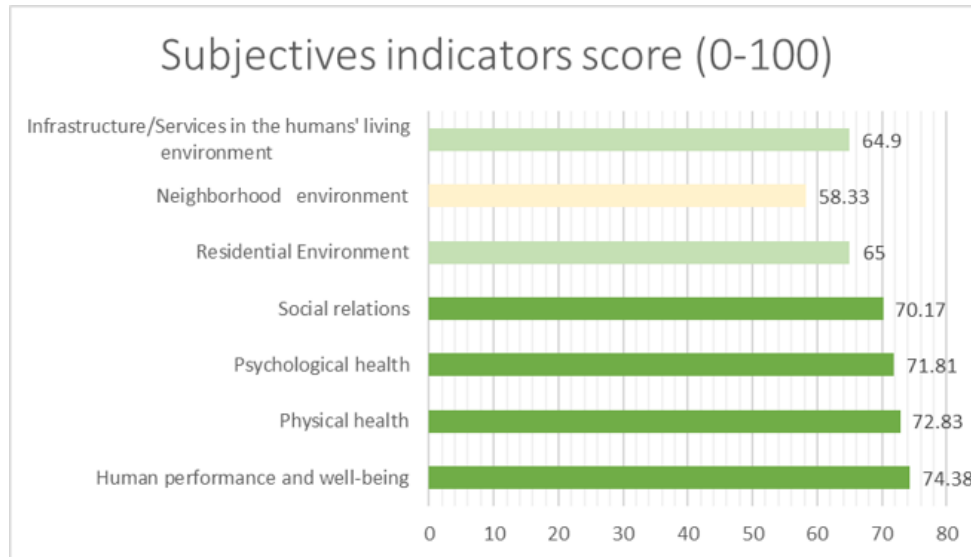


Figure 136: Quality of life association scores

KPI 9.36 Number of noise data

Expected Impact: To develop and apply a health-relevant, indicator-based approach for assessing urban noise pollution in Chania, Greece, by analysing mobile and stationary noise measurements across time and space, examining their association with land use and population density, in order to support evidence-based strategies for healthier and more equitable urban environments (Direct Impact)

VS(s): 1, 2

Evaluation Method: Pre & Post Intervention

VS1:

- Pre-Intervention: Before the implementation of VS1, no systematic noise level data was available for the city of Chania.
- Post-Intervention: The deployment of environmental sensors equipped in VS1, significantly enhanced the city's monitoring capabilities. As a result, approximately 59,704 data points on noise levels were collected, providing a foundational dataset for urban acoustic analysis.

VS2:

- Pre-Intervention: As with VS1, no noise data had been previously gathered before the rollout of VS2, which hindered understanding of spatial and temporal variations in noise exposure across Chania.
- Post-Intervention: By integrating mobile environmental sensors on bicycles and stationary bike stations, VS2 produced an extensive dataset of approximately 7,754,992 noise-level measurements across different city zones.

The post-intervention implementation of VS1 and VS2 enabled the first-ever noise monitoring database for Chania. This supports data-driven urban planning, public health research, and the development of targeted strategies to reduce environmental noise. The integration of fixed and mobile sensing technologies proved both technically feasible and impactful, paving the way for smarter, more responsive urban policies.

KPI 9.37 Number of health and lifestyle data

Expected Impact: 1) To evaluate and apply a health-relevant, indicator-based approach for assessing quality of life in Chania, Greece, by analysing how key factors, such as human performance and wellbeing, physical and mental health, social relations, and environmental conditions like green space access and noise levels, relate to demographic characteristics, in order to inform evidence-based urban planning and policy. 2) To explore the associations between engagement with urban green spaces and various self-reported health and well-being outcomes among residents in Chania, highlighting the role of nature exposure in supporting physical and mental health (Direct Impact)

VS(s): 1

Evaluation Method: Pre & Post Intervention

As presented in Table 110 and Figure 133 below, health data were collected from a representative sample of 1,200 citizens and categorized into 10 thematic areas, enabling detailed analysis of urban H&WB determinants.

Questionnaire	Sample
Quality of life Questionnaire (ID9.8)	326
Smoke cessation Questionnaire (ID9.20)	64

Physical Activity Questionnaire (ID9.16)	120
Comprehensive Health, Lifestyle, and Green Space Engagement Questionnaire	718
Total	1228

Table 159: Sample sizes for each questionnaire used, totalling 1,228 respondents

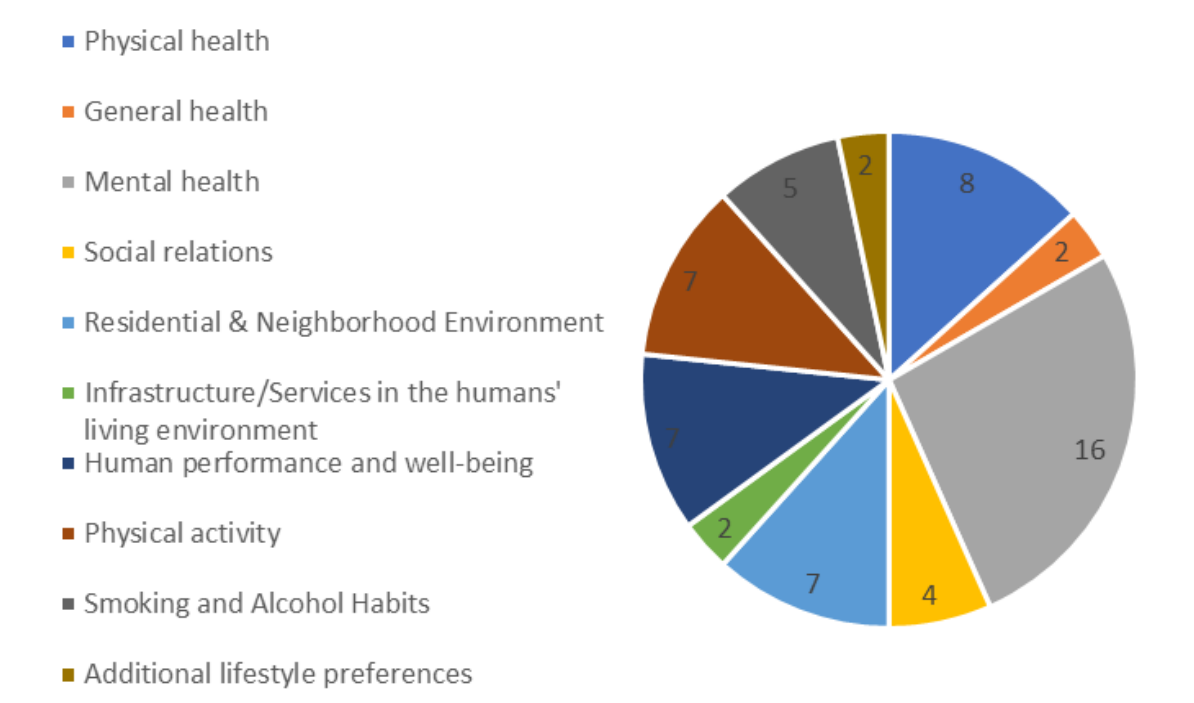


Figure 137: No of health and lifestyle factors considered in each category

The health and lifestyle data are the following:	
Physical health	Cardiovascular Diseases
	Stroke

	Diabetes
	High Cholesterol
	High Blood Pressure
	physical pain
	medical treatment
	BMI
General health	health problem
	general health rate
Mental health	Concentration
	Sleep
	Useful part in things
	Decisions making
	Strain
	Overcoming difficulties
	Daily activities
	Facing problems

	Unhappy
	Confidence
	Worthless
	Happy
	negative emotions
	Life enjoy
	Stress in Daily Life
	meaning of life
Social relations	Social interaction within green space
	Support from friends
	Sex life
	Personal relationships
Residential & Neighbourhood Environment	noise levels
	Green space accessibility
	Green space availability
	Satisfaction with the green spaces

	Satisfaction with the Neighbourhood Environment
	Comfort in neighbourhood environment
	Environmental health
Infrastructure/Services in the humans' living environment	access to health services
	Satisfaction with Transport
Human performance and well-being	Concentration
	safety
	energy for activities
	sleep
	ability to work
	personal satisfaction
	Stress in Daily Life
Physical activity	Duration of Physical Activity
	Type of Physical Activity
	Employment and Work-Related Physical Activity

	Transportation Physical Activity
	Household and Yard Physical Activity
	Leisure Time Physical Activity
	Sitting Activities
Smoking and Alcohol Habits	Smoking Habits and Dependence
	Previous Smoking Cessation Attempts
	Motivation to Quit Smoking
	Perception of Smoking as a Disease
	Alcohol
Additional lifestyle preferences	GS Type preferences
	Frequency and duration of GS visits

Table 160: Health and lifestyle data gathered and analysed

Challenge 10

KPI 10.1 Number of jobs created

Expected Impact: Increased job opportunities (Direct Impact)

VS(s): 1

Evaluation Method: Pre & Post Intervention

The intervention led to the creation of two new positions

Post intervention	Description of job
2	The MULaR Manager is responsible for the overall management, security, maintenance, and cultural programming of a designated public space. This role ensures the space is safe, well-maintained, and actively used for community engagement through events and activities. The person is responsible to coordinate with local authorities, cultural organizations, and service providers to meet operational needs while enhancing the cultural and social value of the space.

Table 161: Chania no. of jobs created

KPI 10.5 Definition of parameters for (re)designing of green public spaces based on the well-being of users

Expected Impact: Definition of parameters for (re)designing green public spaces based on the well-being of users (Direct Impact)

VS(s): 1,2

Evaluation Method: Pre & Post Intervention

VS1:

Based on the study's findings [Lilli, A., Tsekeri, E. & Kolokotsa, D. *A health relevant approach for assessing urban green spaces. Discover Cities* 1, 37 (2024). <https://doi.org/10.1007/s44327-024-00029-z>], several planning strategies are recommended for optimizing green spaces to improve their environmental and social benefits:

- **Increased Tree Cover and Leaf Area:** Multi-layered planting strategies, accompanied by a reduction in unnecessary grass and non-permeable surfaces can yield elevated environmental benefits. Introducing species with larger canopies and increased leaf area suits better MGC-like green spaces while for regions like SAP, increased tree cover affords better results.
- **Optimal Seasonal Vegetation Patterns:** Seasonal variations in vegetation cover shall be considered towards an optimized green space planning methodology. Species that maintain higher NDVI values during off-peak months seem a

favorable choice for areas similar to MGC. In regions like SAP, strategies to preserve greenery throughout summer to balance the high winter NDVI could be adopted.

- **Enhanced Carbon Sequestration and Storage:** In areas with dominant large trees like SAP, preserving species that excel in carbon storage, like Blue gum eucalyptus, is an important design consideration. In parks with predominantly smaller trees like MGC, the introduction of larger species or species known for effective carbon sequestration (like the Benjamin fig) holds significant potential.
- **Biodiversity Promotion:** In diverse areas like MGC, introducing native species can enhance biodiversity, while in regions like SAP, resilient species that support diverse ecosystem services are preferable.
- **Addressing Spatial Disparities and Amenities Optimization:** Focus on equitable access and enhanced amenities and environmental attributes can lead to improved perceived green space attractiveness. For urban spaces like MGC, additional features such as areas for active recreation, sunbathing, and play constitute potential choices.
- **Enhanced-Diversified Tree Planting for Improved Pollution Removal:** Strategic selection of species highly effective at capturing pollutants like ozone and particulate matter in high-traffic zones constitute preferable methodological steps. To evaluate the most suitable trees, ecosystem services models can be particularly useful as decision-support tools for city planning.
- **Targeted Cooling Strategies in High-Heat Areas:** Cooling effects can be enhanced by optimizing vegetation layout with diverse plant species and densities, thus addressing temperature variations within green spaces. In high-heat areas targeted interventions can reduce thermal stress. High-traffic zones, such as playgrounds, which often experience elevated temperatures, should receive particular attention to ensure a comfortable environment for users.

Based on the study's findings [Tsekeri, E., Lilli, A., Daras, T. et al. *On the evaluation of quality of life in Chania Crete, Greece. Discov Cities* 2, 1 (2025). <https://doi.org/10.1007/s44327-024-00038-y>], several planning strategies are recommended for improving both urban and peri-urban environments in Chania by addressing key factors such as noise pollution, green spaces, healthcare services, and social infrastructure:

1. Improvement of Green Spaces and Environmental Quality: Expanding and enhancing green spaces contributes to better environmental quality and boosts the well-being of urban residents.
2. Noise Pollution Mitigation: Reduction of noise pollution can greatly improve both mental and physical health in urban areas.
3. Health Infrastructure: Expanding healthcare services, particularly mental health support, increases accessibility and enhances overall well-being.
4. Enhancing Social Infrastructure and Community Engagement: Strengthening social infrastructure encourages community engagement and improves quality of life for all demographics.
5. Public Transport and Accessibility: Developing reliable, affordable public transport systems improves connectivity and access to essential services for residents.
6. Community-Driven Urban Planning: Involving communities in urban planning decisions fosters equitable and sustainable growth.
7. Noise and Environmental Quality Standards: Enforcing strict environmental standards helps reduce pollution and improve urban livability.

The results of this study [*This study is presented in Confidential Deliverable D7.6 and is under review process*], highlight the complex interplay between GS characteristics, user demographics, and health outcomes, offering clear guidance for urban planning and public health interventions.

- Demographically Responsive Interventions: Tailoring GS-related programs to population subgroups, such as men, younger adults, employed individuals, and those with lower education levels, supports the reduction of health risks and enhances engagement.
- Equitable Access and Proximity Enhancement: Ensuring GS availability within a 10-minute walking distance is a priority for promoting cardiovascular health. Planning efforts can incorporate a decentralized network of small green pockets within residential zones, particularly in underserved or high-risk areas such as neighborhoods with elderly or low-income populations.
- Quality-Oriented, Multi-Functional Design: Aesthetic quality, safety, and functionality are key drivers of GS usage and mental well-being. Incorporating elements such as shaded rest areas, natural features, effective lighting, and consistent maintenance enhances the overall experience. Gardens, given their

strong association with visitation frequency, are suitable candidates for design investment and spatial replication.

- **Diversified GS Typologies:** Varied user preferences call for a heterogeneous GS network. Integrating a mosaic of GS types, such as gardens, forests, and waterfronts, addresses diverse age and gender-based needs, broadening engagement and use.
- **Infrastructure for Regular and Prolonged Use:** Strategies that support increased visit frequency and longer durations—linked to various physical and mental health benefits—include shaded pathways, continuous walking loops, fitness trails, innovative infrastructure that facilitates engagement, and low-threshold community events that promote habitual use.
- **Integration of Green Infrastructure with Active Mobility:** Nature-based and water-based physical activities demonstrated stronger mental health benefits than urban-based equivalents. Embedding green infrastructure into mobility corridors and incentivizing outdoor recreation fosters sustained physical activity in restorative settings.
- **Provision for Both Social and Solitary Use:** Diverse interaction modes influence mental health differently. Designing flexible-use areas within GSs—including open lawns for group gatherings and quiet zones for individual use—offers users autonomy and supports the psychological benefits of both socialization and solitude.

VS2:

Based on the study's findings [*This study is presented in Confidential Deliverable D7.6 and is under review process*], several recommendations can be made to improve air quality in Chania and similar urban environments:

- **Integration of Air Quality Data into Urban Planning:** Using pollution data in development projects helps minimize environmental impact while supporting clean air initiatives.
- **Encouraging mixed-use zoning and smart city strategies** reduce emissions, enhance walkability, and improve air quality outcomes
- **Enhancing Public Transportation and Sustainable Mobility:** Expanding public transportation and promoting sustainable mobility are crucial for reducing vehicular emissions and improving urban air quality. Efficient transport services reduce reliance on private vehicles, lowering emissions and traffic

congestion. By enhancing public transit in city centers, it encourages eco-friendly travel alternatives and supports a cleaner environment

- Urban Green Infrastructure and Air Pollution Mitigation: Expanding urban green infrastructure helps reduce air pollution by filtering pollutants, lowering greenhouse gas emissions, and improving overall environmental conditions. Increasing green spaces, urban tree coverage, and parks in pollution hotspots enhances air quality, promotes biodiversity, and provides equitable access to cleaner urban environments
- Traffic and Emission Control Policies: Effective regulation of vehicle emissions and traffic congestion can significantly curb air pollution and improve public health. Additionally, implementing congestion pricing strategies discourages unnecessary vehicle use in peak traffic areas, ultimately reducing pollution levels and enhancing urban mobility efficiency
- Air Quality Monitoring and Public Awareness: Expanding the use of mobile and stationary air quality monitoring systems ensures accurate real-time pollution data collection, enabling policymakers to make informed decisions. Raising public awareness through campaigns on air pollution risks fosters behavioral changes that support cleaner air practices, such as reducing vehicle use and adopting cleaner fuels

Based on the study's findings [*This study is presented in Confidential Deliverable D7.6 and is under review process*], several recommendations can be made to adapt noise mitigation strategies:

- The results emphasize the need for adaptive noise mitigation strategies, including traffic flow management, pedestrianization, and targeted noise reduction in high-exposure zones. Effective mitigation measures such as noise barriers, speed reductions, urban greening, and acoustic zoning have proven effective in reducing environmental noise levels and their associated health impacts
- Cities implementing low-emission zones and smart traffic management have successfully lowered noise pollution in high-density urban areas
- Additionally, noise mapping and action plans recommended by the European Environmental Noise Directive have demonstrated the benefits of integrating noise control into urban planning

- Ultimately, addressing noise pollution through comprehensive urban planning and mitigation strategies is essential for safeguarding public health and enhancing overall well-being in urban environments.

The evaluation method is grounded in the WHO Healthy Cities framework, using five core categories: Environmental Quality, Health & Wellbeing, Social Determinants of Health, Built Environment, and Governance & Participation. These categories were selected to ensure a holistic and balanced assessment of urban interventions, covering both physical infrastructure (e.g. green space, mobility, zoning) and social systems (e.g. equity, inclusion, participation). Each intervention parameter is mapped using a binary alignment matrix, enabling structured visual comparison. To complement this, a qualitative weighted scoring system is applied to thematic groups of parameters (e.g. air quality, accessibility). The score out of 10 reflects performance across four criteria:

- Coverage (30%): how comprehensively the theme addresses its dimension; Alignment with
- WHO Healthy City principles (30%): how closely it reflects international standards and evidence;
- Implementation Potential (20%): how realistic and scalable the measures are in practice; and
- Transformative Impact (20%: the extent to which the measures drive long-term, systemic change. This combined approach enables consistent, transparent comparison across pilot cities while maintaining focus on health, equity, and sustainability outcomes.

Parameter	Environmental Quality	Health & Wellbeing	Social Determinants of Health	Built Environment	Governance & Participation
Increased Tree Cover and Leaf Area	✓	✓		✓	

Optimal Seasonal Vegetation Patterns	✓	✓			
Enhanced Carbon Sequestration and Storage	✓			✓	
Biodiversity Promotion	✓	✓	✓		
Addressing Spatial Disparities and Amenities Optimization			✓	✓	✓
Enhanced-Diversified Tree Planting for Improved Pollution Removal	✓	✓			
Targeted Cooling Strategies in High-Heat Areas	✓	✓		✓	
Improvement of Green Spaces and	✓			✓	

Environmental Quality					
Noise Pollution Mitigation	✓	✓			
Health Infrastructure		✓	✓		
Enhancing Social Infrastructure and Community Engagement			✓		✓
Public Transport and Accessibility			✓	✓	
Community-Driven Urban Planning				✓	✓
Noise and Environmental Quality Standards	✓				✓
Demographically Responsive Interventions			✓		✓
Equitable Access and			✓	✓	

Proximity Enhancement					
Quality-Oriented, Multi-Functional Design		✓		✓	
Diversified GS Typologies	✓			✓	
Infrastructure for Regular and Prolonged Use		✓		✓	
Integration of Green Infrastructure with Active Mobility	✓	✓		✓	
Provision for Both Social and Solitary Use		✓	✓		
Integration of Air Quality Data into Urban Planning	✓				✓
Encouraging mixed-use zoning and smart city strategies				✓	✓

Enhancing Public Transportation and Sustainable Mobility	✓	✓		✓	
Urban Green Infrastructure and Air Pollution Mitigation	✓	✓			
Traffic and Emission Control Policies	✓				✓
Air Quality Monitoring and Public Awareness	✓				✓
Adaptive Noise Mitigation Strategies	✓	✓			
Low-Emission Zones and Smart Traffic Management	✓			✓	
Noise Mapping and Action Plans	✓				✓

Comprehensive Urban Planning				✓	✓
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Table 162: Chania parameters

1. Environmental Sustainability & Climate Resilience

Increased Tree Cover and Leaf Area

- Optimal Seasonal Vegetation Patterns
- Enhanced Carbon Sequestration and Storage
- Biodiversity Promotion
- Urban Green Infrastructure and Air Pollution Mitigation
- Diversified GS Typologies
- Traffic and Emission Control Policies

These parameters focus on ecosystem functionality, ecological integration, and long-term climate resilience. Strategies such as enhancing canopy cover and promoting biodiversity mirror best practices in WHO and EU Healthy City frameworks (e.g. Sponge Cities, Paris climate initiatives). The integration of green infrastructure supports both environmental stability and health co-benefits.

Alignment Score: 9/10

2. Air Quality & Pollution Mitigation

- Enhanced-Diversified Tree Planting for Improved Pollution Removal
- Integration of Air Quality Data into Urban Planning
- Air Quality Monitoring and Public Awareness
- Low-Emission Zones and Smart Traffic Management
- Noise Pollution Mitigation
- Noise and Environmental Quality Standards
- Noise Mapping and Action Plans

These parameters directly target pollutant exposure, emissions, and public awareness. Combining policy (e.g., low-emission zones), monitoring (e.g., sensors, mapping), and

nature-based filtering (trees) represents a comprehensive mitigation approach, well-aligned with WHO Air Quality Guidelines and urban health standards.

Alignment Score: 8.5/10

3. Human Well-Being & Social Infrastructure

- Health Infrastructure
- Enhancing Social Infrastructure and Community Engagement
- Provision for Both Social and Solitary Use
- Adaptive Noise Mitigation Strategies
- Community-Driven Urban Planning
- Demographically Responsive Interventions
- Infrastructure for Regular and Prolonged Use

These measures foster physical and mental health, safety, social cohesion, and long-term civic well-being. Their alignment with WHO's social and mental health determinants is strong, especially in creating inclusive, community-driven systems that provide a broad sense of well-being.

Alignment Score: 9.5/10

4. Accessibility & Equitable Urban Planning

- Addressing Spatial Disparities and Amenities Optimization
- Equitable Access and Proximity Enhancement
- Enhancing Public Transportation and Sustainable Mobility
- Encouraging Mixed-Use Zoning and Smart City Strategies
- Comprehensive Urban Planning
- Public Transport and Accessibility

This group of parameters supports equitable access to resources and infrastructure for all demographics, directly supporting WHO's equity and accessibility pillars. They emphasize walkability, mixed land use, and inclusive service distribution.

Alignment Score: 9/10

5. Urban Heat Mitigation & Thermal Comfort

- Targeted Cooling Strategies in High-Heat Areas
- Improvement of Green Spaces and Environmental Quality
- Quality-Oriented, Multi-Functional Design
- Integration of Green Infrastructure with Active Mobility

These parameters focus on thermal comfort and climate responsiveness. They are particularly relevant in Southern European urban contexts like Chania, where heat stress is a pressing issue. Strategies mirror those from Paris' Urban Cooling Plan and WHO Urban Heat guidelines.

Alignment Score: 9/10

KPI 10.6 Replication of solutions

Expected Impact: High replication potential of Visionary Solutions (Direct Impact)

VS(s): 1, 2

Evaluation Method: Co-evaluation

The graphs below present the number of responses regarding the replicability of various solutions.

- Mobile Urban Living Room (MULR):

Replicability results show a generally positive outlook, with the majority of responses indicating moderate (23), high (20) or very high (15) replicability. Only a small number of respondents considered it not replicable (2) or low replicable (7). This suggests that, although some barriers may still exist, the solution is perceived as adaptable in various contexts.

- Sensor kits:

This solution received a particularly high rating for its replication potential. The majority of participants rated it as highly (25) or very highly replicable (21), and very few as low (1) or not replicable (3). These results show a clear consensus on the feasibility of replicating this solution in other locations or contexts.

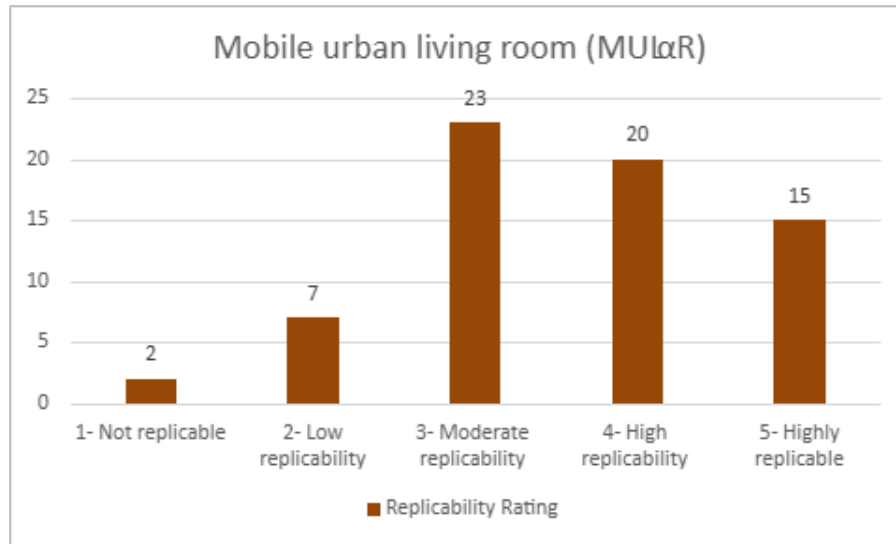


Figure 138: Chania MULR (VS1) replication potential results

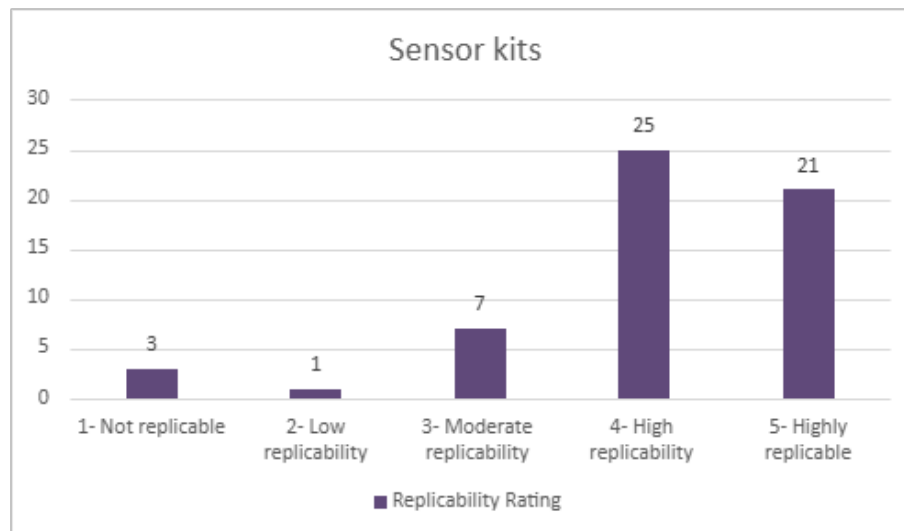


Figure 139: Chania sensor kits (VS2) replication potential results

KPI 10.8 Saved healthcare spending

Expected Impact: Savings in healthcare spending (Direct Impact)

VS(s): 1

Evaluation Method: Pre & Post Intervention

Based on a 10% increase in exposure to these spaces by approximately 5,569 people, applying common disease prevalence, evidence-based reduction rates, and average treatment costs, it is estimated that:
will result in annual savings mainly in health conditions such as high cholesterol (EUR 294,698), diabetes (EUR 62,238), depression (EUR 53,046), hypertension (EUR 51,001), stroke (EUR 32,076) and cardiovascular disease (EUR 3,762).

The following graph shows the projected healthcare savings in Chania associated with increased use of green spaces after the intervention.
Total Estimated Annual Healthcare Savings=496,822€

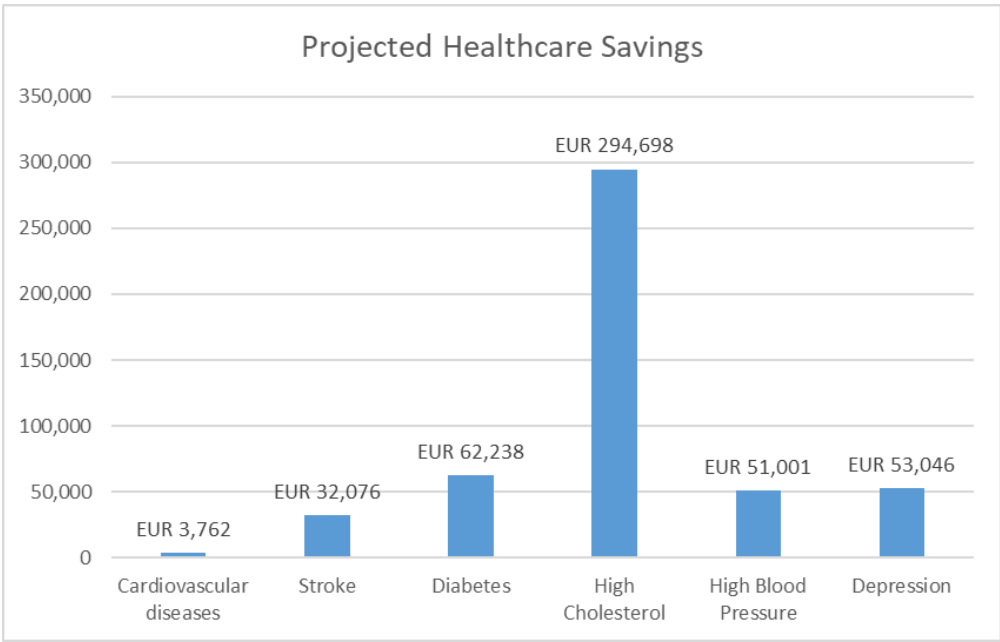


Figure 140: Chania projected healthcare savings

KPI 10.9 Public & private investments during/after the project

Expected Impact: Increased public/private investments (Direct Impact)

VS(s): 1,2

Evaluation Method: Pre & Post Intervention

Chania received a total investment of €467,349.06, with €33,464.38 in EU funding supporting environmental & health monitoring (€33,464.38) and human resources (€13,000.00) through the VARCITIES project. Additional funding from Local Government

Support amounted to €433,884.68, used for the replacement of the Municipal Bike Sharing System. While no investment was allocated to infrastructure or pilot-specific technologies during the project, future plans aim to significantly enhance these areas. No in-kind contributions or private sponsorships were recorded during the pilot phase.

Future funding opportunities for Chania are centred on the expansion of green infrastructure, advanced health and environmental monitoring, and innovative urban mobility initiatives. Local Sustainability Grants offer funding to increase public benches, shaded areas, and deploy stationary sensor kits. European Green Deal Funding provides an opportunity to scale up pilot outcomes by incorporating more advanced health and environmental monitoring technologies.

Environmental non-profit grants, such as those from the Clean Air Fund, target air quality and noise monitoring projects to improve urban health. Academic and Research Partnerships may further expand Chania's sensor network, building on deployments already initiated by related projects like JustNature. Income derived from project outcomes, such as monetized air quality data, presents another stream to support future enhancements.

The Urban Innovation Action (UIA) Programme encourages experimental urban solutions and could finance the scaling and broader deployment of successful pilots. Additionally, Public-Private Partnerships and CSR initiatives from companies could provide special events funding and further co-financing aligned with public goals.

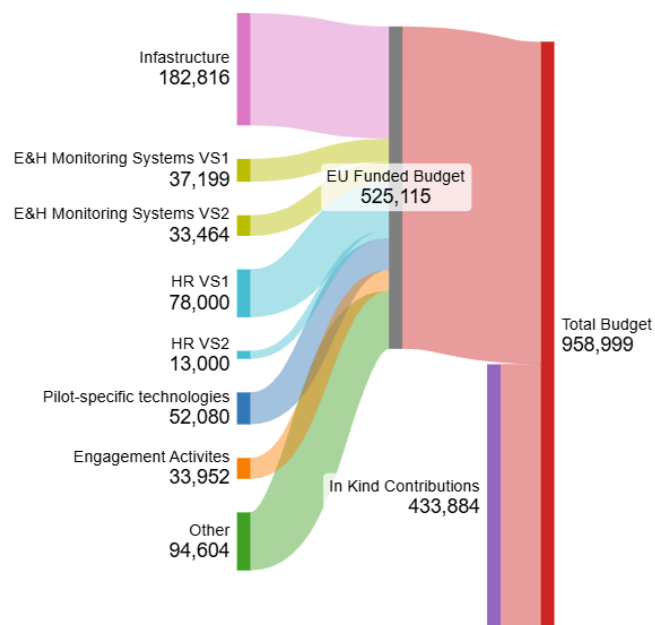


Figure 141: Current public & private investment in Chania

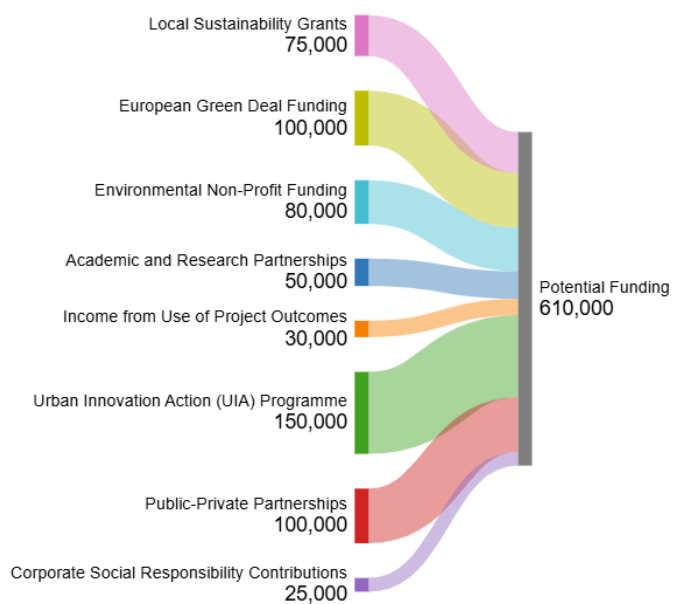


Figure 142: Future public & private investment in Chania

Chania's VARCITIES pilot location has a total estimated future funding potential of €610,000, sourced from a mix of public grants, research collaborations, and innovative

financing schemes. These future funding streams will support the city's ambitions in green infrastructure development, advanced environmental monitoring, public engagement, and sustainable urban mobility.

A2.3 Dundalk

Challenge 1

KPI 1.4 Energy

Expected Impact: Energy savings from lighting upgrades and improvements (Direct Impact)

VS(s): 1,2

Evaluation Method: Pre & Post

- Existing ground floodlights five in number 400W high pressure sodium to 200W L.E.D. floodlights with colour
- Existing 80W MBFU lamps were removed and replaced with (supply and fit) new corn type L.E.D. lamps @ 27W complete with clean opal cover and external reflector

KPI 1.5 Local energy production from renewable energy resources

Expected Impact: Increased energy savings (Direct Impact)

VS(s): 1,2

Evaluation Method: Pre & Post

Year	Electricity (kWh)	Gas (kWh)
2019	60,450 kWh	174,112 kWh
2020	52,440 kWh	190,353 kWh
2021	29,760 kWh	143,822 kWh
2022	49,440 kWh	150,430 kWh
2023	35,700 kWh	133,393 kWh

Table 163: Dundalk energy production from renewable energy resources

Energy saved/ year = an average of 5.000 kWh by the PVs on the roof of the pilot site (Varcities project allowed to measure that, LCC couldn't before the project)

Dundalk Museum - Solar PV Generation		
Date	Total (kWh)	Difference (kWh)
28/02/2024	59422.68	
20/03/2024	59671.18	248.5
16/04/2024	60183.05	511.87
25/04/2024	60386.17	203.12
01/05/2024	60525.96	139.79

Table 164: Dundalk Museum - Solar PV Generation

Challenge 2

KPI 2.4 Reduction in water routed to urban sewerage system

Expected Impact: Reduction in water routed to drainage network (Direct Impact)

VS(s): 2

Evaluation Method: Pre & Post

The bar graph below displays monthly rainfall (in millimetres) recorded by a rain gauge sensor throughout 2024. Rainfall peaked in March, with over 1,200 mm, followed by high levels in February and November. The driest months were June, May, and December, each with less than 250 mm of precipitation. Overall, the data highlights a pattern of heavier rainfall in late winter and early spring, with drier conditions during the summer months.

Month	Cumulative Precipitation (mm)	Monthly Precipitation (mm)	Precipitation
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January	349.85	349.85
February	1,250.33	900.48
March	2,466.99	1,216.66
April	3,167.18	700.19
May	3,374.36	207.18
June	3,581.15	206.79
July	4,277.30	696.15
August	4,961.94	684.64
September	5,154.17	192.23
October	5,444.62	290.45
November	6,342.19	897.57
December*	6,508.94	166.75

*December total is partial (data until 11/12/2024).

Table 165: Reduction in water routed to urban sewerage system in Dundalk

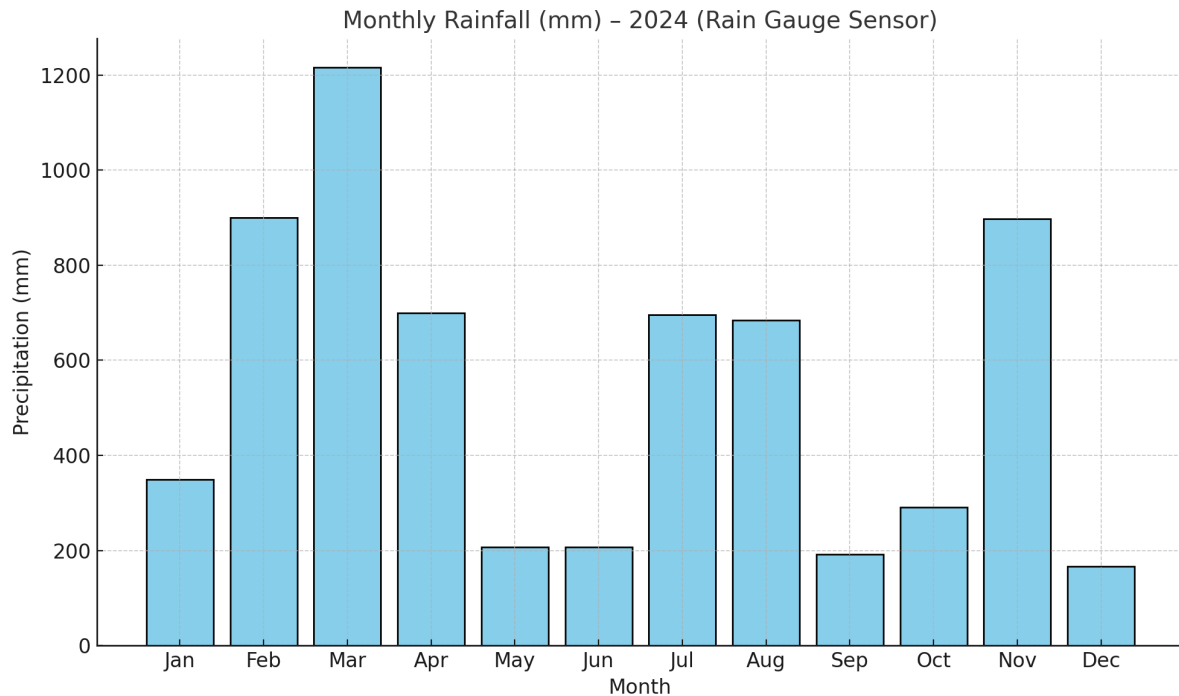


Figure 143: Monthly rainfall from rain gauge sensor in Dundalk

Challenge 4

KPI 4.2 Accessibility of urban green spaces for population

Expected Impact: Increased accessibility of urban green spaces (Direct Impact)

VS(s): 2,3

Evaluation Method: Benchmarking

The graphs represent the impact on accessibility to green spaces in four areas, taking into account distance and walking time, pre and post intervention. The benchmarks are 300 metres distance and 15 minutes walking time, both values taken from the European Environment Agency (EEA).

The first graph shows larger pre-intervention distances in all zones, with East (2.1 km) being the furthest and West (1.3 km) the closest.

After the intervention it is shorter in the west (0.65 km) and north (0.7 km). No change in the south (1.5 km). No areas reached the 300 m standard despite the average walking distance to green spaces being reduced by 25.83%.

The second graph shows how pre-intervention the longest walking time to a green area was in the South and East (29 min), the shortest in the West (18 min).

After the intervention, walking times were reduced in all areas, with the North (10 min) and West (9 min) managing to stay below the recommended 15 minutes. The average walking time to green spaces has been reduced by 32.96%,

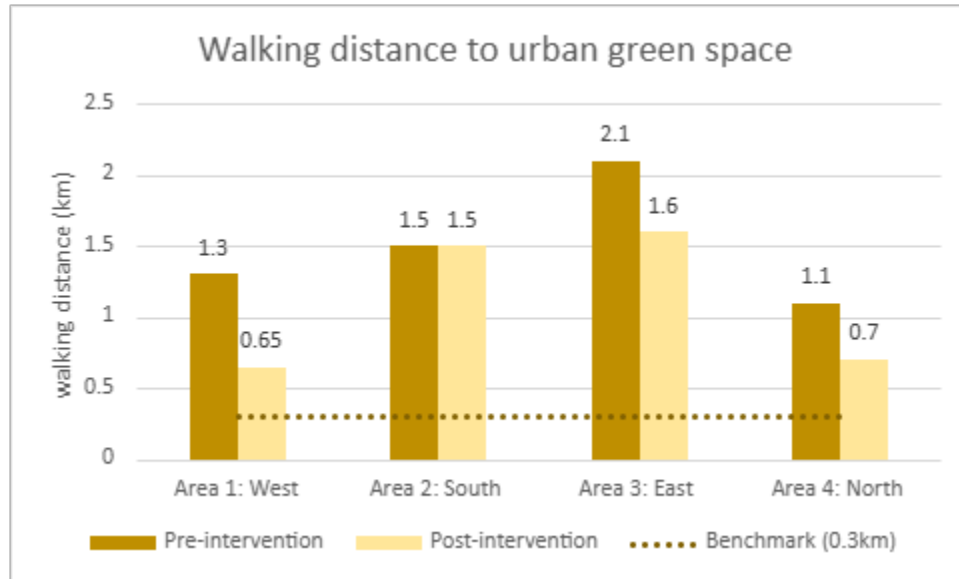


Figure 144: Walking distance to urban green space in Dundalk (distance)

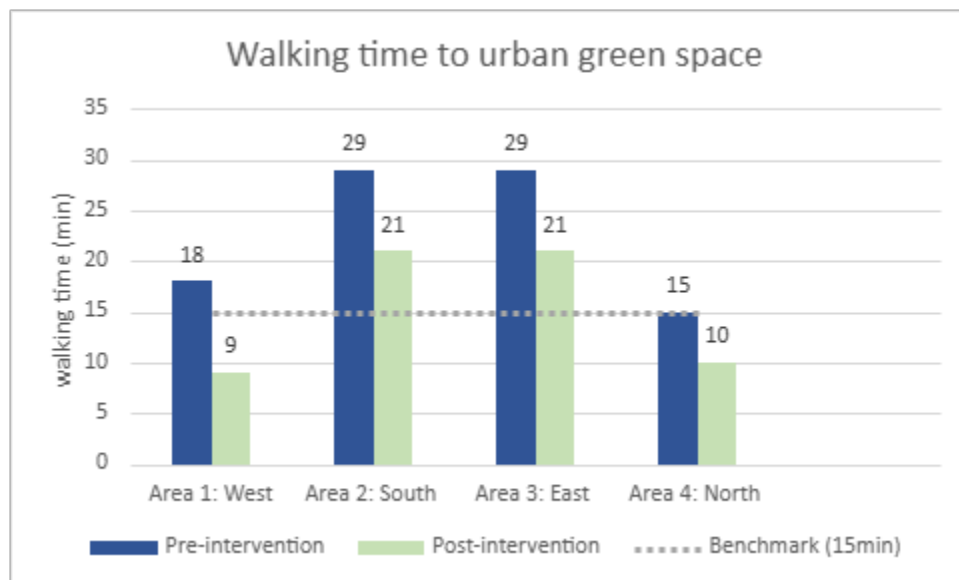


Figure 145: Walking distance to urban green space in Dundalk (time)

KPI 4.3a Recreational or cultural value of green spaces (number of visitors)

Expected Impact: Increased recreational and cultural value of green spaces (Direct Impact)

VS(s): 1,2,3

Evaluation Method: Pre & Post

The bar graph below illustrates the monthly attendance of groups using the Outdoor Learning Pod from June 2024 to March 2025. Usage varies across the year, with attendance peaking in October 2024, February 2025, and March 2025. These trends reflect the wide range of users who regularly engage with the pilot site, including community groups such as poetry and choir groups, book clubs, meditation groups, and youth organizations. Additionally, the space supports programming by public bodies and agencies like the HSE, St. John of Gods, and Tusla, as well as events led by Louth Local Development and the Climate Action Team. The pod is also actively used for library initiatives and cultural events such as the Science Festival, Heritage Week, and Culture Night.

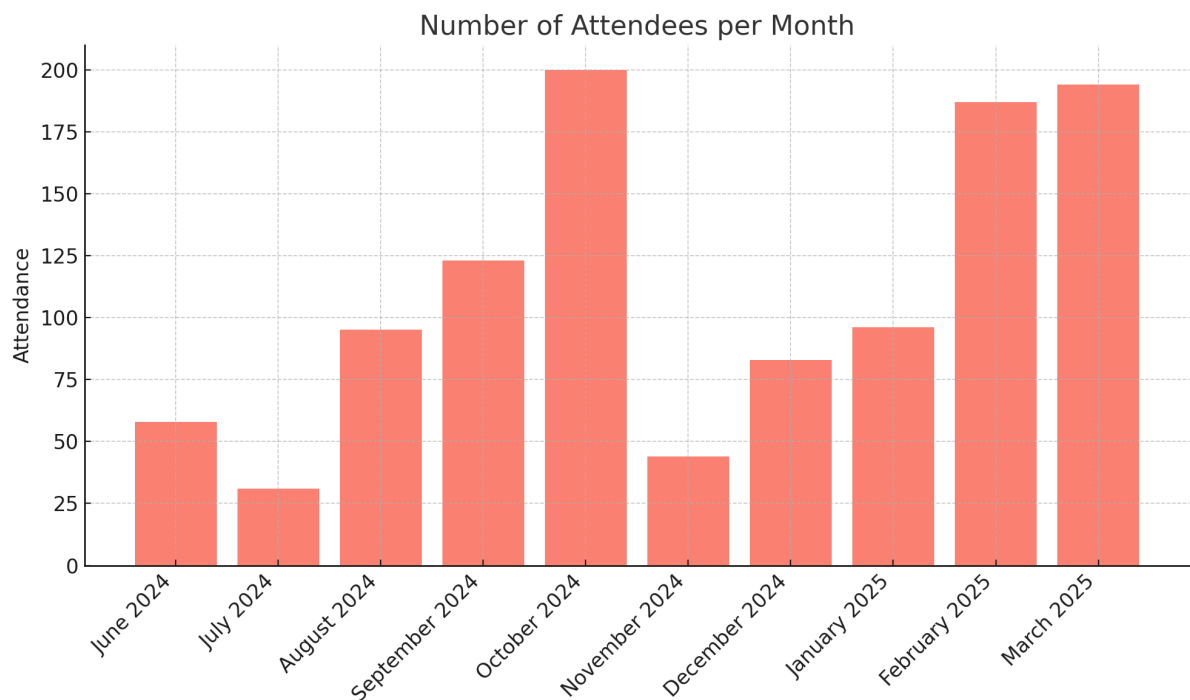


Figure 146: Number of attendees at the outdoor learning pod, Dundalk

KPI 4.3b Recreational or cultural value of green spaces (activities in green spaces)

Expected Impact: Increased recreational and cultural value of green spaces (Direct Impact)

VS(s): 1,2,3

Evaluation Method: Pre & Post

The bar graph displays the number of events held each month at *The Still* from June 2024 to March 2025. Event activity steadily increased over time, with notable growth from January to March 2025, culminating in a peak of over 25 events in March. This rising trend reflects the expanding engagement across a variety of users, including community groups (such as book clubs, choirs, and meditation circles), public services (like the HSE and Tusla), and initiatives by local development and climate action teams. Events also align with national campaigns and cultural programming, such as Heritage Week, Culture Night, and the Science Festival.

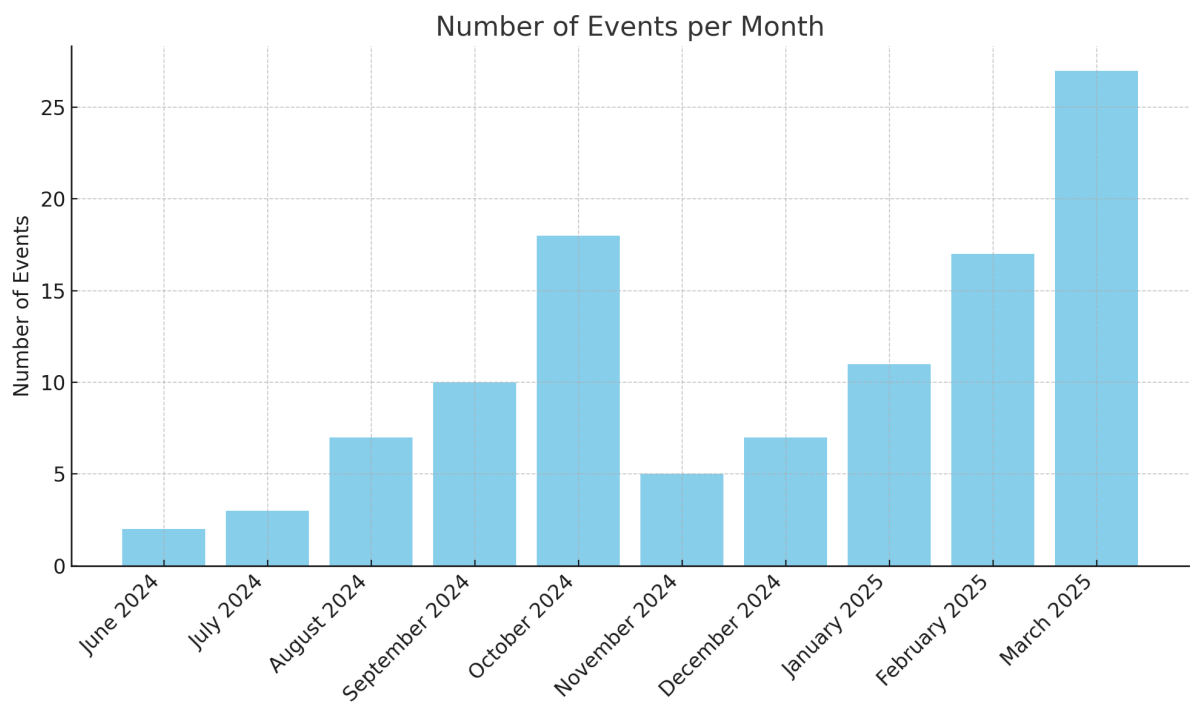


Figure 147: Number of events at the outdoor learning pod, Dundalk

KPI 4.6 Proximity of green infrastructure to green travel routes

Expected Impact: Increased accessibility of urban green spaces (Direct Impact)

VS(s): 2,3

Evaluation Method: Pre & Post

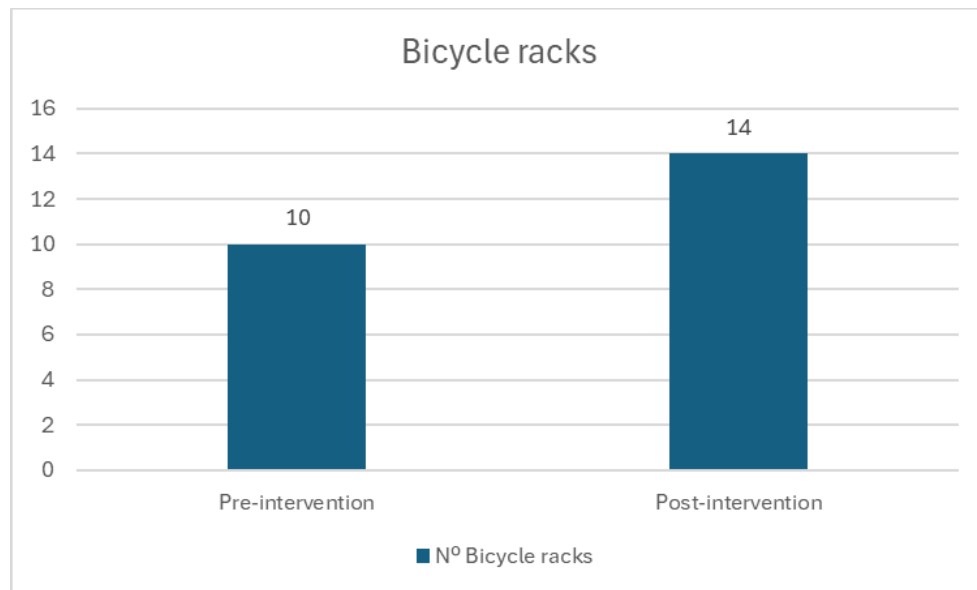


Figure 148: Additional bicycle racks in Dundalk

Prior to the intervention, there were no bicycle racks installed, however, following the intervention, the number of bicycle racks increased to 14. Although the distance from the site to green travel routes remained 0km, there was an increase in the number of covered bike stands. Additionally, a water filling station, a biking repair station and charging points for electrical bikes were also installed, which represents a significant shift in infrastructure that contributes to greener travel.

KPI 4.9 Effectiveness of seating locations

Expected Impact: Increased use of green public space facilities (Direct Impact)

VS(s): 1,2,3

Evaluation Method: Pre & Post

Prior to the intervention, there were no benches in the area. Through the VARCITIES project, a total of 8 new benches were installed, with the following specifications:

- 2 benches with sensors (total seating capacity: 6 people)
- 6 benches without sensors (total seating capacity: 12 people)

KPI 4.11 Species richness and composition with respect to indigenous vegetation and local/national biodiversity targets

Expected Impact: Increased urban biodiversity (Direct Impact)

VS(s): 2

Evaluation Method: Pre & Post

The total number of existing flora species recorded at pre-implementation stage was 9. After intervention the flora species was increased to 50 (10 in 'Area 1' and 40 in 'Area 2') as showcased in the planting plan below.

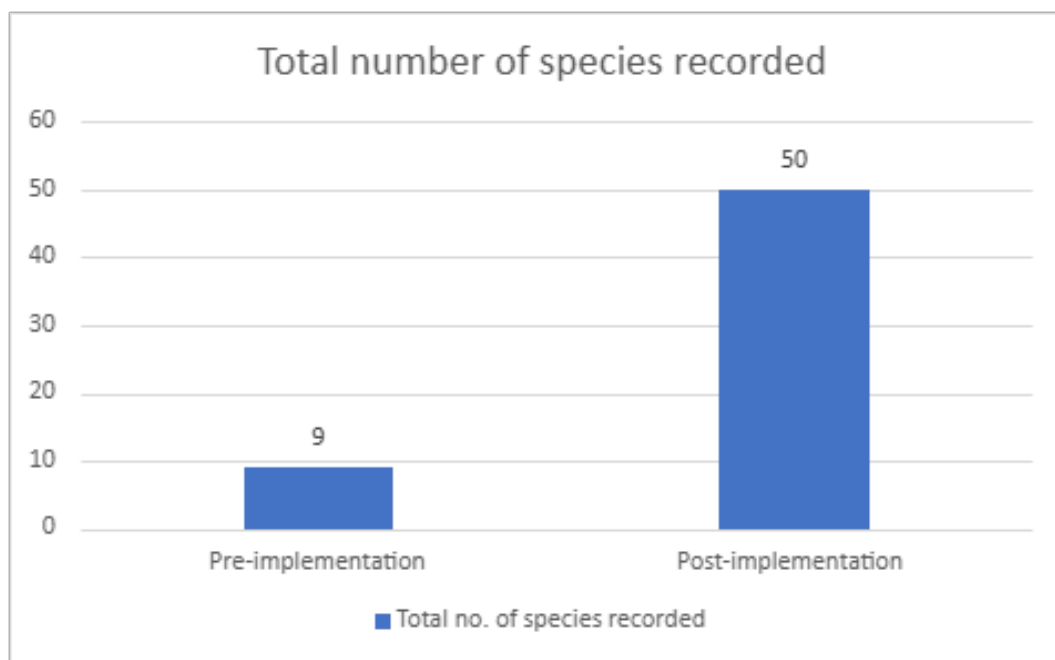
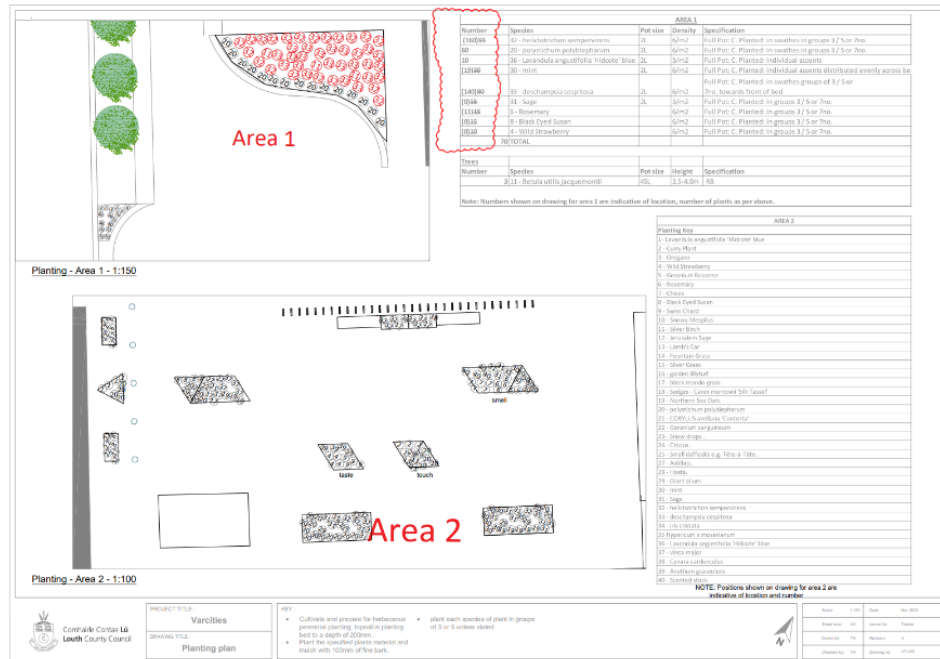


Figure 149: Species recorded in Dundalk



Challenge 5

KPI 5.6 Chemical air quality indicators

Expected Impact: Increased air quality data (Added value)

$$VS(s): 2,3$$

Evaluation Method: Benchmarking

The air quality data collected during the period from 2 August 2023 to 18 March 2025 includes a total of 11,331 entries.

In the PM_{2.5} (orange) and PM₁₀ (blue) graph, PM₁₀ concentrations were consistently higher than PM_{2.5} throughout the period. While PM_{2.5} levels generally remained below 15 µg/m³, PM₁₀ levels showed more pronounced peaks, frequently exceeding 30 µg/m³ and sometimes approaching 60 µg/m³. These peaks were particularly noticeable between late 2023 and early 2025.

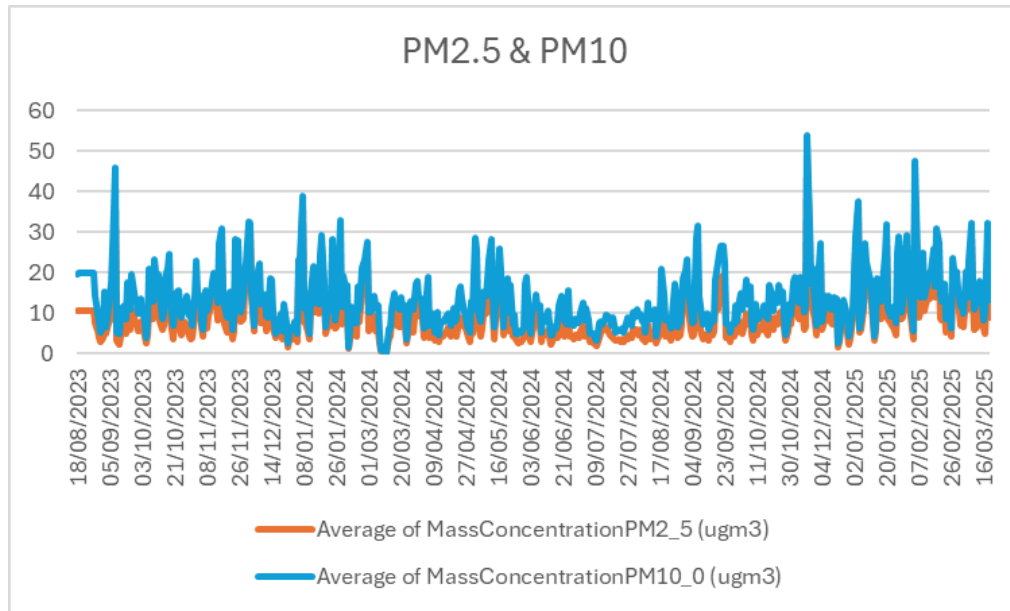


Figure 151: PM2.5 & PM10 in Dundalk

The second graph, showing SO₂ (orange), NO₂ (blue) and CO (green). NO₂ was the most variable and highest of the three pollutants, with frequent increases above 20 µg/m³ and several peaks above 30 µg/m³, especially in late 2023 and early 2024.

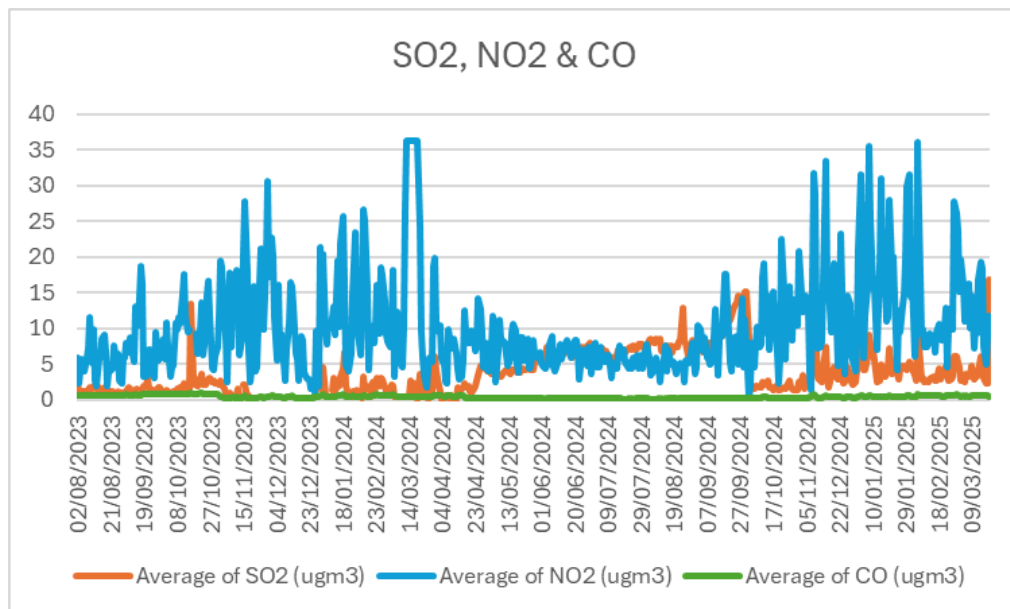


Figure 152: SO₂, NO₂ & CO₂ in Dundalk

Challenge 6

KPI 6.6 Use of reclaimed/recycled building materials

Expected Impact: Increased reclamation of building materials (Direct Impact)

VS(s):1,2,3

Evaluation Method: Pre & Post

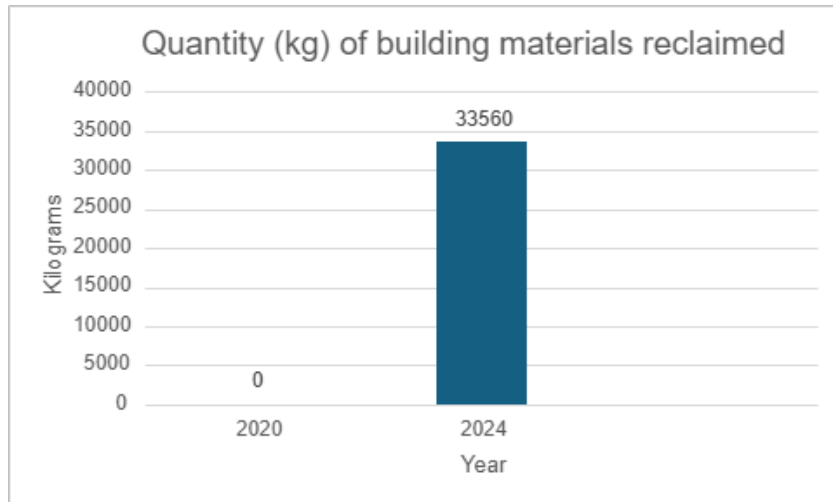


Figure 153: Building materials reclaimed in Dundalk

The bar graph illustrates the quantity (in kilograms) of building materials reclaimed in 2020 and 2024. In 2020, no materials were reclaimed (0 kg). However, in 2024, a significant amount—33,560 kg—of building materials was successfully reclaimed.

Additionally, all 33,560 kg of materials were recycled offsite. This means 100% of the reclaimed materials were either recycled or diverted from landfills.

KPI 6.7 Road surface dedicated to pedestrians

Expected Impact: Increased share of pedestrian areas (Direct Impact)

VS(s): 3

Evaluation Method: Pre & Post

The graph shows the change in pedestrian zones. After the intervention, 371 m2 of pedestrian zones were created, which means a reduction of 5% compared to the car zones.

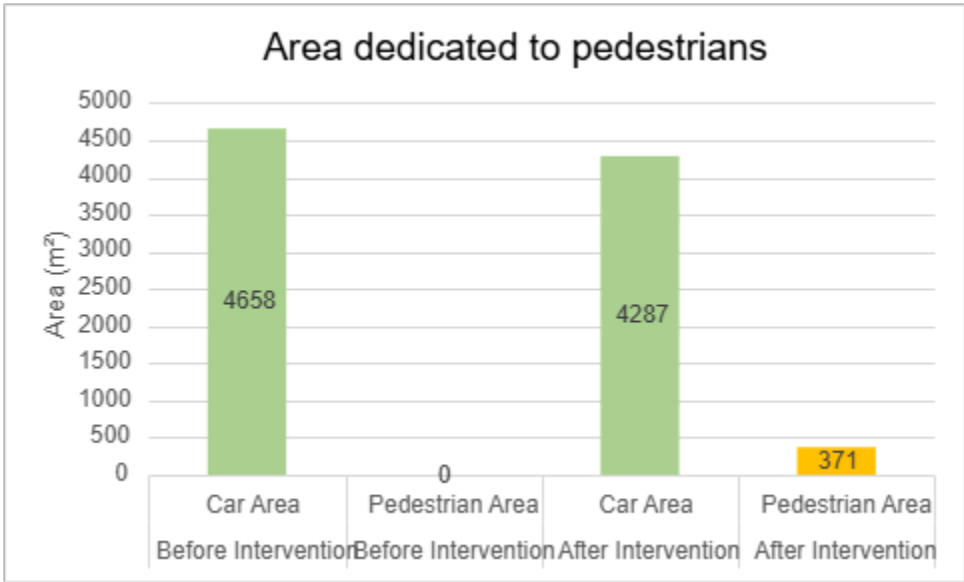


Figure 154: Road surface dedicated to pedestrians in Dundalk

KPI 6.9 Access of residents to cultural facilities on foot

Expected Impact: Increased accessibility of cultural facilities (Direct Impact)

VS(s): 1,2,3

Evaluation Method: Benchmarking

Although the distance from residential areas to cultural areas has not changed, there has been a change in terms of quality, adding a learning pod as a cultural facility. The times all exceed the benchmark, by 4 minutes for the closest and 16 minutes for the longest.

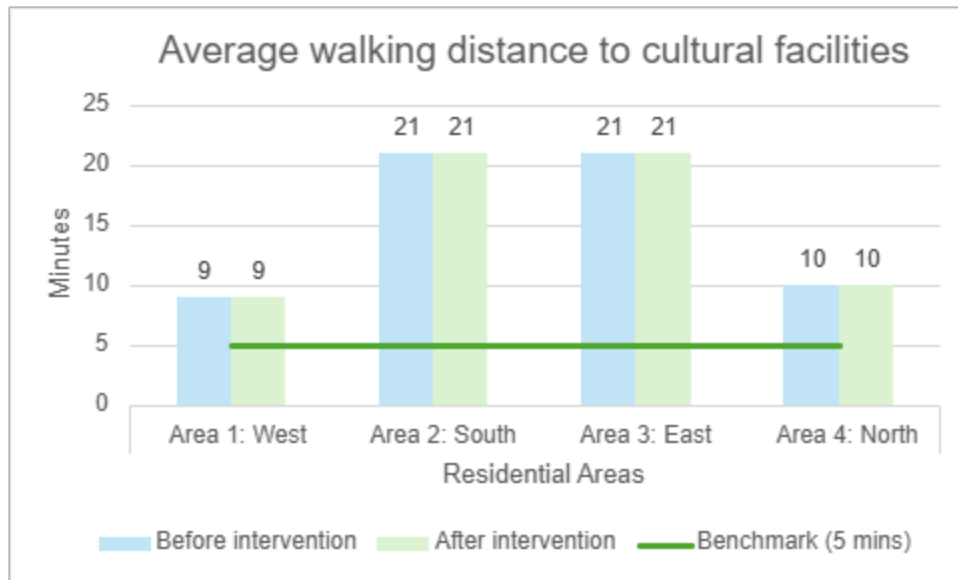


Figure 155: Access of residents to cultural facilities on foot in Dundalk

Challenge 7

KPI 7.8 Citizen participation in and co-creation of the design, implementation and evaluation of project interventions

Expected Impact: Increased and improved participation (Direct Impact)

VS(s): 2

Evaluation Method: Co-evaluation

Through the co-creation workshops, the Dundalk pilot site recruited 21 citizens in workshop 1, while the following 2 workshops had a slightly lower attendance from this category; which 18 citizens each.

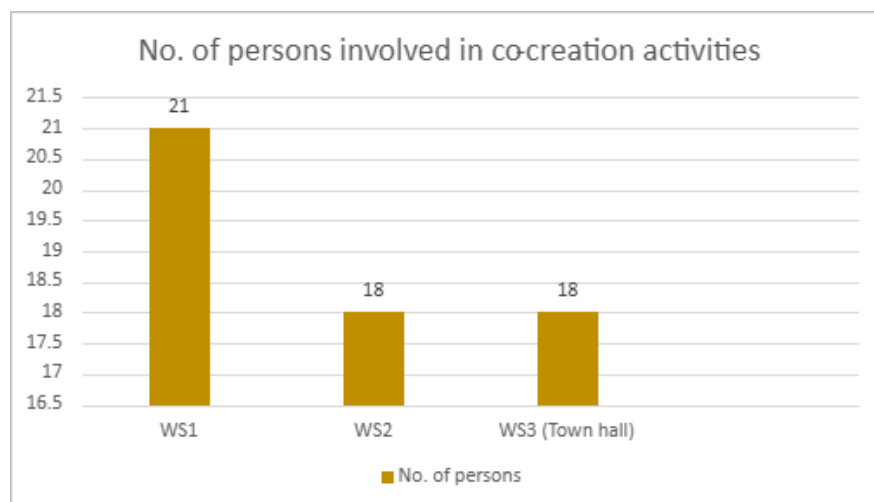


Figure 156: No. of persons involved in co-creation in Dundalk

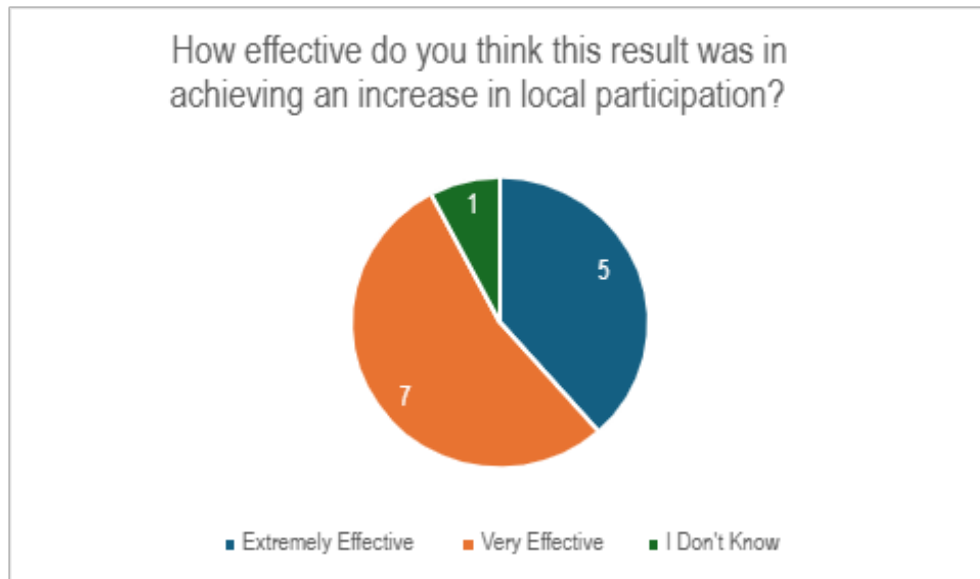


Figure 157: Co-evaluation result

At the final stakeholder event, participants were asked to evaluate how effective the project had been in increasing local citizen participation. The majority of respondents (7) rated the results as very effective.

KPI 7.11 Number of individuals that is aware of the project's objectives, content and processes

Expected Impact: Increased and improved participation (Direct Impact)

VS(s): 1,2,3

Evaluation Method: Co-evaluation

The total number of people aware of the VARCITIES project in Dundalk was determined based on attendance at various activities organized between 2021 and 2024. The highest recorded attendance was 633 participants in 2024. Additionally, further dissemination of the project reached:

- 450 citizens through the Public Participation Network Newsletter
- 85 elected representatives via the Newsletter Page
- 750 LCC staff through the Chief Executive's Monthly Report

- 886 attendees engaged with the Cubbie

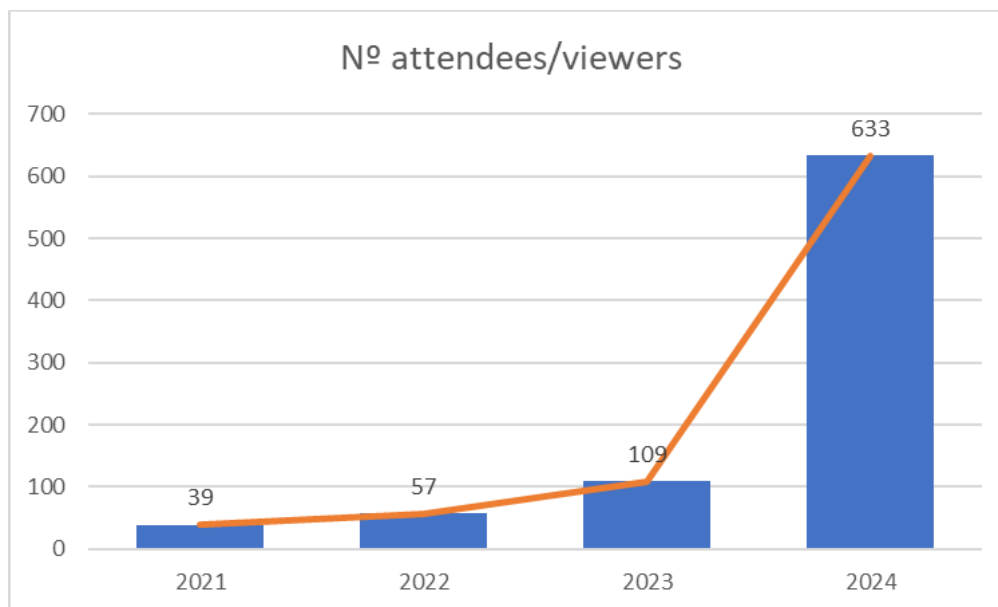


Figure 158: No. of attendees/viewers in Dundalk

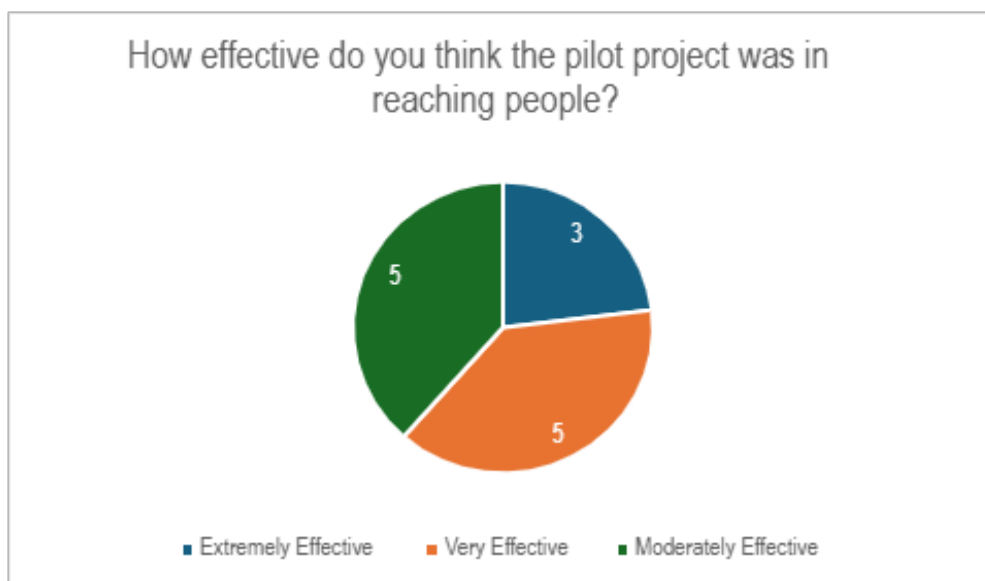


Figure 159: Co-evaluation result

At the final stakeholder event, participants were asked to evaluate how effective the project had been in reaching people. An equal number of respondents (5) rated the results as extremely and very effective.

KPI 7.12 Number of initiatives proposed & implemented by the public in the project's framework

Expected Impact: Increased institutional capacity (Direct Impact)

VS(s): 1

Evaluation Method: Pre & Post

As part of the project, 2 public-led initiatives were recorded:

- Mural Seek Festival – A community-driven event held once within the project framework
- Cubbie – A total of 254 visits and 886 attendees between June and November 2024

More information about the Mural Seek Festival:

Since 2019, the SEEK Urban Arts Festival has used large-scale mural art to celebrate Dundalk's rich cultural and historical heritage. The festival transforms public spaces through curated murals that bring local stories and legends to life.

Now a key feature on Dundalk's urban art trail, the VARCITIES pilot site is stop 13 on the official walking route. It connects artistic expression with placemaking and wellbeing, aligning with the festival's wider goals of regeneration and community engagement.



Figure 160: EPSO Dundalk Map

KPI 7.13 Number of new information channels generated between public institutions & citizenship

Expected Impact: Increased institutional capacity (Direct impact)

VS(s): 1

Evaluation Method: Pre & Post

There were 3 new information channels:

- Library Services – Promoted the use of new Virtual Spaces (VS) in the learning pod and the Cubbie via library services' social media.
- News on a Page – A weekly update for elected representatives on the VARCITIES project and related events.
- Public Participation Network Newsletter – Reached 400-500 people with project updates

KPI 7.16 No of persons involved (on average) in the project activities

Expected Impact: Increased and improved participation (Direct Impact)

VS(s): 1

Evaluation Method: Co-evaluation

In the Dundalk activities organised by its representatives, an upward trend can be observed over the years. A total of 421 people were involved in project activities, with the highest number achieved in the last year, 2024.

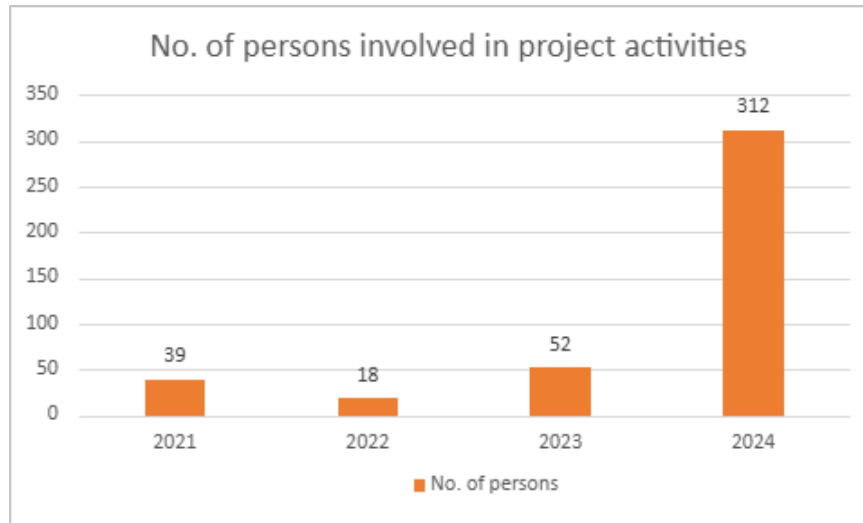


Figure 161: No. of people involved per year in Dundalk

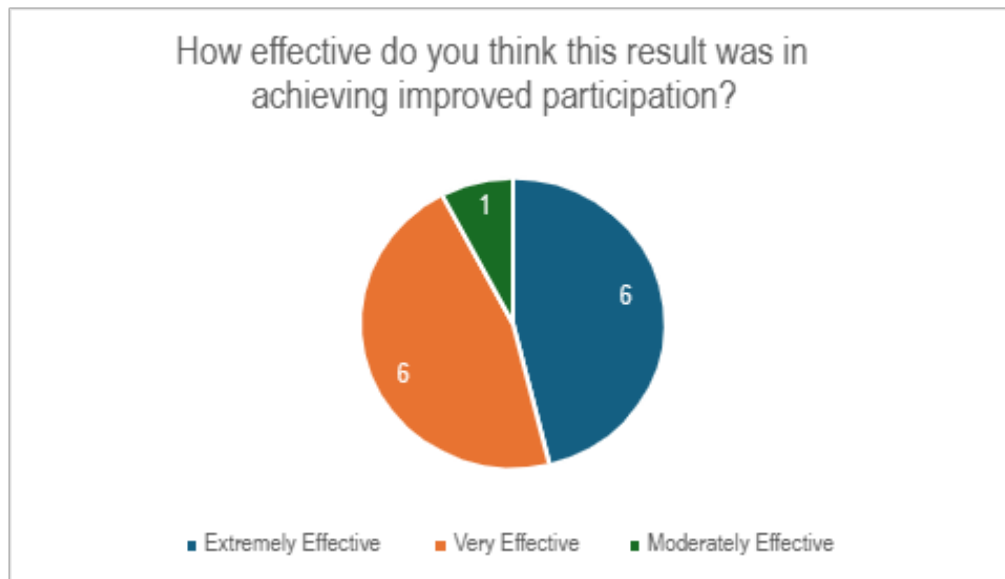


Figure 162: Co-evaluation result for KPI 7.13 in Dundalk

At the final stakeholder event, participants were asked to evaluate how effective the project had been in involving participants in the project activities. An equal number of respondents (6) rated the results as extremely and very effective.

Challenge 8

KPI 8.5 Personal and social background of people who participated in the project's activities

Expected Impact: Fair participation to project activities (Direct Impact)

VS(s): 1,2,3

Evaluation Method: Co-evaluation

In activities organised at the Dundalk pilot site, the largest percentage of participants have reported that they belong to the '31-50' age bracket, which is 60% of the results. The pilot site has recently started focusing on organising socio-cultural activities which are intergenerational and is expected to improve participation from the other age brackets.

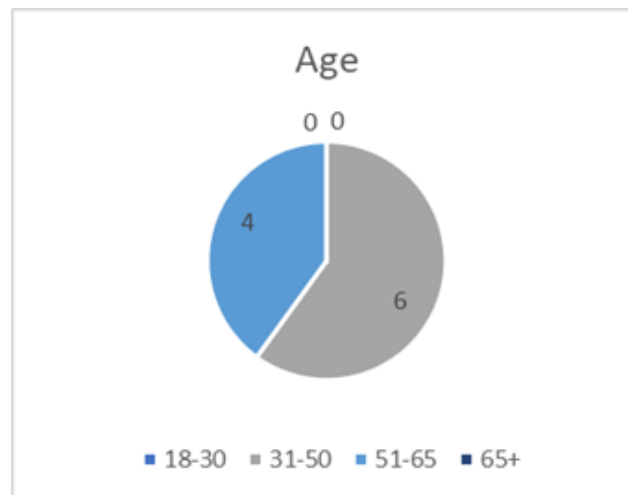


Figure 163: Age groups in Dundalk activities

The results displayed below reflect the participation of genders, resulting in equal participation of males and females at Dundalk pilot related engagement activities. Both categories are at 50% however further activities in 2024 may increase participation from diverse gender groups as well as the ones which are already represented.

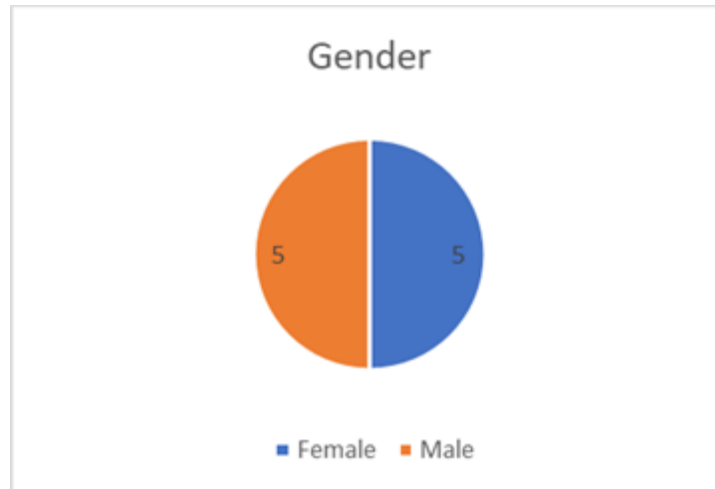


Figure 164: Genders in Dundalk activities

The results shown in the pie chart below indicate a prevalence in participants from the 'heterosexual/straight' category with a percentage of 90%. It is worth noting that 10% of those who attended the events identify themselves as homosexual as a representation of feedback for people making part of that category, making feedback received more inclusive.



Figure 165: Sexual orientation in Dundalk activities

The dominant category in the following chart shows that 70% of the responses came from people coming from a privileged social background, while the remaining 30% being feedback from participants from an underprivileged background. It is considered that a fair balance of responses was achieved for engagement activities organised until the end of 2023.

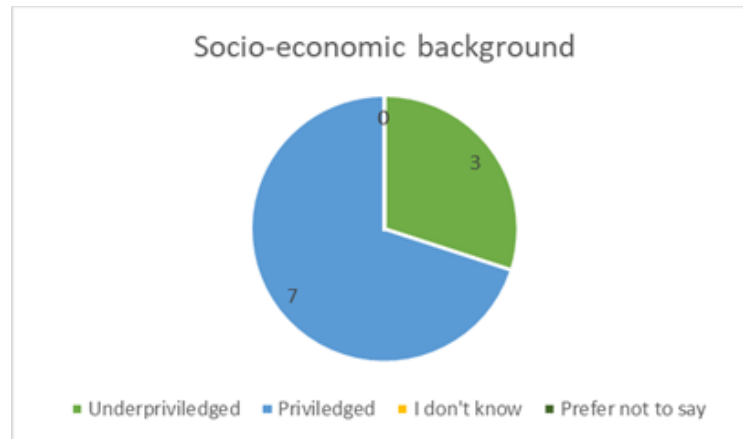


Figure 166: Socio-economic background in Dundalk activities

With regards to the educational background of participants, participants with a master's degree have mostly participated in events, making up 57.1% of the respondents. This is highly beneficial for receiving expert opinions on VARCITIES VSs and engagement activities. representation from other people with different qualifications will be possible through upcoming events.

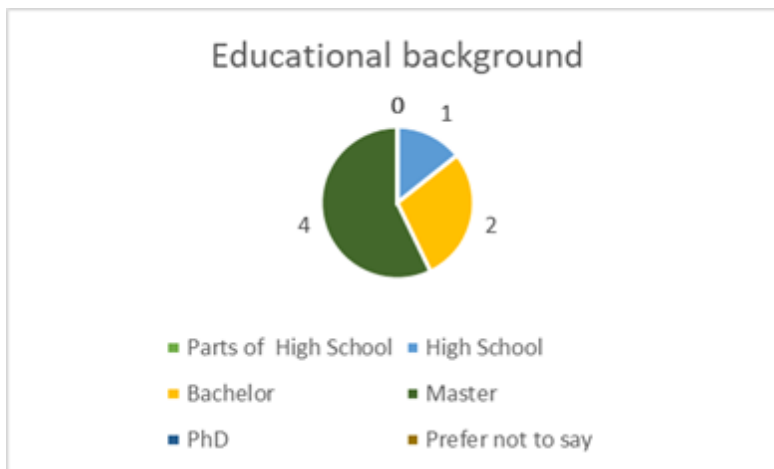


Figure 167: Educational background in Dundalk activities

The pie chart below indicates that the only respondents who submitted the evaluation forms have full time employment, while the rest did not provide feedback. The percentage calculation here is 100%, however it is not possible to report engagement coming from other forms of employment status.



Figure 168: Employment status in Dundalk activities

The share of responses below are evenly distributed overall, however the category of people earning over €3,500 monthly was more representative in the sample collected. 40% of the respondents are part of this income category bracket and perhaps a more even distribution of participants can be highlighted in D7.3 when all other activities would have been organised.

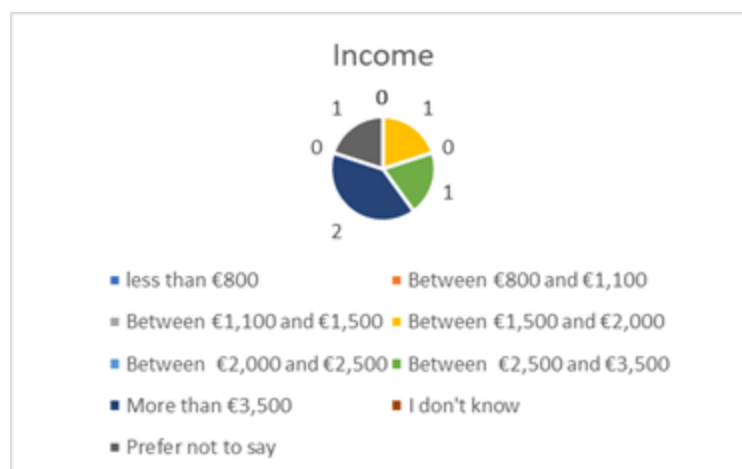


Figure 169: Income in Dundalk stakeholder activities

From the result received, it is established that none of the participants suffer from any of the disabilities mentioned in other categories shown below. The result therefore stands at 100%. As mentioned, specific socio-cultural events planned in 2024 are aiming at improving participation and inclusion from these other groups.

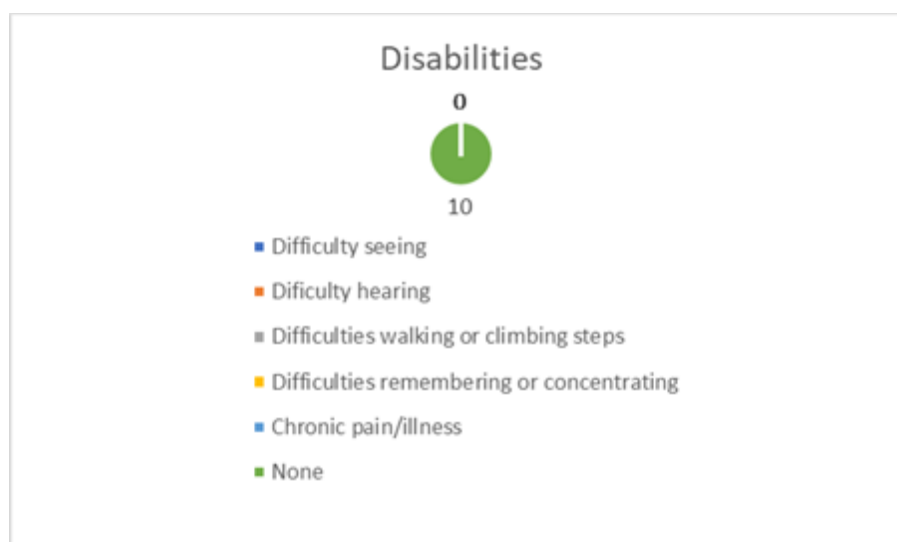


Figure 170: Persons with disability in Dundalk activities

The responses shown below, the highest category of participants who participated are part of the Christian Catholic community. These make up 85.7% of the attendees. The only other person indicated that they do not form part of a religious community.

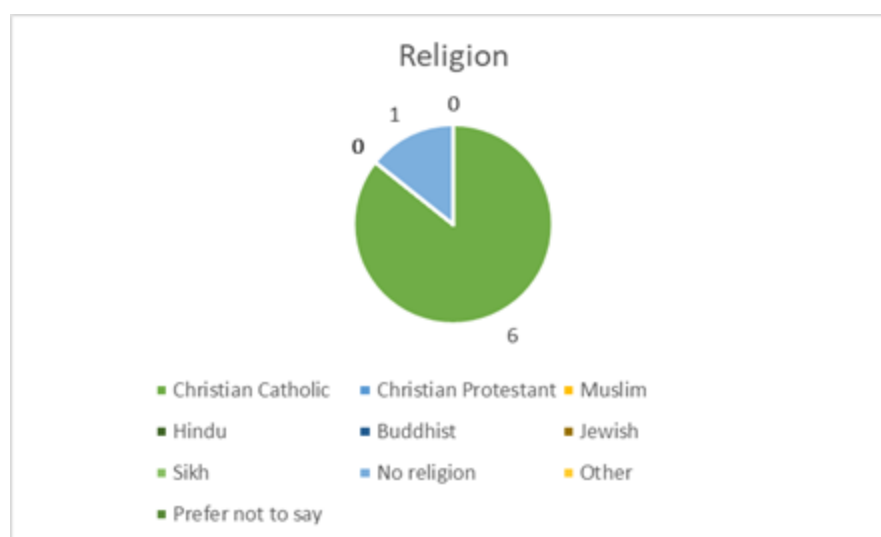


Figure 171: Religions in Dundalk activities

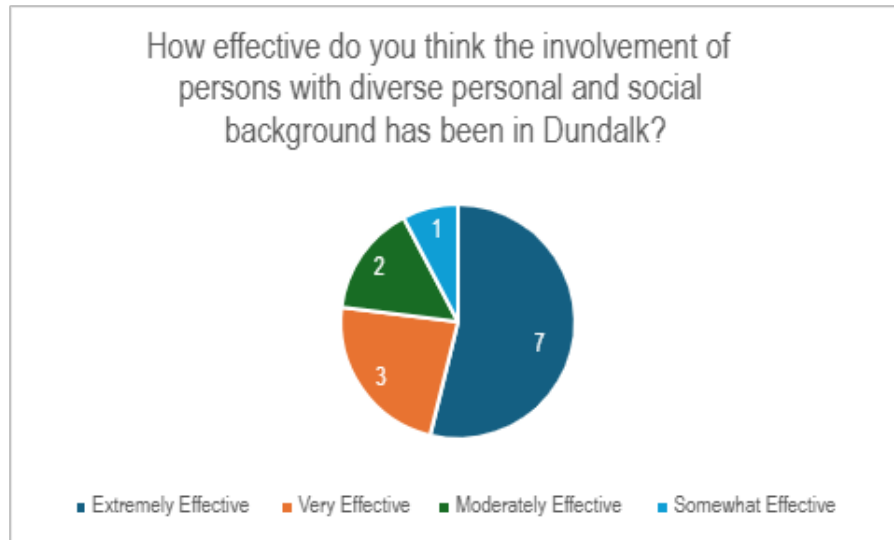


Figure 172: Co-evaluation result for KPI 8.5 in Dundalk

At the final stakeholder event, participants were asked to evaluate how effective the involvement of persons with diverse personal and social background has been in Dundalk. The majority of respondents (7) considered the outcome to be extremely effective.

KPI 8.8 Participation of individuals with functional disabilities

Expected Impact: Greater inclusion of people with functional disabilities (Direct Impact)

VS(s): 1,2

Evaluation Method: Pre & Post

The project successfully engaged individuals with functional disabilities in various activities in 2023 and 2024:

- 2023 – 1 participant with a hearing impairment
- 2024 – 886 participants across 254 visits (June–November 2024) using the Cubbie for autism and other needs

Following the pilot site experience, the Autism Association purchased a Cubbie for independent use.

Challenge 9

KPI 9.4 Noise reduction rates

Expected Impact: Increased noise data (Added value)

VS(s): 2,3

Evaluation Method: Benchmarking

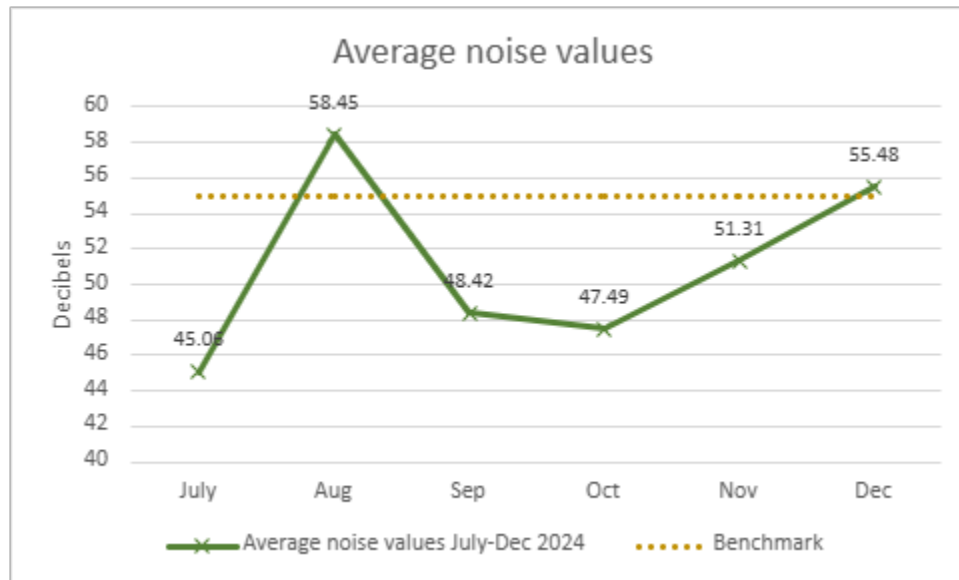


Figure 173: Average noise values in Dundalk

From sensor data obtained between July and December 2024, noise levels remained well below the benchmark in four out of six months. In August, the benchmark was exceeded by 3.45 dB while in December, the benchmark was exceeded by 0.48db.

KPI 9.5 No of hours spent outdoors, time people spend in the facility

Expected Impact: Increased outdoor presence (Direct Impact)

VS(s): 1,2,3

Evaluation Method: Pre & Post

This KPI was not measured.

KPI 9.6 Perceived well-being before and after visit to facility

Expected Impact: Increased health and wellbeing (Direct Impact)

VS(s): 2

Evaluation Method: Pre & Post

Total of 1215 sessions accessed, averaging at; 6 daily, 29 weekly and 111 monthly

10:30 – 13:00 was the most popular time with 36% of all usage coming between these times. 18 individuals have availed Cubbie's OT Service after using Cubbie in Dundalk Library. 88% of sessions were successful, with users reporting a wellbeing improvement / feeling happy and regulated after their Cubbie break. The Dundalk pilot opted to measure people's improvement before and after visiting the facility (cubbie) instead of green space as it is more relevant for their case.

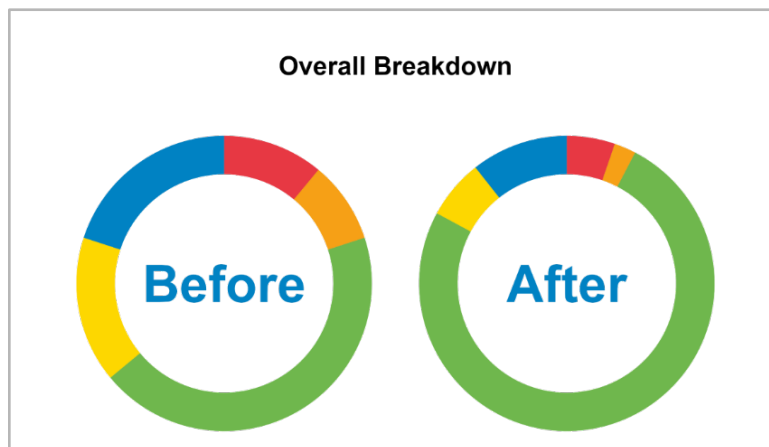


Figure 174: Perceived wellbeing in facility in Dundalk

KPI 9.8 Feeling of improving the quality of life

Expected Impact: Improved quality of life (Direct Impact)

VS(s): 1,2,3

Evaluation Method: Pre & Post

This KPI was not measured.

KPI 9.19 Increase in walking and cycling in and around areas of interventions

Expected Impact: Increased outdoor physical activity (increased of data gathering of data of people being physical active) (Direct Impact)

VS(s): 2,3

Evaluation Method: Pre & Post

This KPI was not measured.

Challenge 10

KPI 10.1 No. of jobs created; gross value added

Expected Impact: Increased job opportunities (Direct Impact)

VS(s): 1,2,3

Evaluation Method: Co-evaluation

This KPI was not measured given that economic indicators are not applicable to Louth County Council.

KPI 10.3 Resource efficiency in the urban system

Expected Impact: Increased data on resource efficiency (Direct Impact)

VS(s): 1,3

Evaluation Method: Benchmarking

	Total CO2 emissions in LCC	Staff headcount	Total CO2 emissions per capita
2022	4,500,000 kgCO2	738	6,097.56 kgCO2/employee
2023	3,604,482 kgCO2	755	4,774.14 kgCO2/employee

*Calculation including thermal energy, transport fuels, and electricity

Table 166: Resource efficiency in Dundalk

In 2023, fossil CO2 was 26.5% below the baseline of 1,997,468 kgCO2

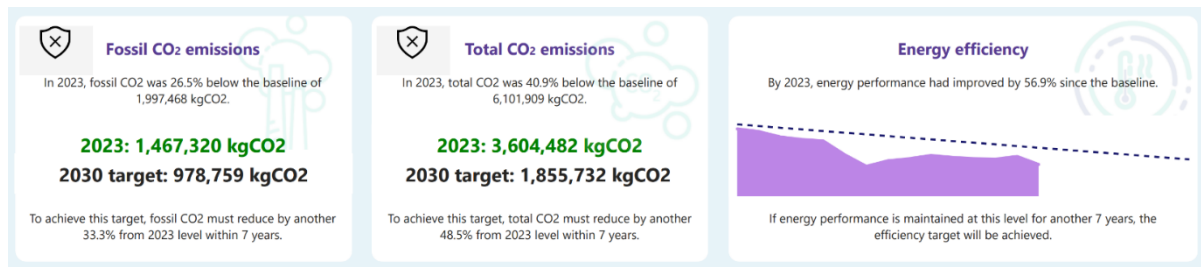


Figure 175: CO₂ emissions (supplementary data) in Dundalk

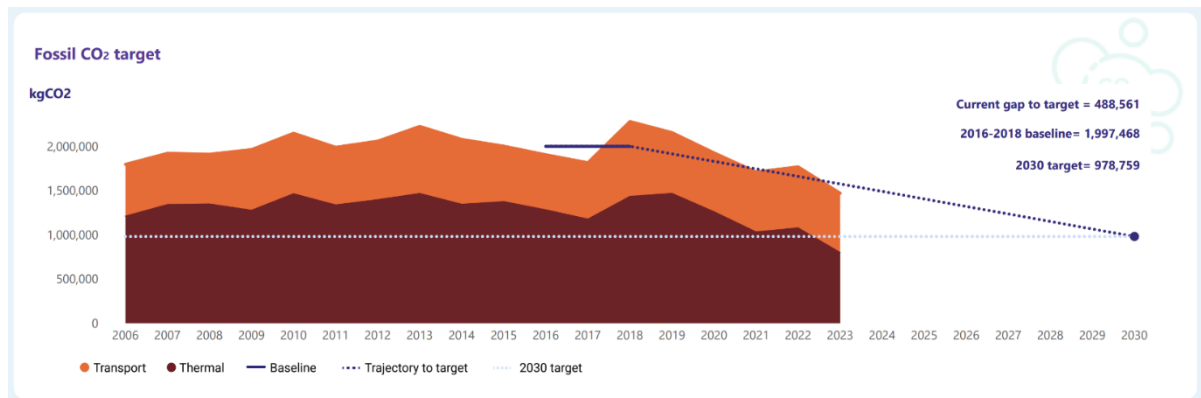


Figure 176: Fossil CO₂ target in Dundalk

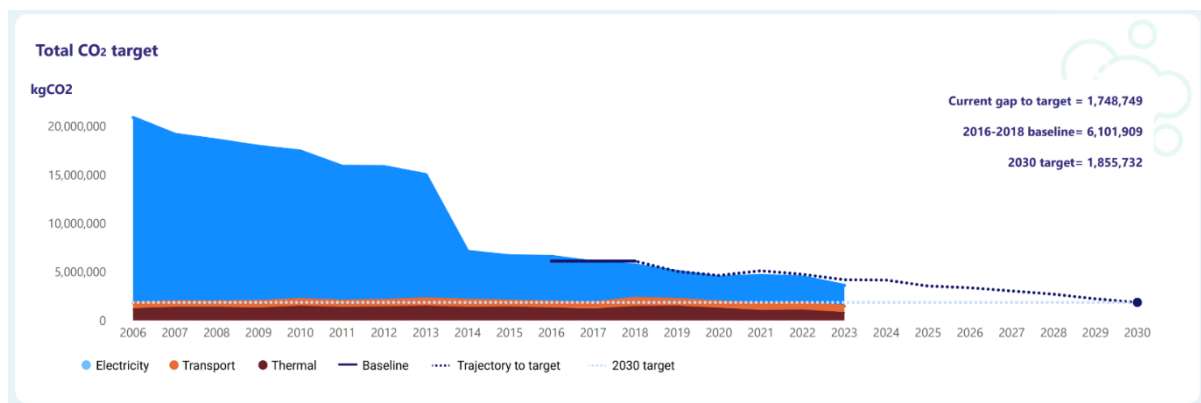


Figure 177: Total Co₂ target in Dundalk

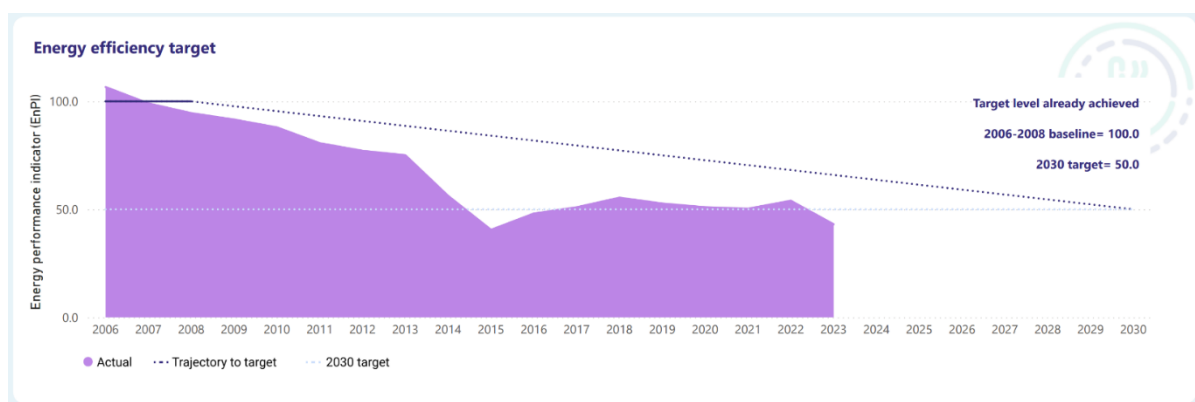


Figure 178: Energy efficiency target in Dundalk

KPI 10.4 Increased footfall and spend in the areas of intervention

Expected Impact: Increased data on footfall and spend in the areas of intervention

VS(s): 1,2,3

Evaluation Method: Pre & Post

People-counting sensors were installed at four locations: the front and rear gates, the alleyway, and between the corner of the library and the corner of No. 3 Roen Place. Footfall data was collected across multiple time periods, with Sensor 1 (front gate) recording the highest volume of activity by a significant margin. Sensor 3 recorded minimal activity, suggesting it may have been faulty or located in a rarely used area. Prior to this intervention, there were no sensors in place to measure footfall in the area.

Sensor	Time Periods Covered	Footfall Count
1	12 Oct 2023 – 3 May 2024	57,941
	3 May 2024 – 22 Oct 2024	53,116
	19 Feb 2025 – 18 Mar 2025	1,840
2	12 Oct 2023 – 18 Mar 2025	12,332
3	12 Oct 2023 – 18 Mar 2025	1
4	12 Oct 2023 – 18 Mar 2025	10,343

Table 167: Footfall count per sensor in Dundalk

KPI 10.5 Definition of parameters for (re)designing of green public spaces based on the well-being of users

Expected Impact: Definition of parameters for (re)designing of green public spaces based on the well-being of users

VS(s): 1,2,3

Evaluation Method: Co-evaluation

This KPI was not measured.

KPI 10.6 Replication of solutions

Expected Impact: High replication potential of Visionary Solutions (Direct Impact)

VS(s): 1,2,3

Evaluation Method: Co-evaluation

The graphs below present the number of responses regarding the replicability of various solutions.

- Learning Pod

The majority of responses (20) place this solution in the moderate replicability category, followed by high replicability (15) which reinforces the perception of a positive potential for scaling up. Only a minority consider the solution to have low replicability (7) or not replicable at all (4).

- Outdoor Urban Green Learning & Sensory Garden

This solution received strong support, with 18 responses each indicating high and very high replicability, suggesting a strong consensus on its potential for replication in other contexts.

- Bike stations with sensors and maintenance facilities

Similarly, this solution was also seen as highly replicable, with 18 responses each for high and very high replicability, reflecting a consistent belief in its adaptability and value.

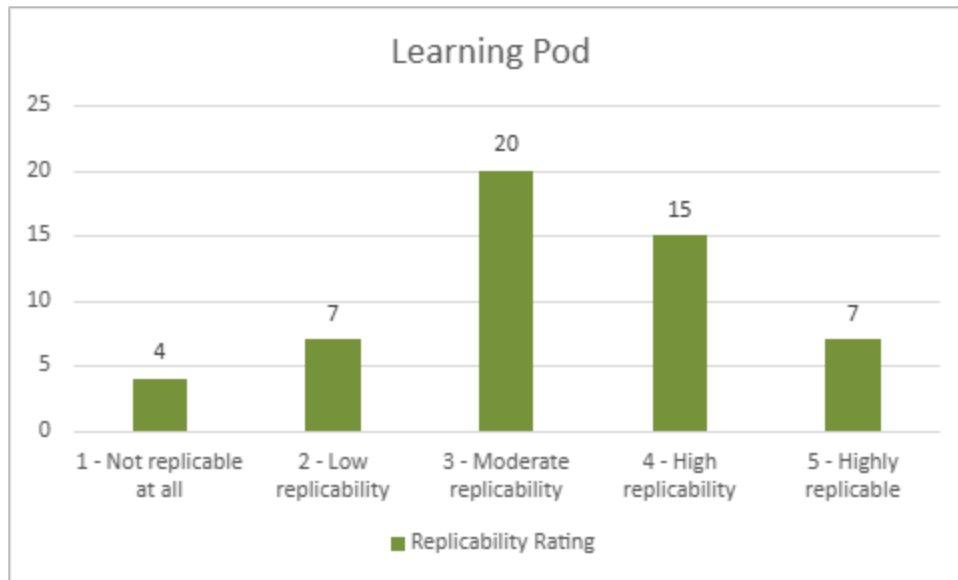


Figure 179: Dundalk VS 1 replication potential

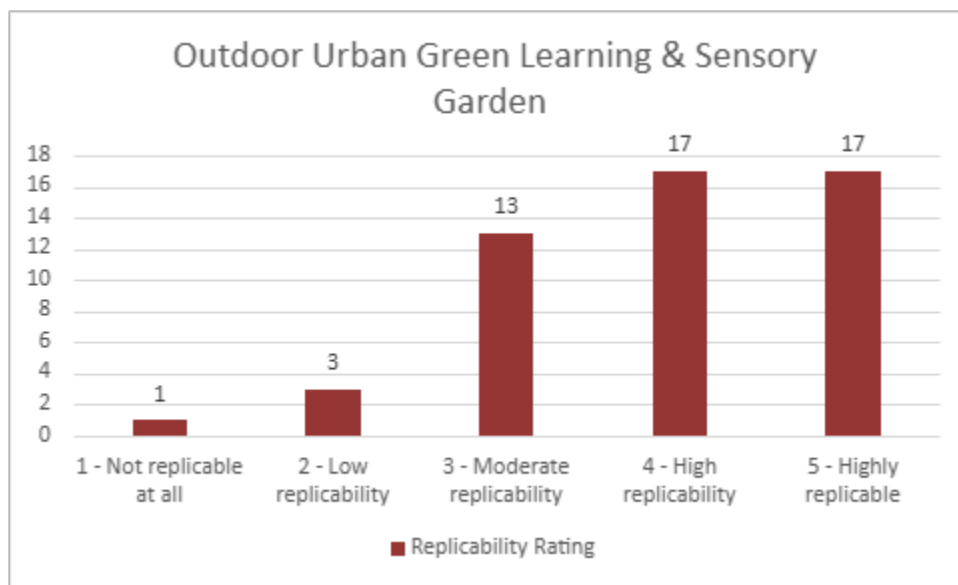


Figure 180: Dundalk VS 2 replication potential

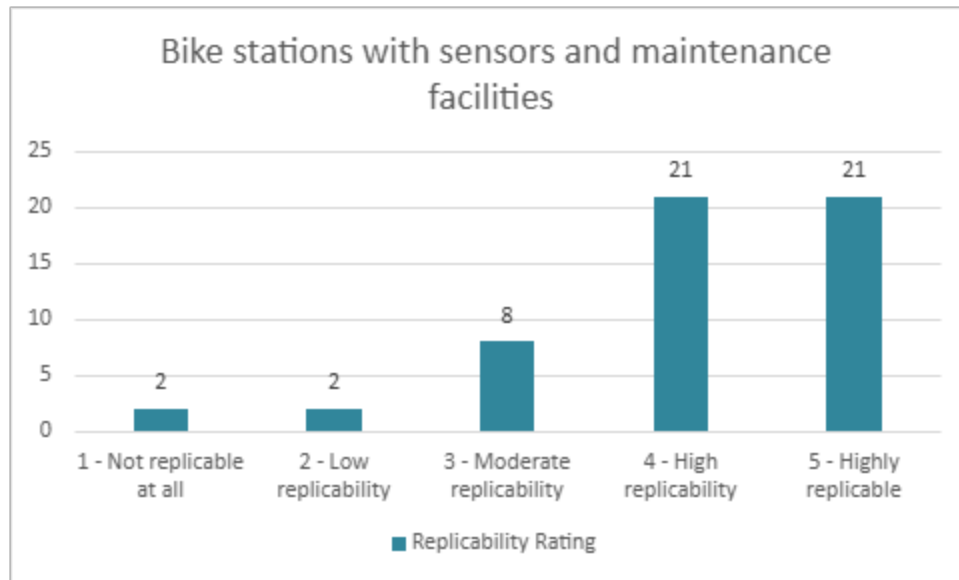


Figure 181: Dundalk VS 3 replication potential

KPI 10.8 Saved healthcare spending

Expected Impact: Savings in healthcare spending

VS(s): 1,2,3

Evaluation Method: Pre & Post

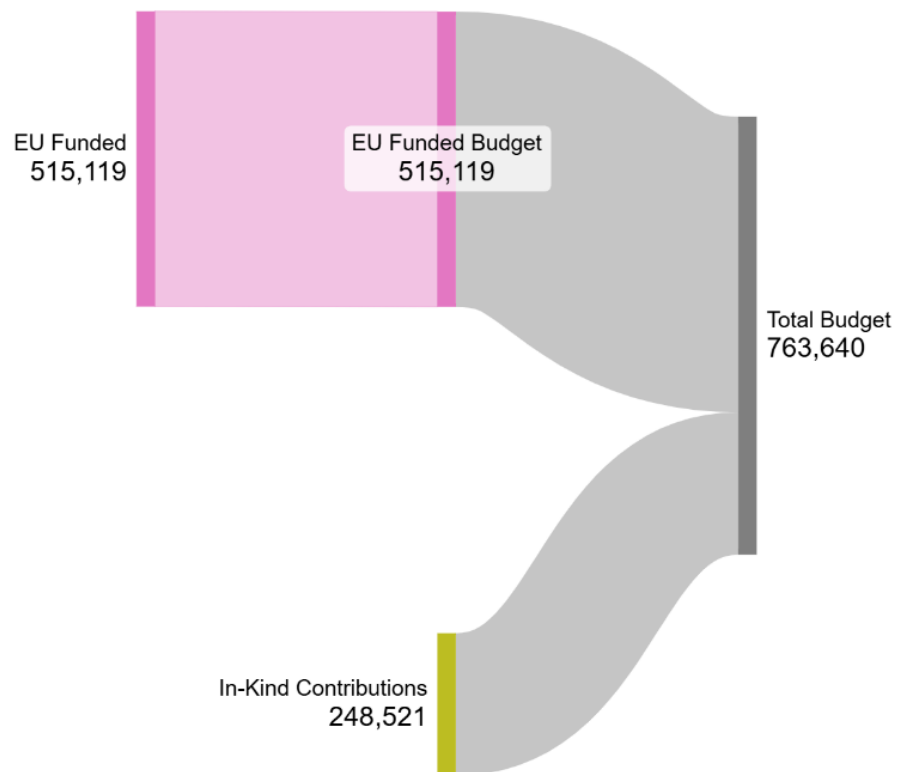
This KPI was not measured.

KPI 10.9 Public & private investments during/after the project

Expected Impact: Increased public & private investments (Direct Impact)

VS(s): 1,2,3

Evaluation Method: Pre & Post



Made at SankeyMATIC.com

Figure 182: Current public & private investment in Dundalk

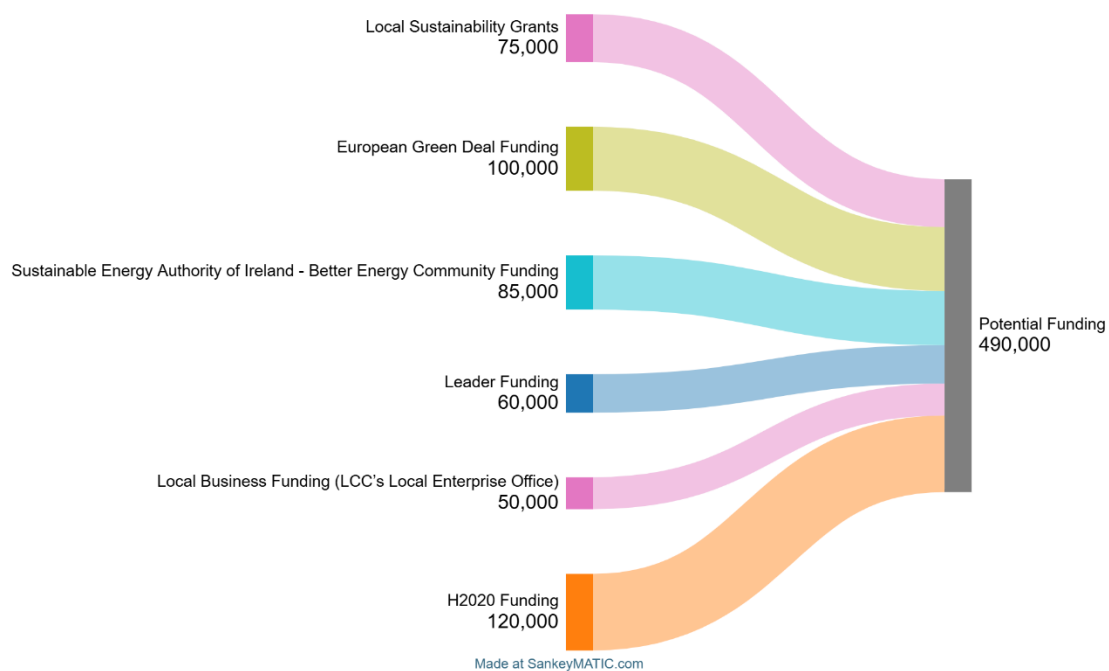


Figure 183: Future public & private investment in Dundalk

A2.4 Gżira

Challenge 1

KPI 1.1 C removed/stored by vegetation

Expected Impact: Increased data on carbon storage in and sequestration by vegetation (Added value)

VS(s): 1

Evaluation Method: Pre & Post

A tree inventory of tree species in Gżira was inputted into the i-Tree Eco model to estimate the amount of carbon sequestered and stored in Gżira. Trees in Gżira tree inventory are estimated to store 878 tons of carbon (€367 thousand). Of the species sampled, Aleppo pine stores the most carbon (approximately 17.9% of the total carbon stored) and Australian pine sequesters the most (approximately 23% of all sequestered carbon.)

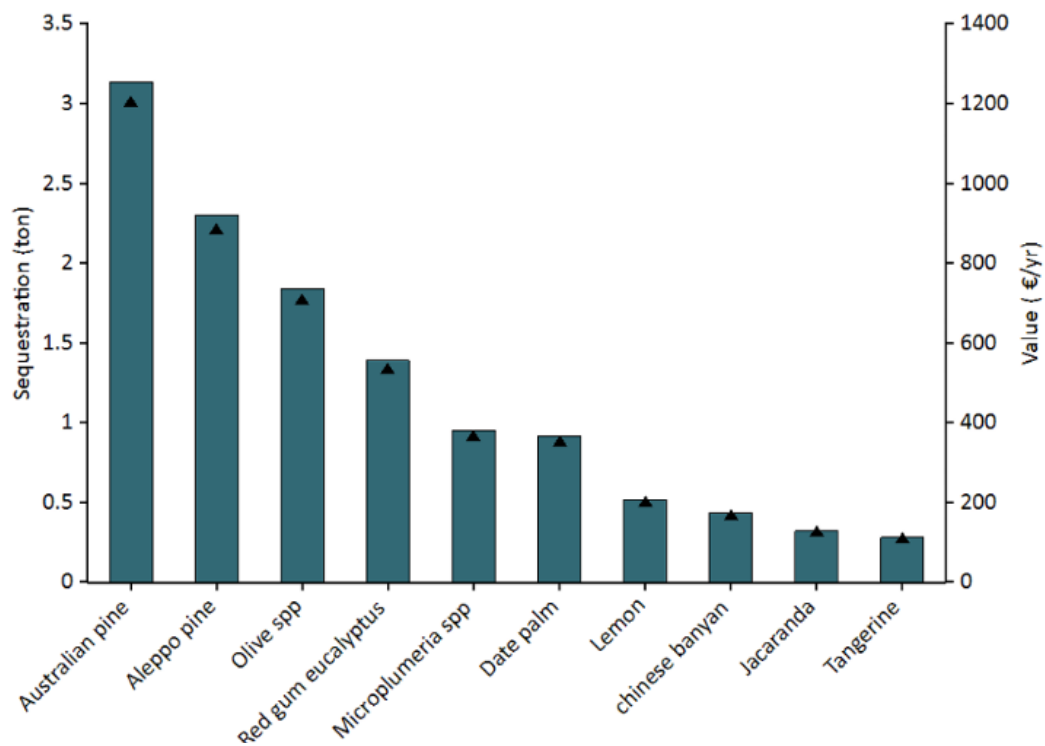


Figure 184: Estimated annual gross carbon sequestration (points) and value (bars) for urban tree species with the greatest sequestration in Gzira

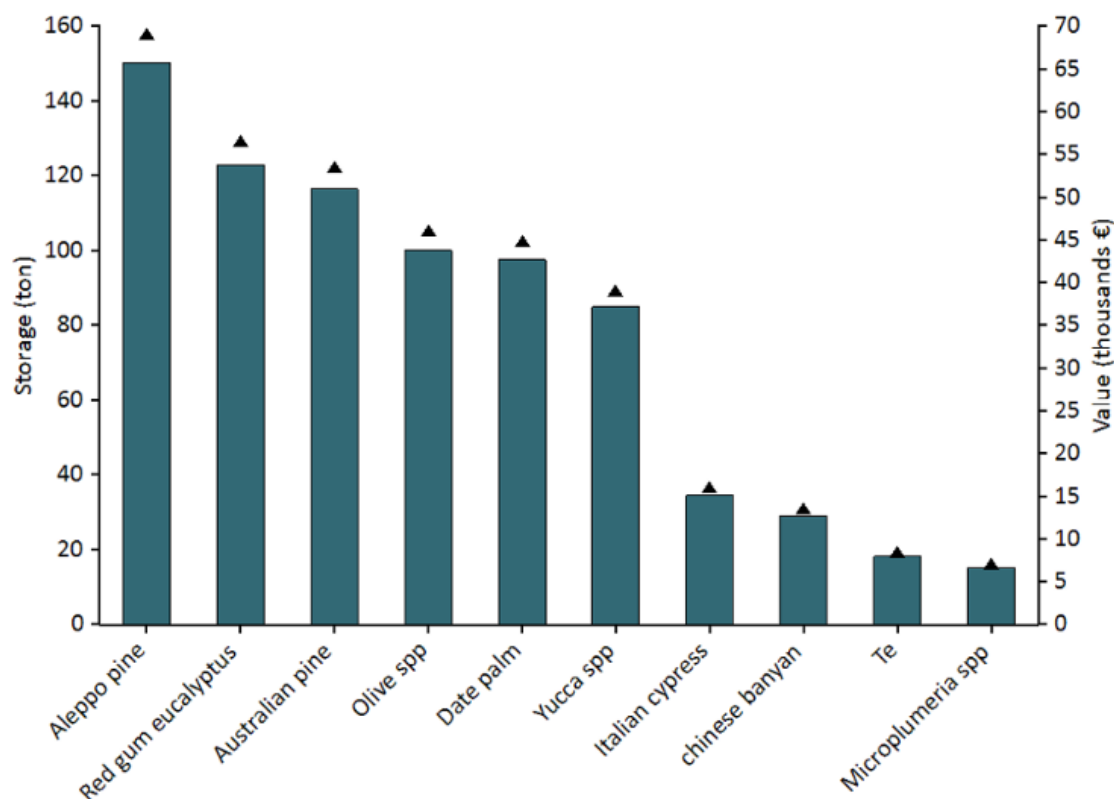


Figure 185: Estimated carbon storage (points) and values (bars) for urban trees species with the greatest carbon storage in Gzira

Challenge 4

KPI 4.1 Surface of public green space per capita

Expected Impact: Increased public green space surface per capita (Direct Impact)

VS(s): 1,3

Evaluation Method: Benchmarking

The table presents data on the area of public green space per inhabitant before and after an intervention in a given area. While the increase in green space is not sufficient to meet the benchmark set by the WHO, it is a first step towards meeting international recommendations.

	Green area (m2)	No. of inhabitants	m2/capita	WHO Benchmark
--	--------------------	-----------------------	-----------	------------------

				(m2/capita)
Pre-intervention	28175	13137	2.14	9
Post-intervention	28291.66	13137	2.15	9

Table 168: Surface of public green space per capita in Gżira

Surface area of new green area at St Clare Gżira Primary = 116.66m²

KPI 4.2 Accessibility of urban green spaces for population

Expected Impact: Increased accessibility of urban green spaces (Direct Impact)

VS(s): 3

Evaluation Method: Benchmarking

The following graphs show accessibility to urban green spaces in Gżira, before (blue) and after the intervention (orange), quantified in walking time (minutes), and walking distance (metres), from specific reference points (D1 to D12).

Before the intervention, walking time ranged from 4 to 11 minutes, but was reduced to 7 minutes after the intervention, with only 2 to 4 minutes being necessary at some points.

After the intervention, the distances have been reduced, and from 260 to 851 metres, most of the points are below 400 metres.

Of the 12 reference points:

- 100% of the points now have a walking distance equal to or less than 7 minutes.
- 75% of the points have reduced walking distances to 400 metres or less to a green space, with 2 of them having it reduced to 450 metres.
- 58% of the points have had their distance to a green space reduced.

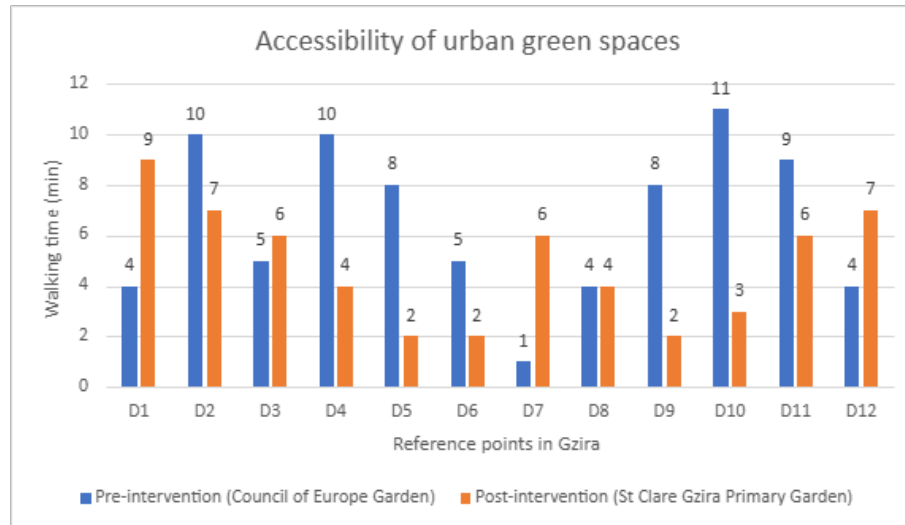


Figure 186: Accessibility of urban green spaces in Gzira (time)

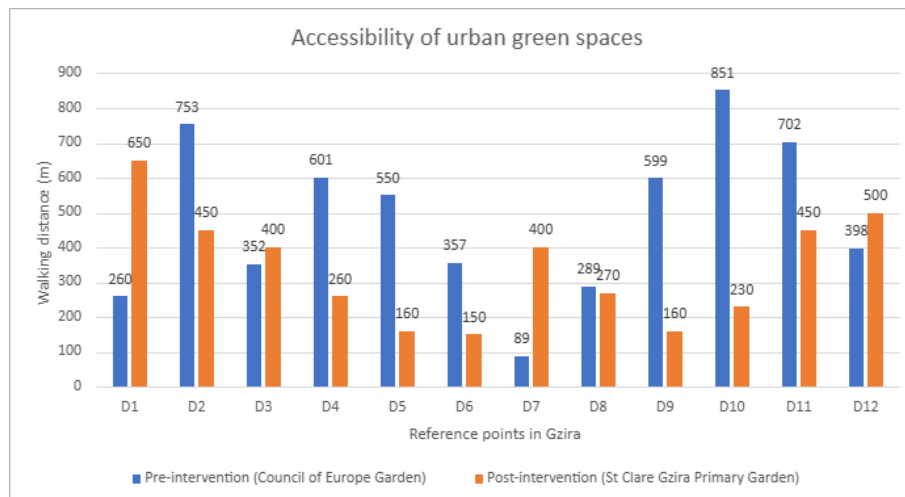


Figure 187: Accessibility of urban green spaces in Gzira (distance)

KPI 4.3a Recreational or cultural value of green spaces (number of visitors)

Expected Impact: Increased recreational and cultural value of green spaces (Direct Impact)

VS(s): 1,3

Evaluation Method: Co-evaluation

The bar chart below illustrates attendance figures across various events. The Council of Europe Gardens Event attracted the highest number of visitors, reaching around 70. This

was followed by Pop-up Activity 2 with approximately 50 visitors, and Pop-up Activity 3 with around 30. The Preliminary Pop-up Park 1, 2, and 3 events each drew roughly 25 attendees, indicating consistent but moderate engagement. Pop-up Activity 1 had the lowest turnout, with around 10 visitors.

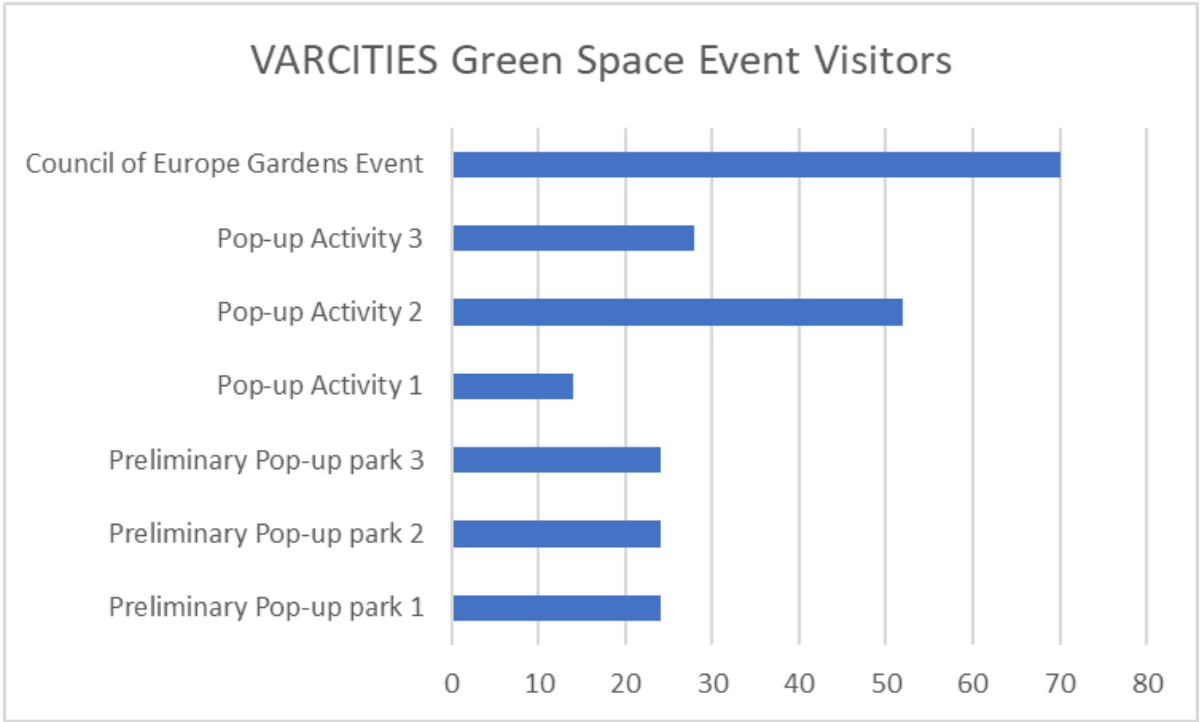


Figure 188: Green spaces event attendees in Gżira

KPI 4.3b Recreational or cultural value of green spaces (activities in green spaces)
 Expected Impact: Increased recreational and cultural value of green spaces (Direct Impact)

VS(s): 1,3
 Evaluation Method: Co-evaluation

The bar chart represents the number of recreational or cultural events in green spaces between 2021 and 2024:
 Two types of events are distinguished: those corresponding only to the implementation of the project (VARCITIES in orange) and those open to the whole public (Public Events (in blue).

In 2021 and 2022, only VARCITIES events took place, with a value of approximately 3 events per year. In 2023, the total number of events increased to 4, with a combination of VARCITIES and public events. In 2024, all registered events were public, reaching a total of 4 events.

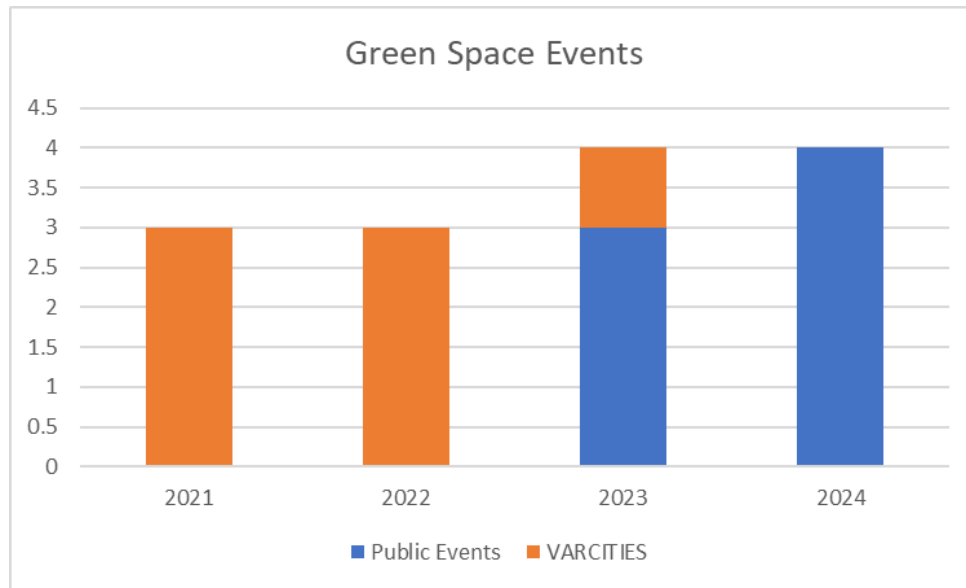


Figure 189: Green space events in Gżira

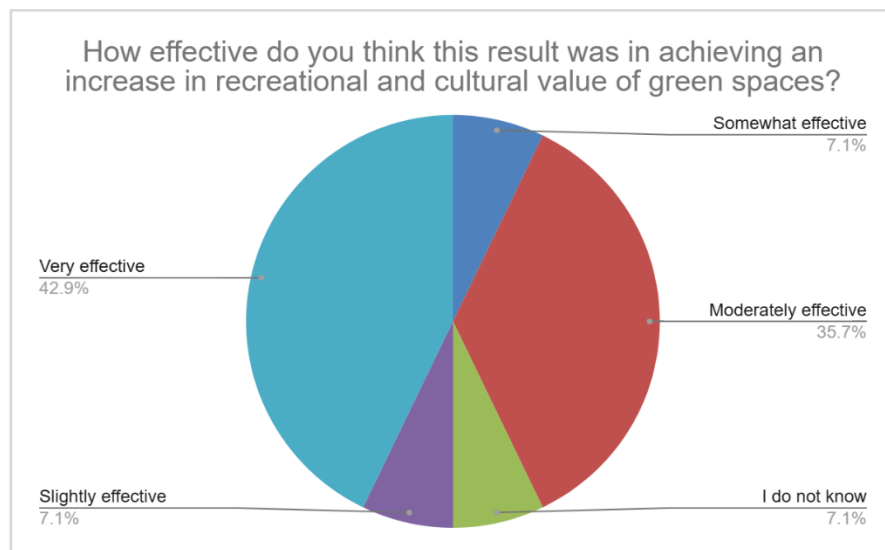


Figure 190: Co-evaluation result for green space activities in Gżira

At the final stakeholder event, participants were asked to assess how effective the number of activities and attendees had been in enhancing the recreational and cultural

value of green spaces. The majority of respondents rated the outcome as very effective (42.9%).

KPI 4.11 Species richness and composition with respect to indigenous vegetation and local/national biodiversity targets

Expected Impact: Increased urban biodiversity (Direct Impact)

VS(s): 1,3

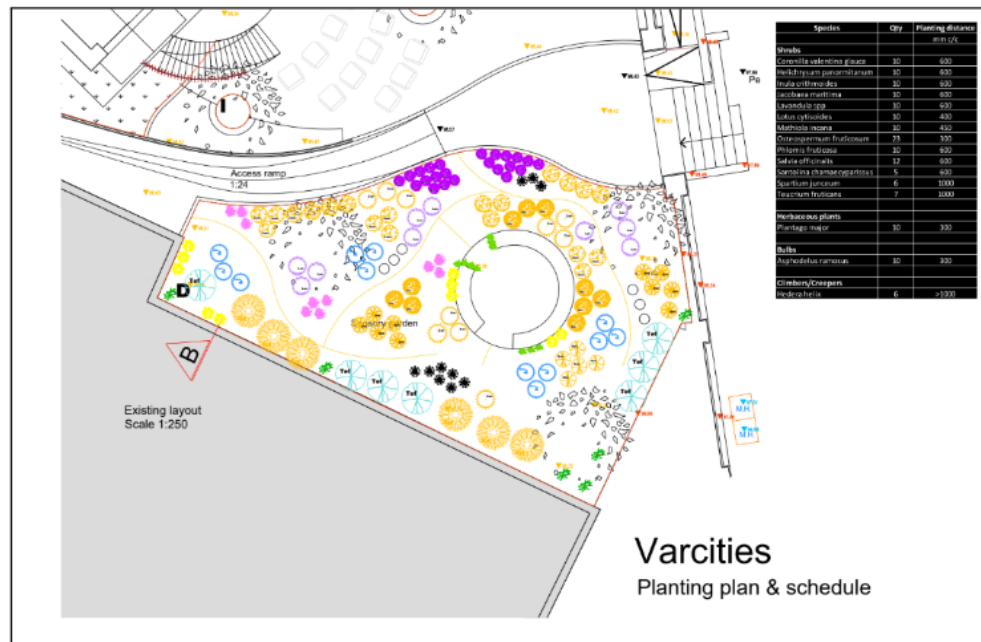
Evaluation Method: Benchmarking

The table below shows the different species and the number of individuals of each species planted in VS1 and VS3. The species richness is 22, and the total abundance across all species is 201. In line with national and local biodiversity targets, all 22 species are indigenous to Malta. This contributes to the conservation of native flora as outlined in Malta's National Biodiversity Strategy and Action Plan (NBSAP) and supports the EU Biodiversity Strategy for 2030 objectives, which emphasize the restoration and protection of indigenous species and habitats. The total abundance of 201 individuals further strengthens the establishment of native plants in urban environments.

Species name	Number of individuals
Coronilla valentina glauca	10
Jacobaea maritima	10
Lavandula spp	10
Lotus cytisoides	10
Mathiola incana	10
Osteospermum fruticosum	23
Salvia officinalis	12
Santolina chamaecyparissus	5
Spartium junceum	6
Plantago major	10
Asphodelus ramosus	10

Hedera helix	6
Helichrysum panormitanum	15
Inula crithmoides	15
Teucrium fruticans	7
Phlomis fruticosa	15
Arbutus unedo	2
Thymus vulgaris	5
Capparis spinosa	5
Cistus creticus	5
Pancratium maritimum	5
Olea europaea	5

Table 169: Plant & tree species in Gżira



KPI 4.21 Number of sensory elements

Expected Impact: Increased data from sensors (Direct Impact)

VS(s): 2

Evaluation Method: Pre & Post

This KPI considers the added digital value of VS2, which were installed or used to gather environmental data about the pilot site. No sensors were previously available in the pilot site, therefore the baseline is '0'. These sensors are directly transmitting data to the H&WB platform developed in WP5.

The number of sensors is represented in the table below;

Sensor	Quantity
Outdoor Air Quality (public space)	4
Traffic counters	7
Wind	1
Indoor Air Quality	1
Citizen Science Sensors (Air Quality)	10
Noise	1

Table 170: No. of sensors in Gżira

Challenge 5

KPI 5.6 Chemical air quality indicators

Expected Impact: Increased (chemical) air quality data (Added value)

VS(s): 2

Evaluation Method: Benchmarking

Wall mounted sensors were installed in ten locations across Gżira, including both the balconies and outdoor spaces of resident's homes and public spaces. This deliberate involvement of local citizens facilitates participatory research, a key approach of VS2.

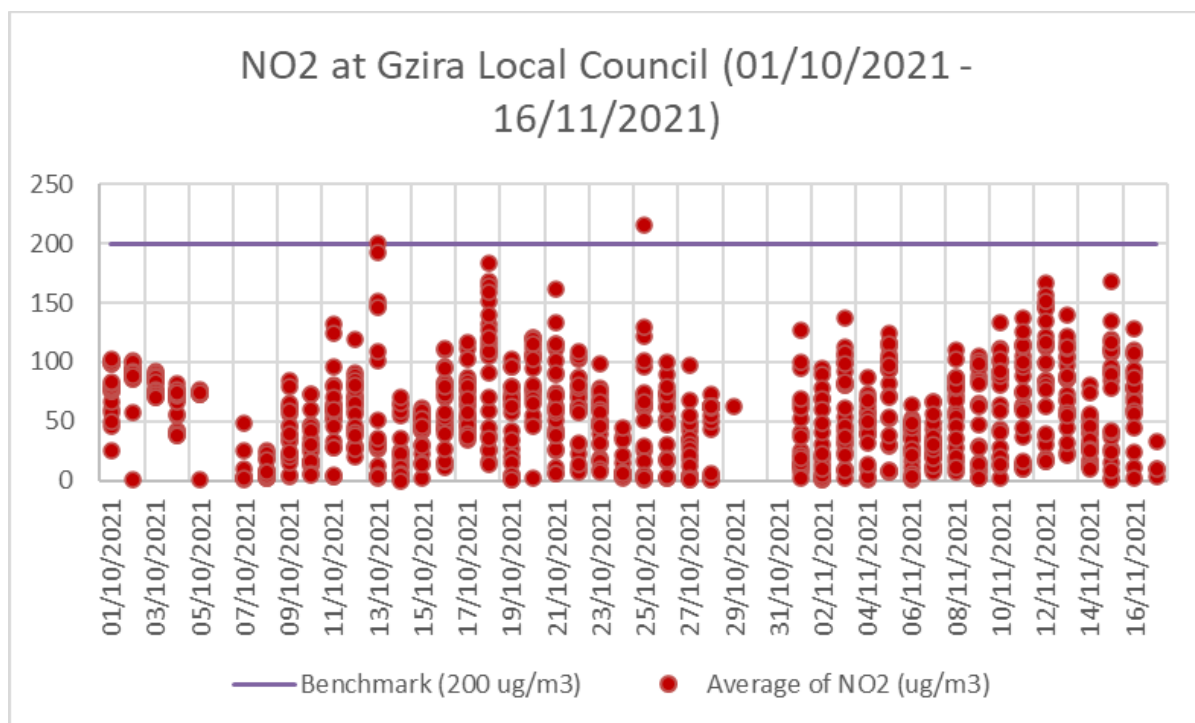


Figure 192: NO2 at Gżira Local Council

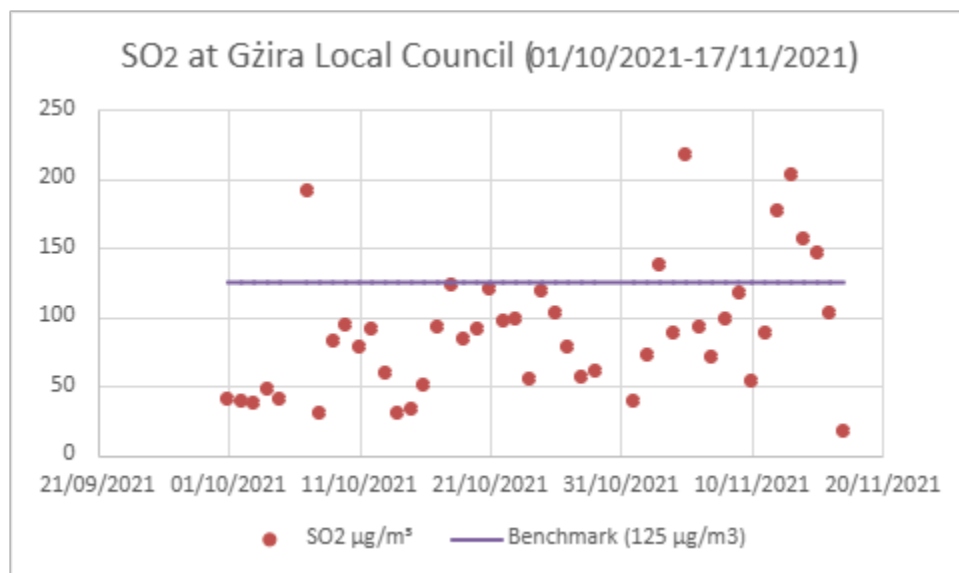


Figure 193: SO2 at Gżira Local Council

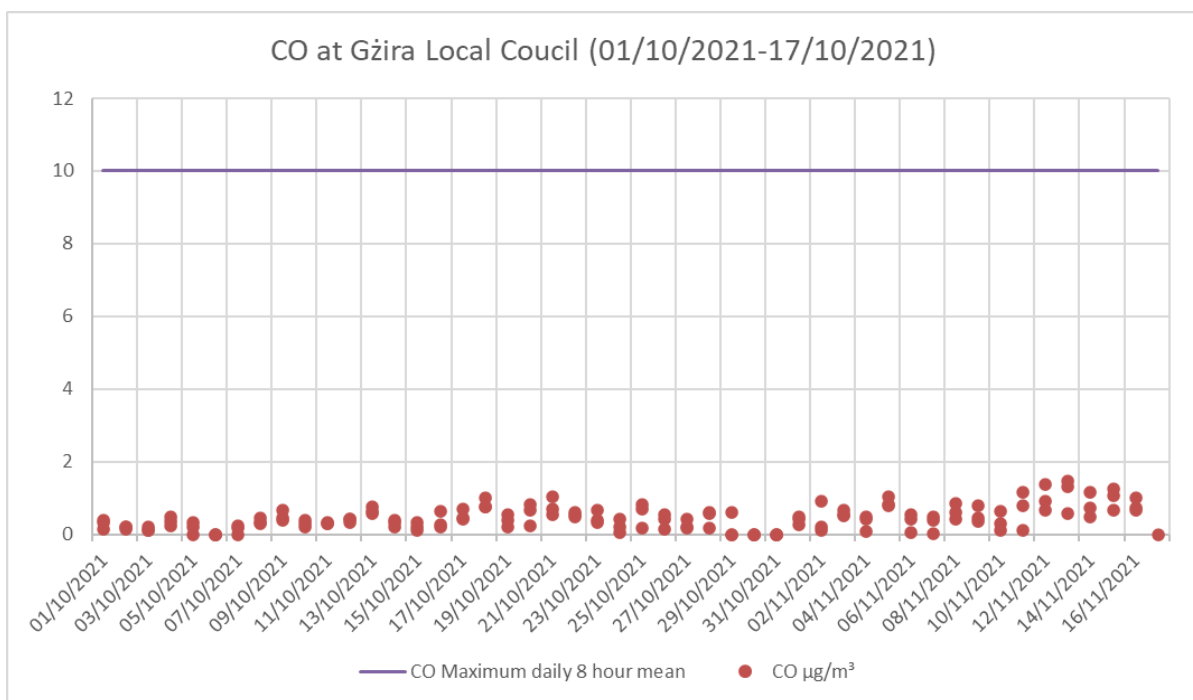


Figure 194: CO at Gżira Local Council

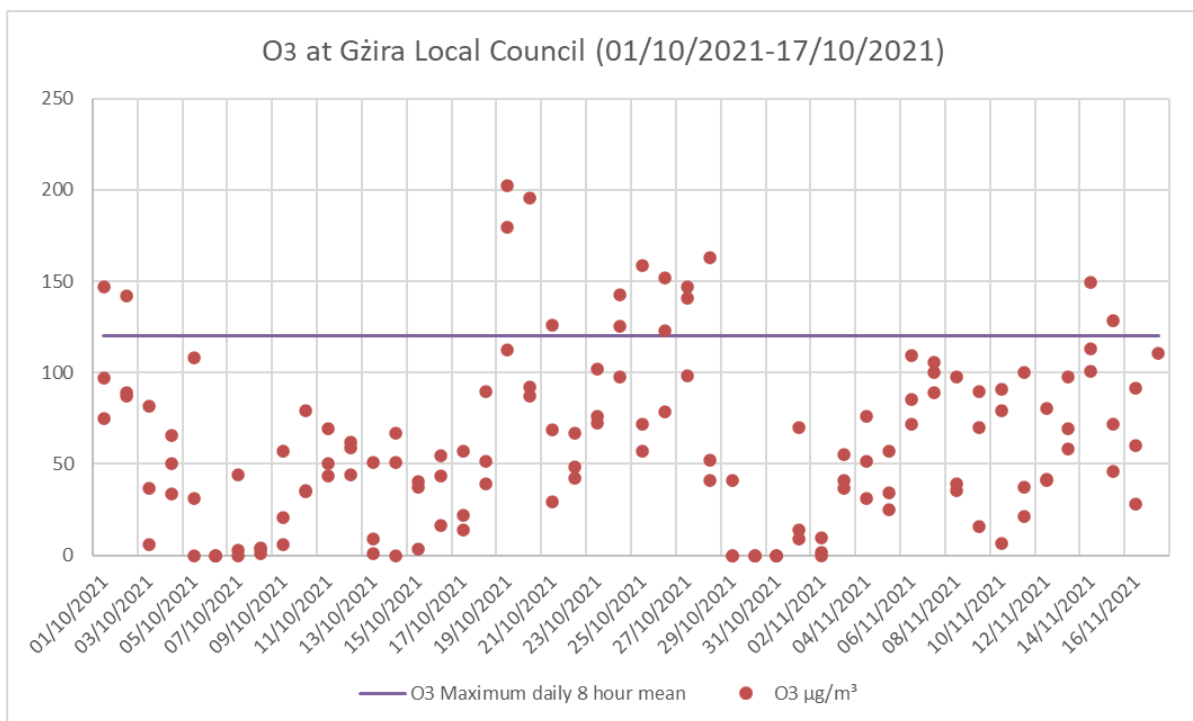


Figure 195: O3 at Gżira Local Council

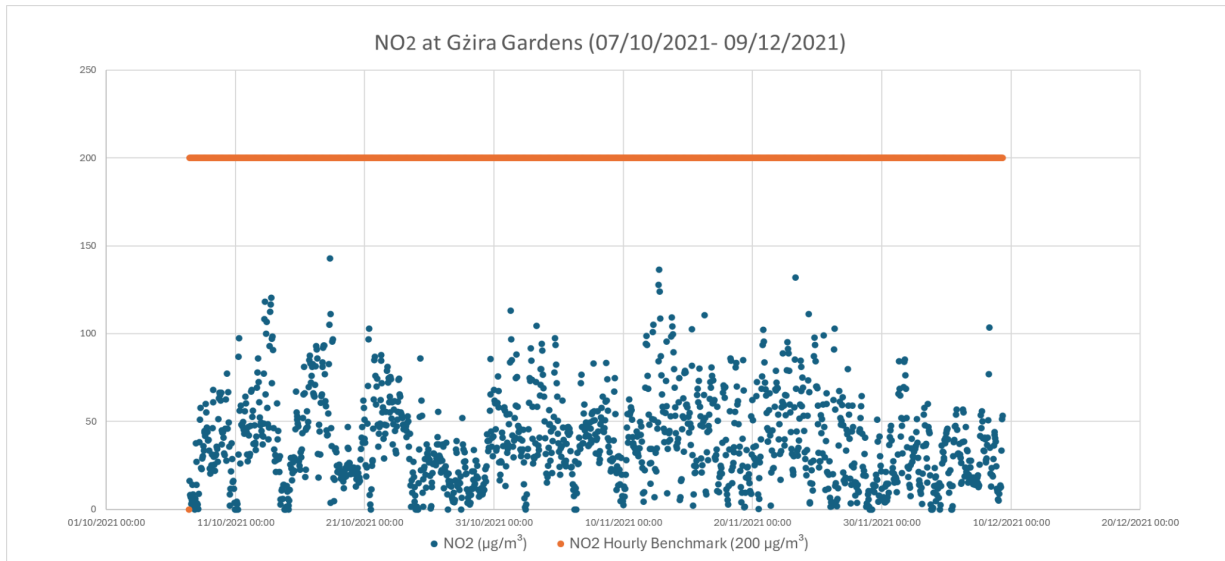


Figure 196: NO2 at Gżira Gardens

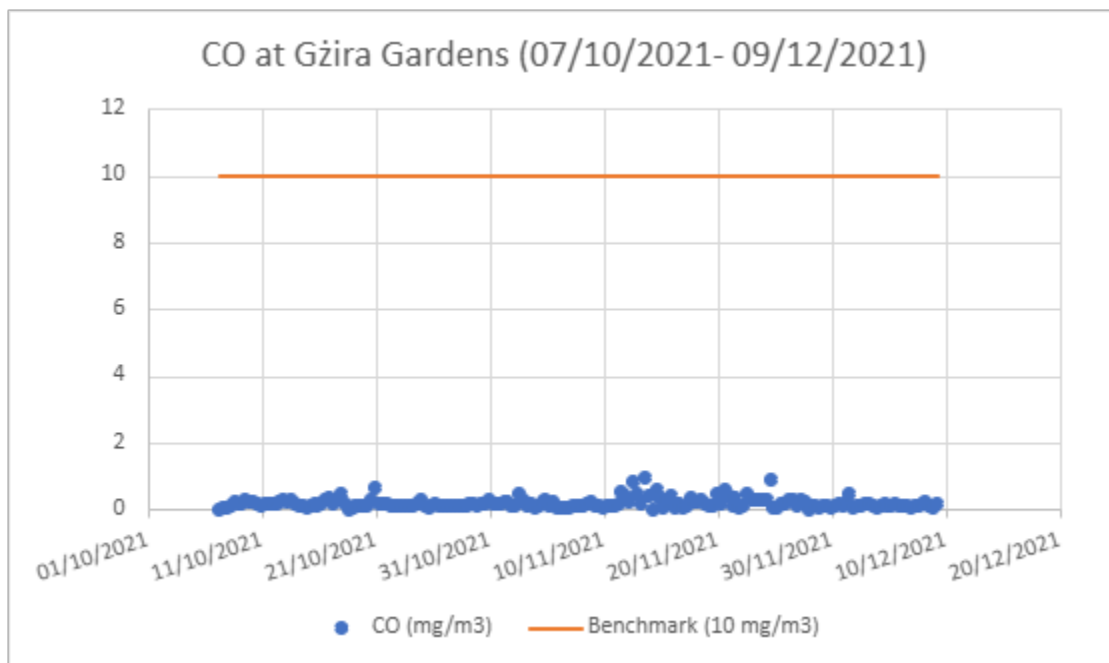


Figure 197: CO at Gżira Gardens

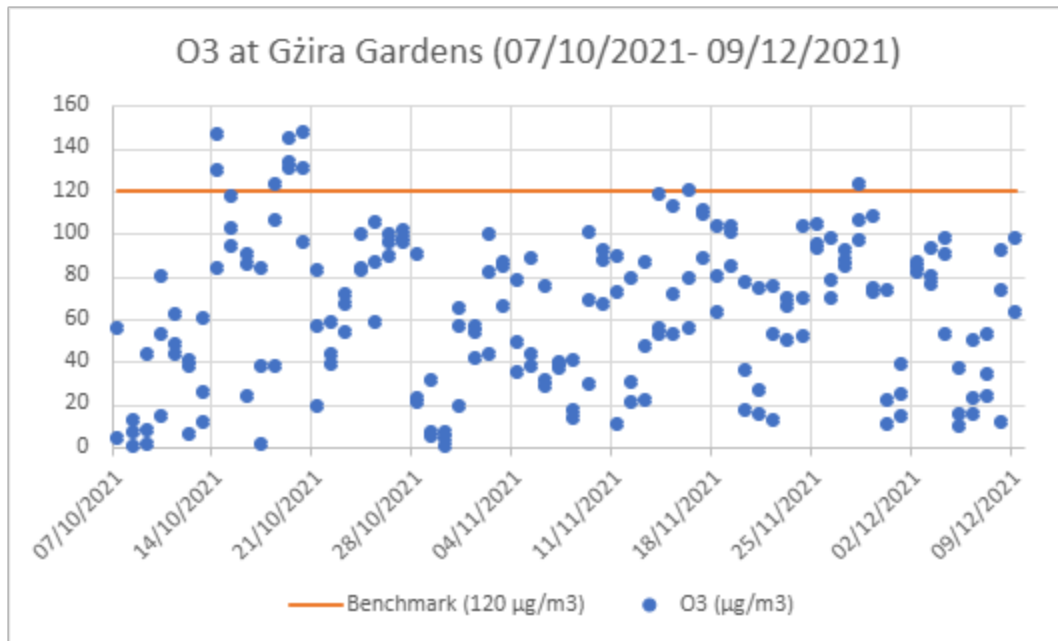


Figure 198: O3 at Gżira Gardens

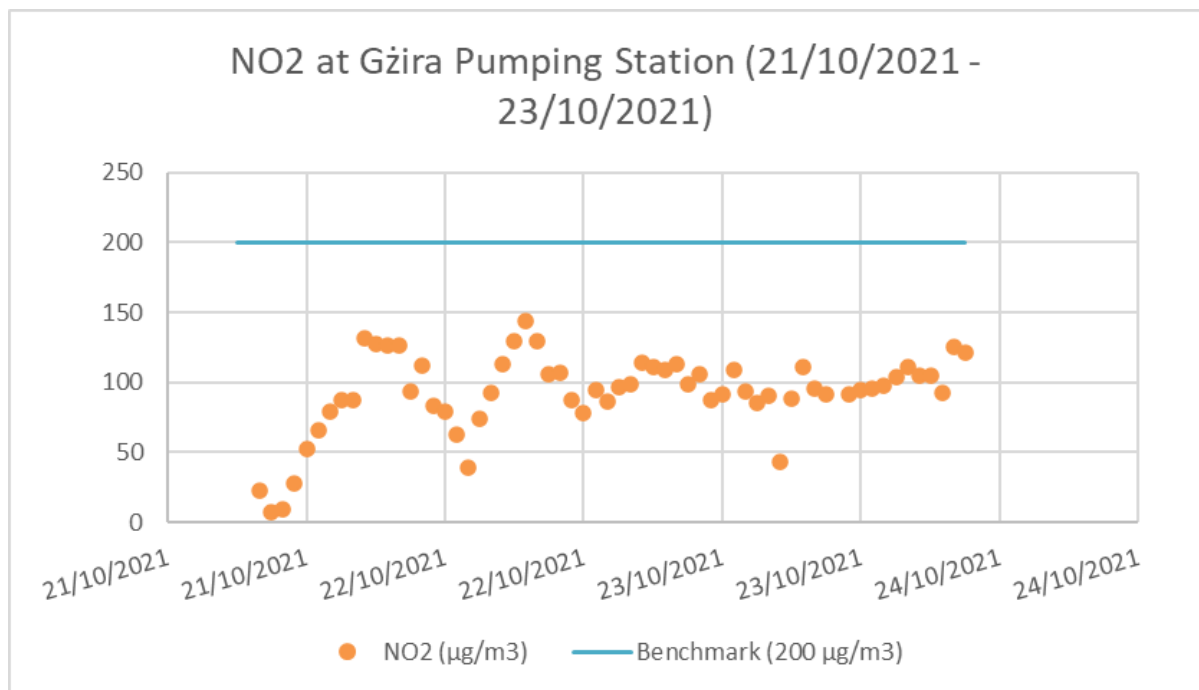


Figure 199: NO2 at Gżira Pumping Station

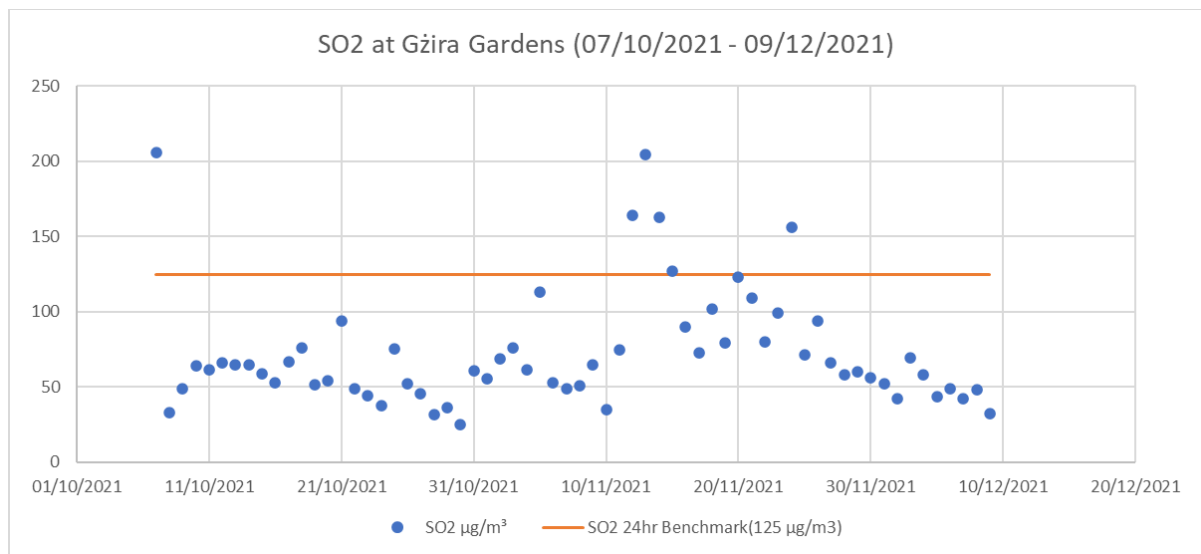
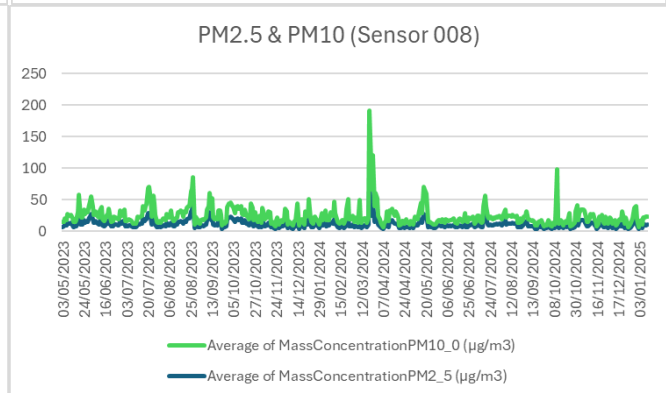
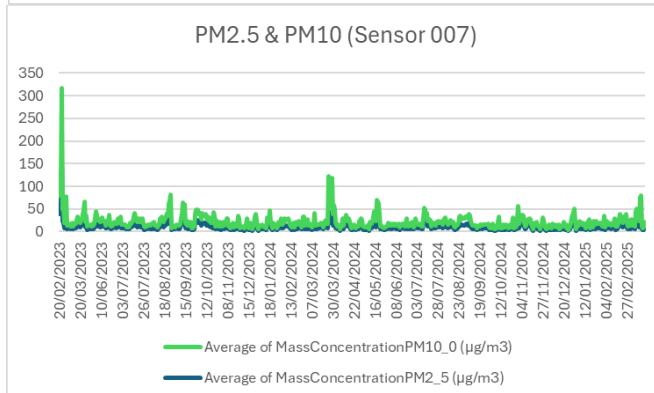
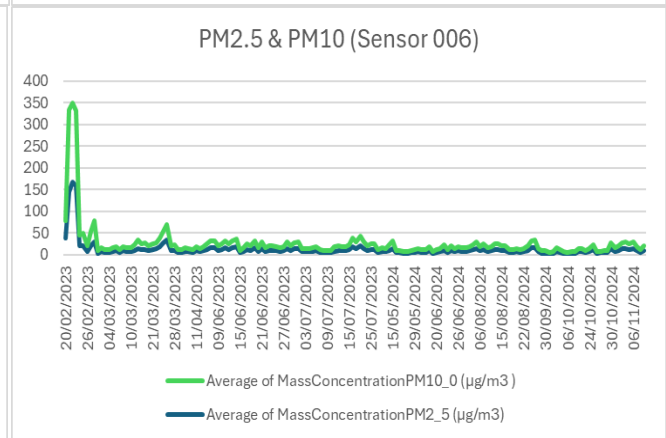
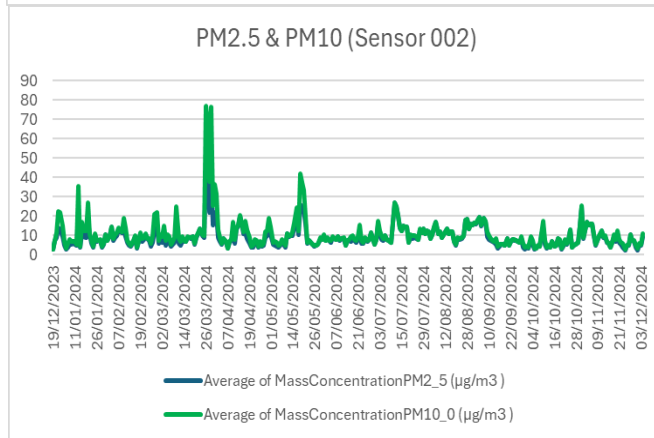
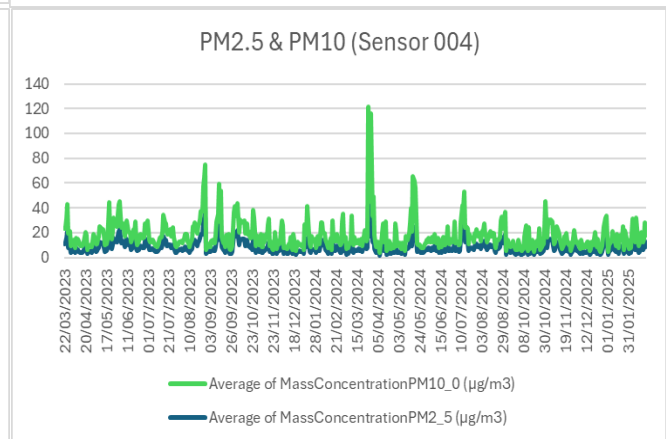
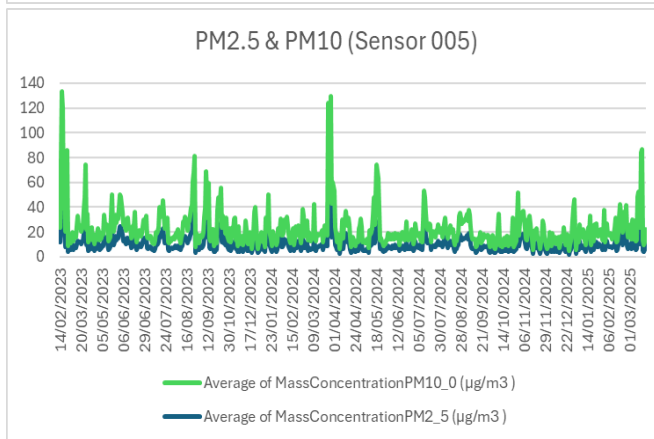
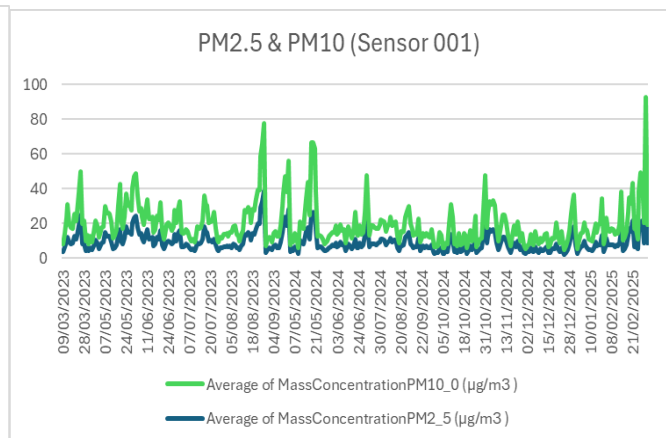
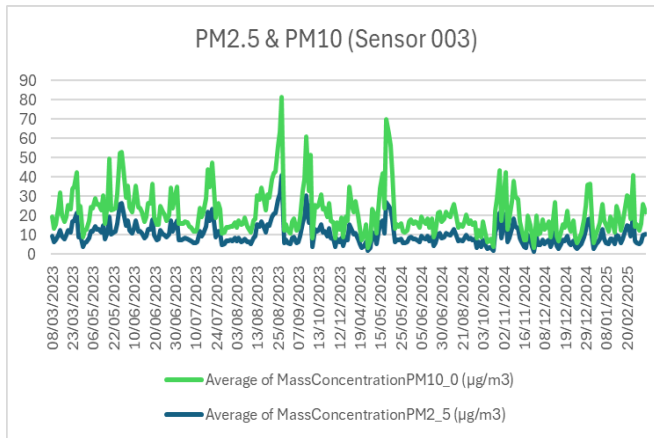


Figure 200: SO2 at Gżira Gardens



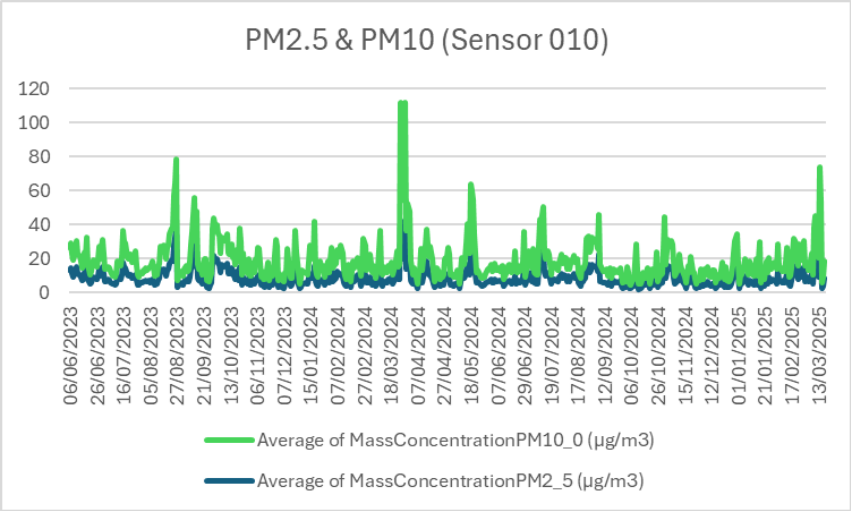


Figure 201: Gżira PM sensor data

KPI 5.7 Air pollution episodes

Expected Impact: Increased data on air quality (pollution episodes) (Added value)

VS(s): 2

Evaluation Method: Benchmarking

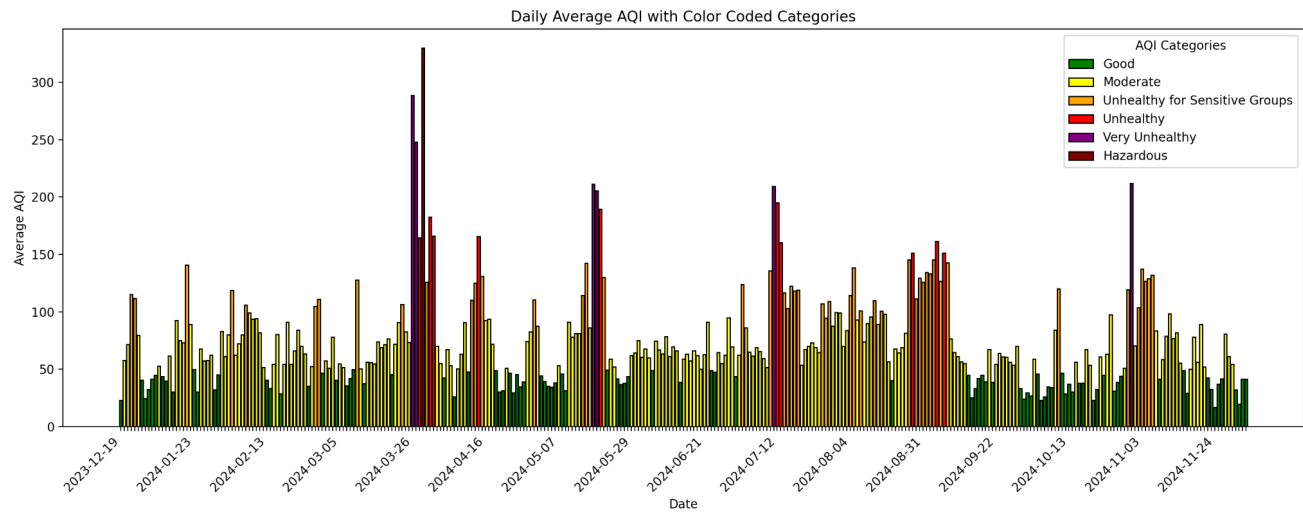


Figure 202: Gżira daily average AQI

Pollutant	Concentration	Averaging Period	Legal Nature	Permitted exceedances
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				per year
Fine particles (PM2.5)	20 µg/m3	1 year	Stage 2 limit value to be met as of 1.1.2020 ***	n/a
Sulphur dioxide (SO2)	125 µg/m3	24 hours	Limit value to be met as of 1.1.2005	3
Nitrogen dioxide (NO2)	200 µg/m3	1 hour	Limit value to be met as of 1.1.2010	18
Nitrogen dioxide (NO2)	40 µg/m3	1 year	Limit value to be met as of 1.1.2010 *	n/a
Particulate matter (PM10)	40 µg/m3	1 year	Limit value to be met as of 1.1.2005 **	n/a
Carbon monoxide (CO)	10 mg/m3	Maximum daily 8 hour mean	Limit value to be met as of 1.1.2005	n/a

Table 171: Air Quality Thresholds (EU)

Sensor ID/location	Pollutant	Period	Benchmark used	Number of exceedances
1	PM2.5	09/03/2023-14/03/2025	20 µg/m3 (yearly)	18
1	PM10	09/03/2023-14/03/2025	40 µg/m3 (yearly)	3
2	PM2.5	19/12/2023-03/12/2024	20 µg/m3 (yearly)	12
2	PM10	19/12/2023-03/12/2024	40 µg/m3 (yearly)	4

3	PM2.5	08/03/2023-02/03/2025	20 µg/m3 (yearly)	19
3	PM10	08/03/2023-02/03/2025	40 µg/m3 (yearly)	2
4	PM2.5	22/03/2023-07/03/2025	20 µg/m3 (yearly)	20
4	PM10	22/03/2023-07/03/2025	40 µg/m3 (yearly)	4
5	PM2.5	14/02/2023-18/03/2025	20 µg/m3 (yearly)	39
5	PM10	14/02/2023-18/03/2025	40 µg/m3 (yearly)	12
6	PM2.5	20/02/2023-08/11/2024	20 µg/m3 (yearly)	9
6	PM10	20/02/2023-08/11/2024	40 µg/m3 (yearly)	5
7	PM2.5	20/02/2023-18/03/2025	20 µg/m3 (yearly)	39
7	PM10	20/02/2023-18/03/2025	40 µg/m3 (yearly)	13
8	PM2.5	03/05/2023-08/01/2025	20 µg/m3 (yearly)	31
8	PM10	03/05/2023-08/01/2025	40 µg/m3 (yearly)	9
10	PM2.5	06/06/2023-18/03/2025	20 µg/m3 (yearly)	19
10	PM10	06/06/2023-18/03/2025	40 µg/m3 (yearly)	4
Gżira Gardens	SO2	07/10/2021-09/12/2021	125 µg/m3 (24hours)	6

Gżira Local Council	SO2	01/10/2021-17/11/2021	125 µg/m3 (24hours)	7
Gżira pumping station	NO2	21/10/2021-23/10/2021	200 µg/m3 (hourly)	0
Gżira Local Council	NO2	1/10/2021-17/11/2021	200 µg/m3 (hourly)	0
Gżira Gardens	NO2	07/10/2021-09/12/2021	200 µg/m3 (hourly)	0
Gżira Gardens	CO	07/10/2021-09/12/2021	10 mg/m3 (Maximum daily 8 hour mean)	0
Gżira Gardens	O3	07/10/2021-09/12/2021	120 µg/m3 (Maximum daily 8 hour mean)	10

Table 172: Gżira air quality measurements with EU threshold evaluation

Challenge 7

KPI 7.8 Citizen participation in and co-creation of the design, implementation and evaluation of project interventions

Expected Impact: Increased and improved participation (Direct Impact)

VS(s): 1,2,3

Evaluation Method: Co-evaluation

The co-creation process in the Gżira pilot took a slightly different approach. Apart from the first 3 co-creation workshops, the Gżira pilot representatives organised 3 pop-up activities as part of VS1 to include additional feedback from the Gżira communities living around the pilot site. The ideas behind this approach were also due to a lack of citizen representation in the first 2 workshops, and the focus of VS1 on the immediate community. In the first workshop, the attendance of citizens was rather low compared to non-citizen stakeholders such as experts and practitioners, with 3 being the total. The second workshop had a lower participation with just one local citizen attending. The participation from this category was significantly improved through the pop-ups, shown below as 'VS1', and in which 72 citizens participated. Finally, 2 other participants have

participated in the Town Hall event. The total number of citizens until 2023 is therefore 78.

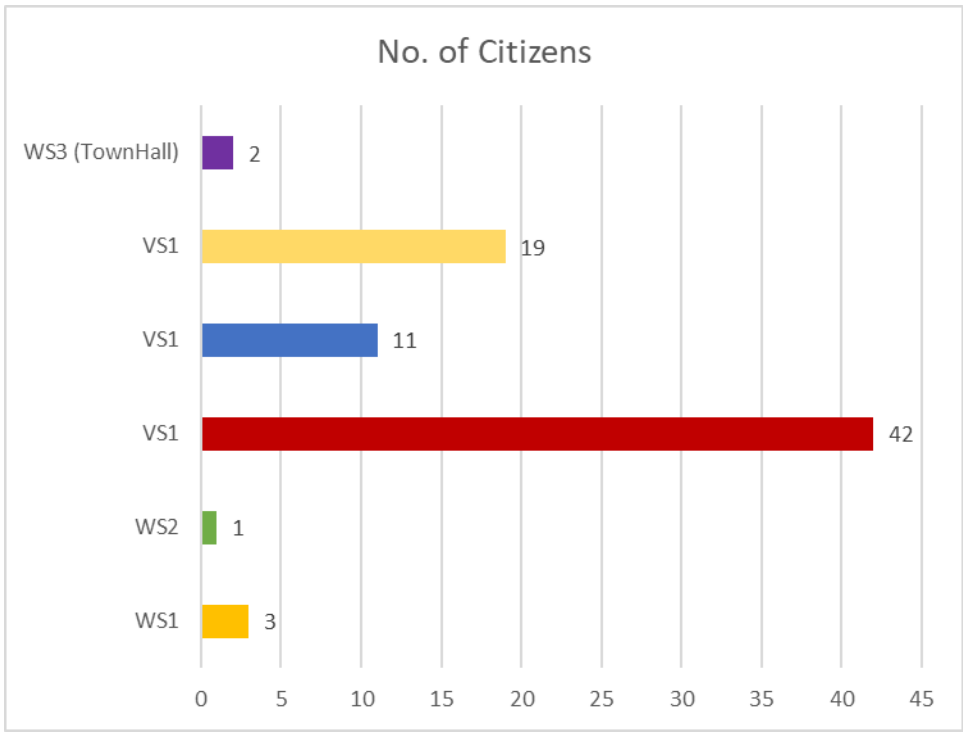


Figure 203: Total no. of citizens in activities in Gżira

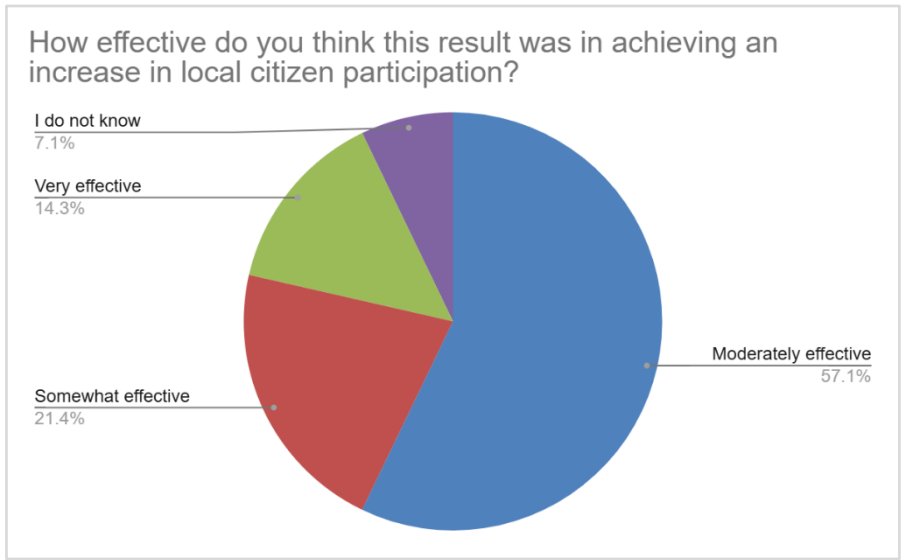


Figure 204: No. of citizens co-evaluation result in Gżira

At the final stakeholder event, participants were asked to evaluate how effective the project had been in increasing local citizen participation. The majority of respondents (57.1%) rated the result as moderately effective, followed by 21.4% who rated it as somewhat effective.

KPI 7.11 Number of individuals that is aware of the project's objectives, content and processes

Expected Impact: Increased and improved participation (Direct Impact)

VS(s): 1,2,3

Evaluation Method: Co-evaluation

Due to a high degree of activity in Gzira, the total number of people who are aware of the project shows a high number of people being aware of VARCITIES. This figure not only takes into consideration the co-creation workshops but also online views of posts which have been published in social media and dissemination materials distributed, attendance in conferences and participation in focus groups and sociocultural events. The estimated total number is 3,997 people. The highest channel reported in that of the social media metrics, adding up to 2,137 viewers.

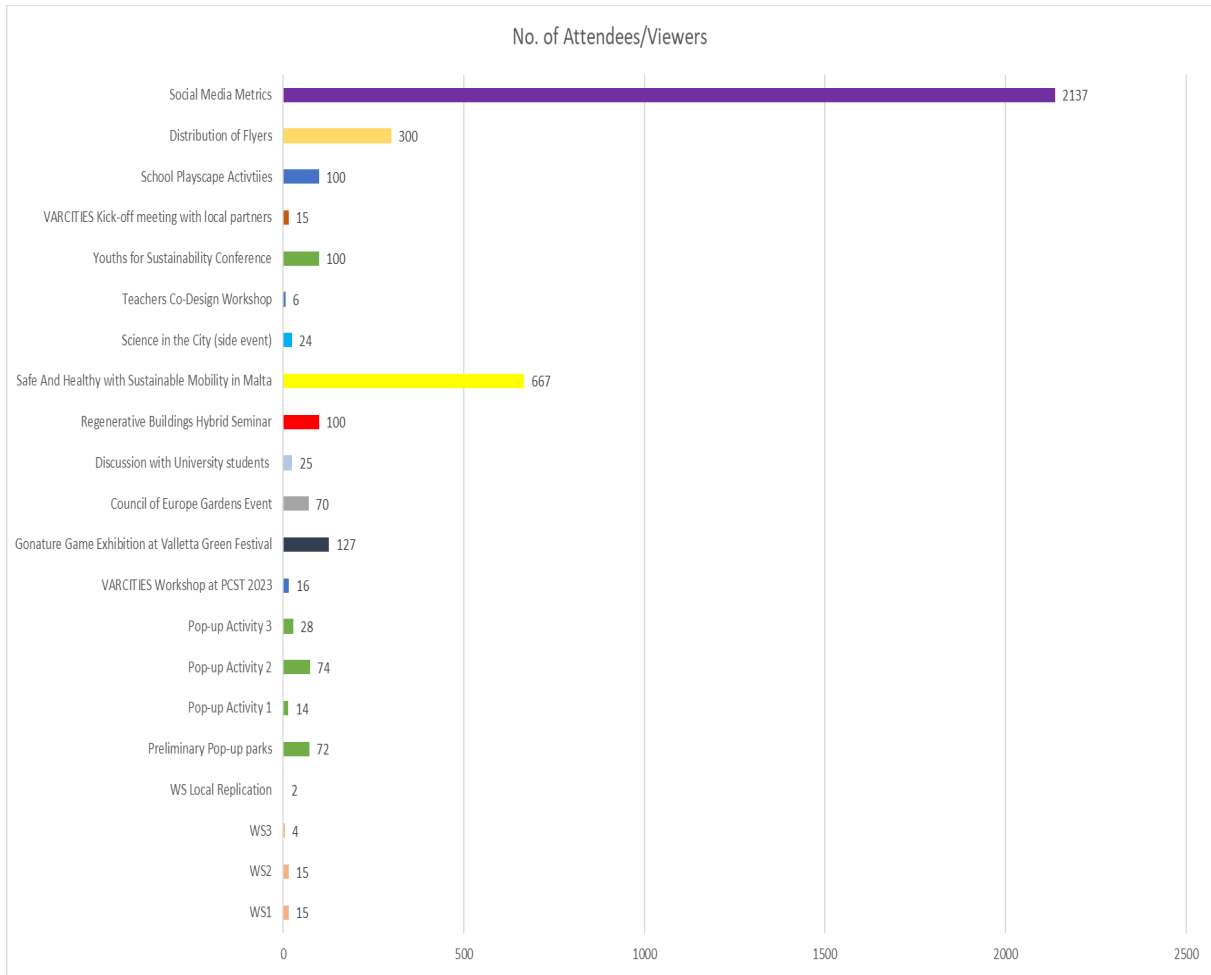


Figure 205: Total no. of People Aware of the Project in Gżira

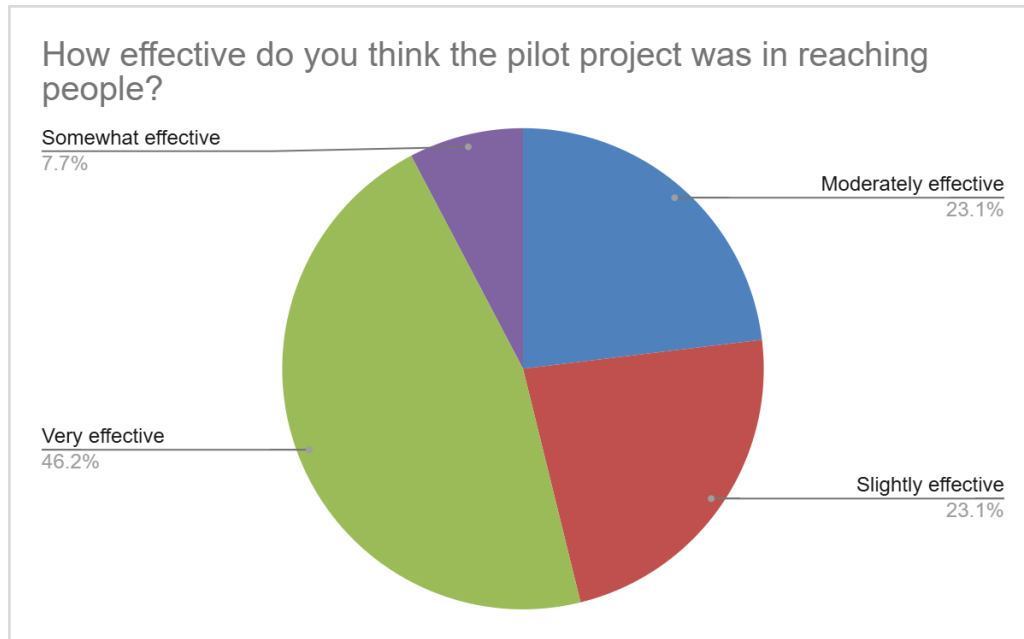


Figure 206: No. of viewers co-evaluation result in Gżira

At the final stakeholder event, participants were asked to assess how effective they thought the project's outreach had been in raising awareness of its objectives, content, and processes. A majority of respondents (46.2%) rated the results as very effective.

KPI 7.16 No of persons involved (on average) in the project activities

Expected Impact: Increased and improved participation (Direct Impact)

VS(s): 1,2,3

Evaluation Method: Co-evaluation

A total number of 567 participants were part of different activities organised in the Gżira pilot site. The highest figure among the events shown below is that of the GoNature Game exhibition, which was presented to citizens at the Valletta Green Festival. The number also takes into account a side activity organised for children while their parents could experience the game. The total number of participants here is 127 people, and the average is 41 people per activity.

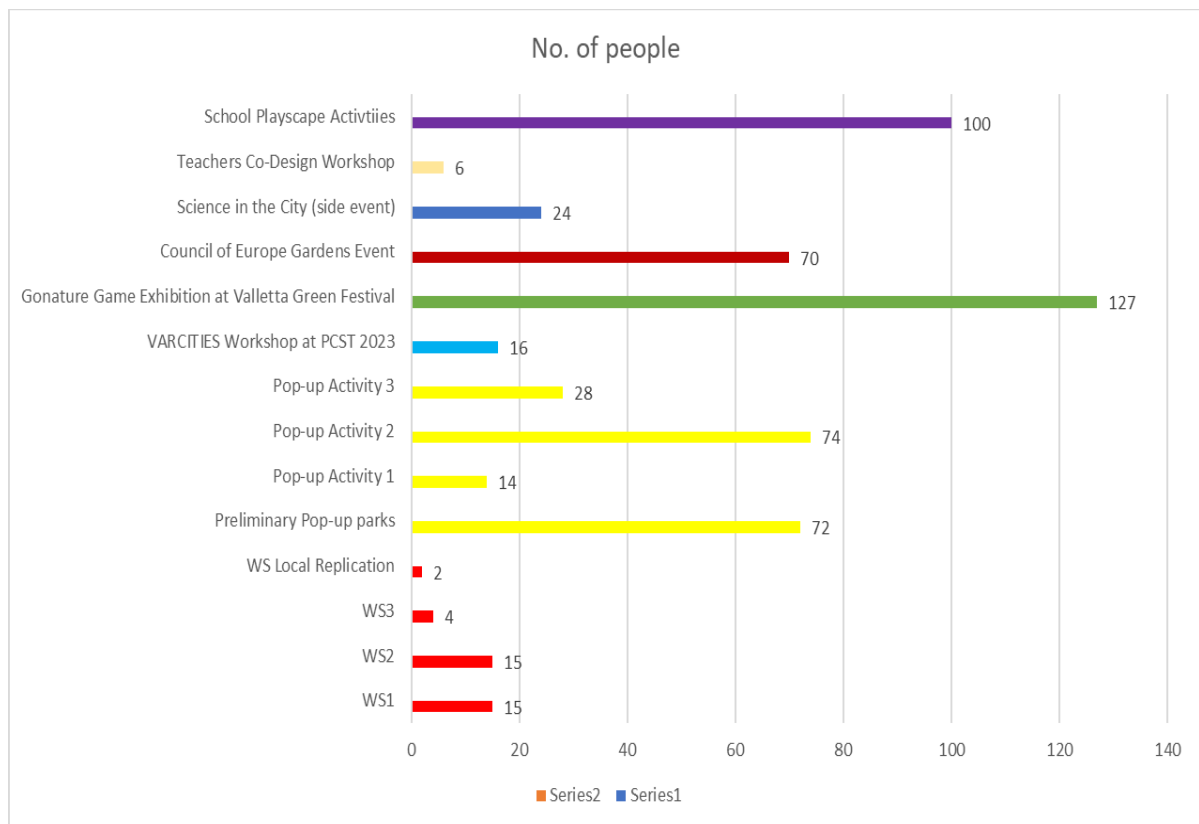


Figure 207: No. of people in Gżira activities

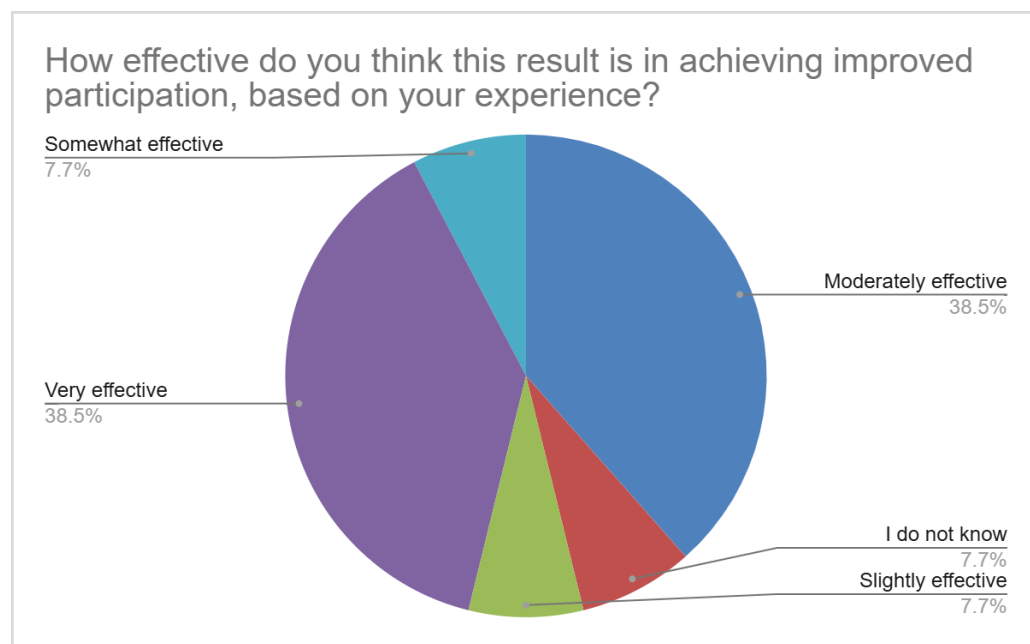


Figure 208: No. of people in Gżira activities co-evaluation result

At the final stakeholder event, participants were asked to assess how effective they thought the result was in achieving improved participation. A majority of respondents (38.5%) rated the results as very effective and moderately effective.

KPI 7.18 Number of participants in citizen science activities

Expected Impact: Increased and improved participation (in citizen science activities)
(Direct Impact)

VS(s): 1,2,3

Evaluation Method: Co-evaluation

The graph illustrates the number of participants involved in various citizen science activities. The highest participation was recorded in the 'Culture Garden' event, which attracted 500 participants. This was followed by the Co-creation workshops held at St. Clare Primary School, which engaged 200 participants. Other activities included three editions of Science in the City, which drew 94, 80, and 24 participants respectively. The Pop-up Music Park had 74 participants, while the GoNature Game Exhibition at the Valletta Green Festival attracted 40 participants. Additionally, the Pop-up Art Park saw 30 participants, and the Pop-up Science Park had 14 participants.

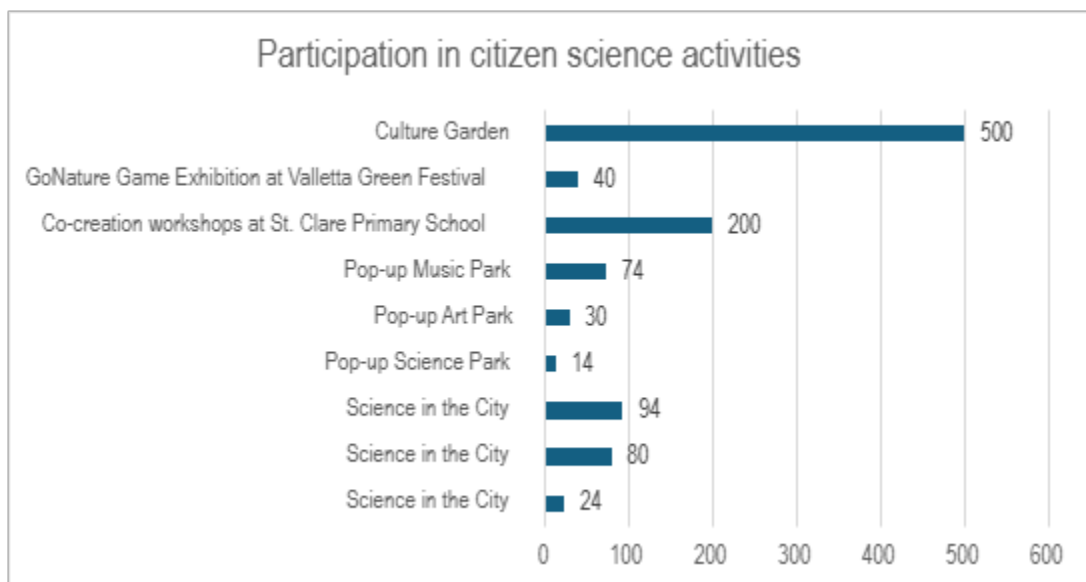


Figure 209: Participation in citizen science activities organised in Gżira

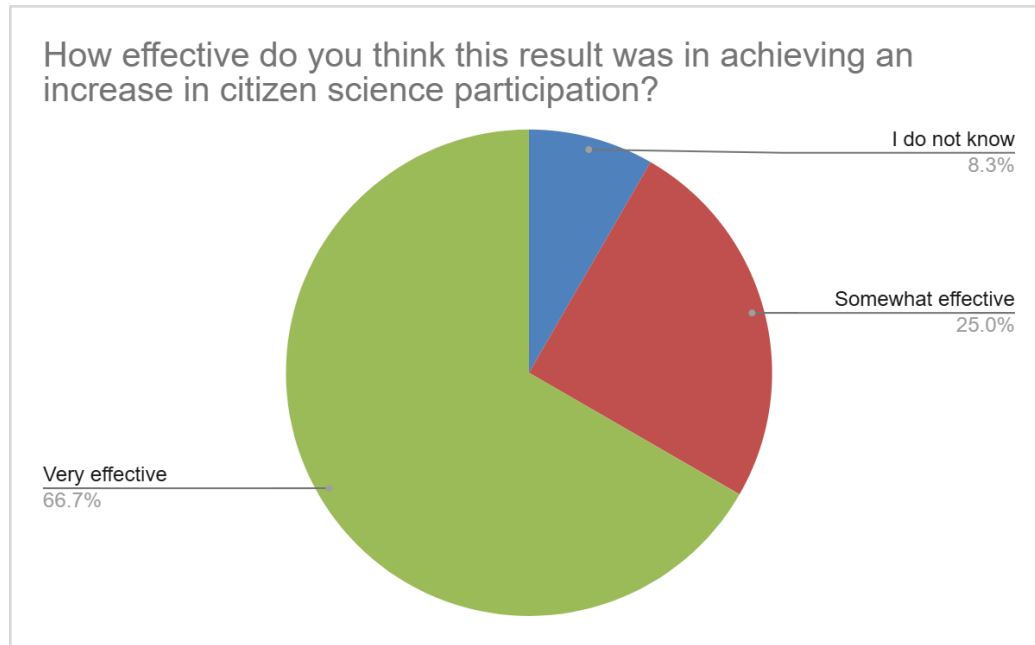


Figure 210: Co-evaluation results of citizen science activity participation

At the final stakeholder event, participants were asked to assess how effective they thought the result was in achieving an increase in citizen science participation. A majority of respondents (66.7%) rated the results as very effective.

Challenge 8

KPI 8.1 The availability and distribution of parks (different types) or ecosystem services with respect to specific individual or household socioeconomic profiles landscape design

Expected Impact: Fair availability of green spaces and ecosystem services (Added value)
VS(s): 1,3

Evaluation Method: Benchmarking

The graph shows the relationship between distance to green spaces and income levels before and after the intervention. Before the intervention (blue line), distances exceed the reference value of 300 metres. After the intervention (green line) the distance decreases to the reference value at low incomes, and significantly exceeds the reference

value at middle incomes. This indicates a more equitable access to green spaces after the intervention.

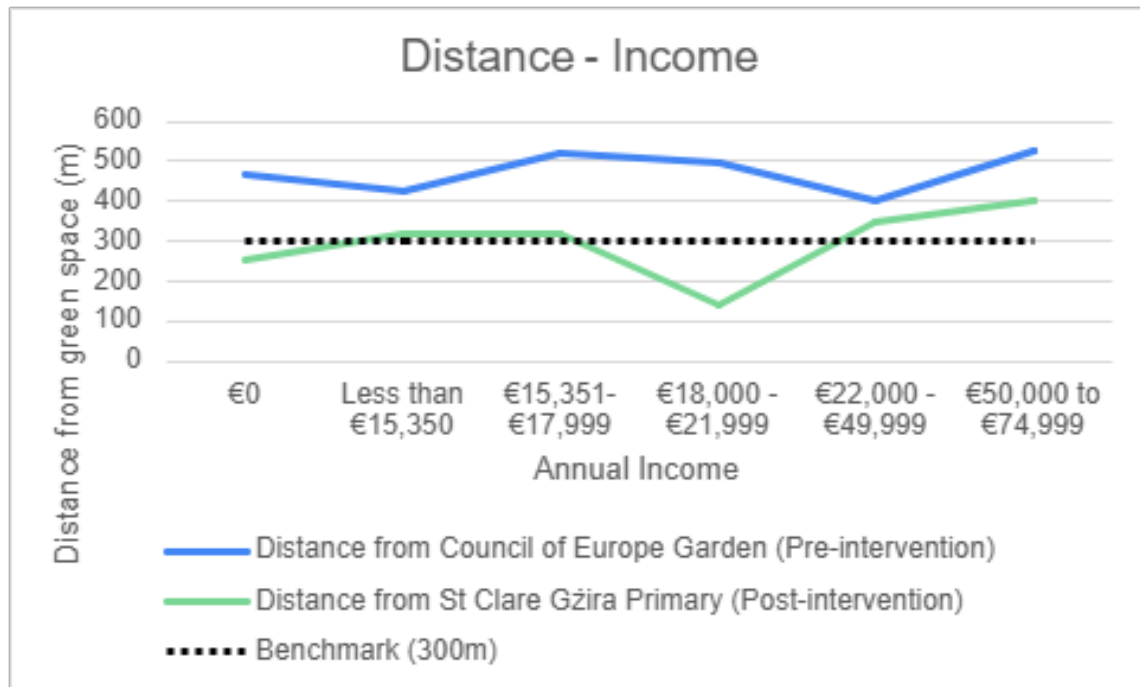


Figure 211: Distance to parks based on income in Gżira

KPI 8.5 Personal and social background of people who participated in the project's activities

Expected Impact: Fair participation to project activities (Direct Impact)

VS(s): 1,2,3

Evaluation Method: Co-evaluation

In Gżira, multiple formats were organised for activities, both online and physical. Some were more targeted at the general populations with events and feedback questionnaires on site with the local community or activities involving children at one of the pilot sites which is a school. Most of the participants were children in co-creation activities at the school, amounting to 280 students, having a percentage of 47.5%. The second category with high participation is that of the '31-50' age group, with a percentage of 22.9%.

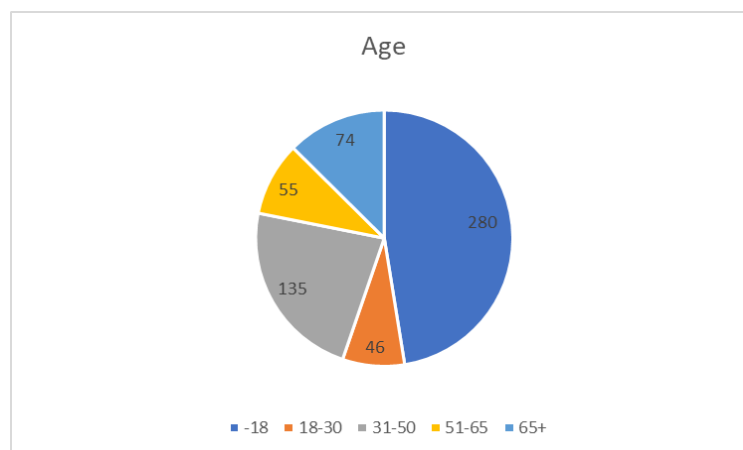


Figure 212: Age groups in Gżira activities

Representation of female and male genders was almost at a par. 51.1% of the participants identify themselves as female while 48.9% were male. No other genders were reported in these activities.

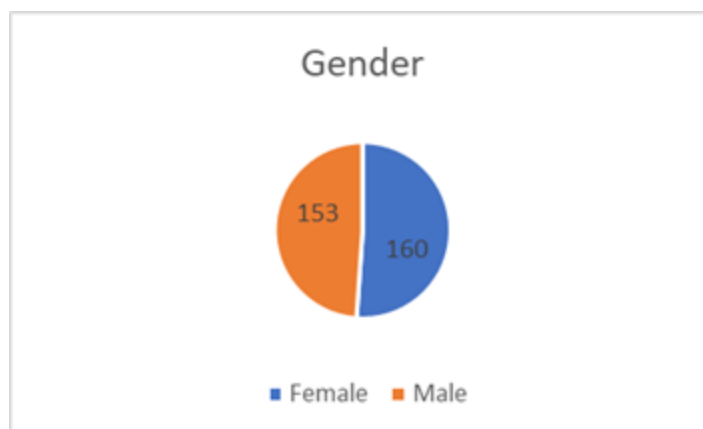


Figure 213: Genders in Gżira activities

In terms of sexual orientation, the 'heterosexual/straight' category was the majority with 87.3%. 16 of these responses came from people who opted not to disclose this type of information about themselves, therefore there could be other forms of participation from diverse categories which benefit the project in the form of feedback received.

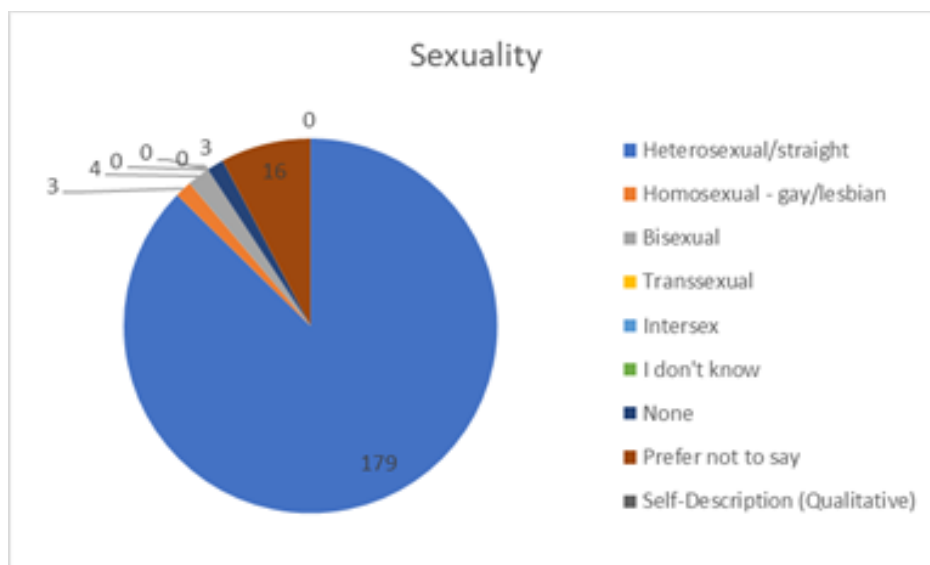


Figure 214: Sexual orientation in Gżira activities

The 'privileged' category in the pie chart below shows the highest number of results and comprises 62.1% of the feedback received. Other categories might improve depending on willingness to participate in upcoming events.

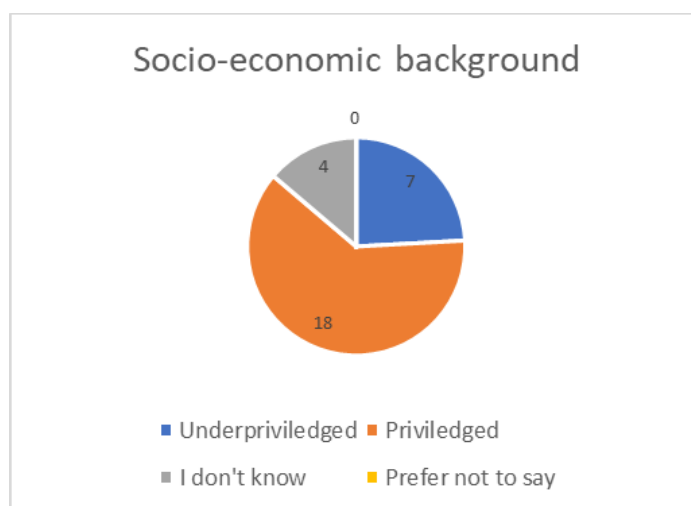


Figure 215: Socio-economic background in Gżira activities

50% of the participants have stated that they had High School education, which is the highest among the other categories. This value is forecasted to change with upcoming events planned at the pilot site.

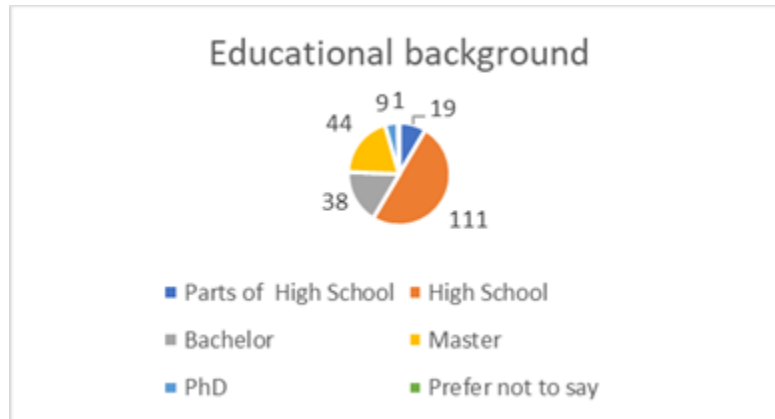


Figure 216: Socio-economic background in Gžira activities

The employment status within participants varied significantly in terms of categorisation. The majority of these respondents have however stated that they are in full-time employment. The percentage for the latter is 46.1%.



Figure 217: Employment status in Gžira activities

The responses related to income brackets of participants were also substantially varied. 60 of these responses are coming from participants with a low monthly income, that of the 'less than €800' category. This implies that a high proportion of the feedback received came from low-income groups, providing a platform to voice their concern through social engagement.

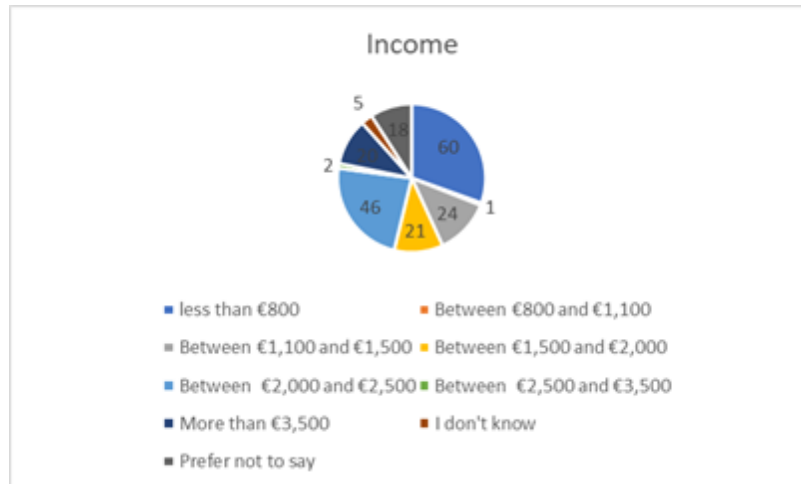


Figure 218: Income in Gżira activities

The diversity of different nationalities which composed the stakeholder group in Gżira-related activities was significant, with feedback from people coming from 21 different countries. The highest among them was that of Maltese citizens, making up 66.7% of the total amount.

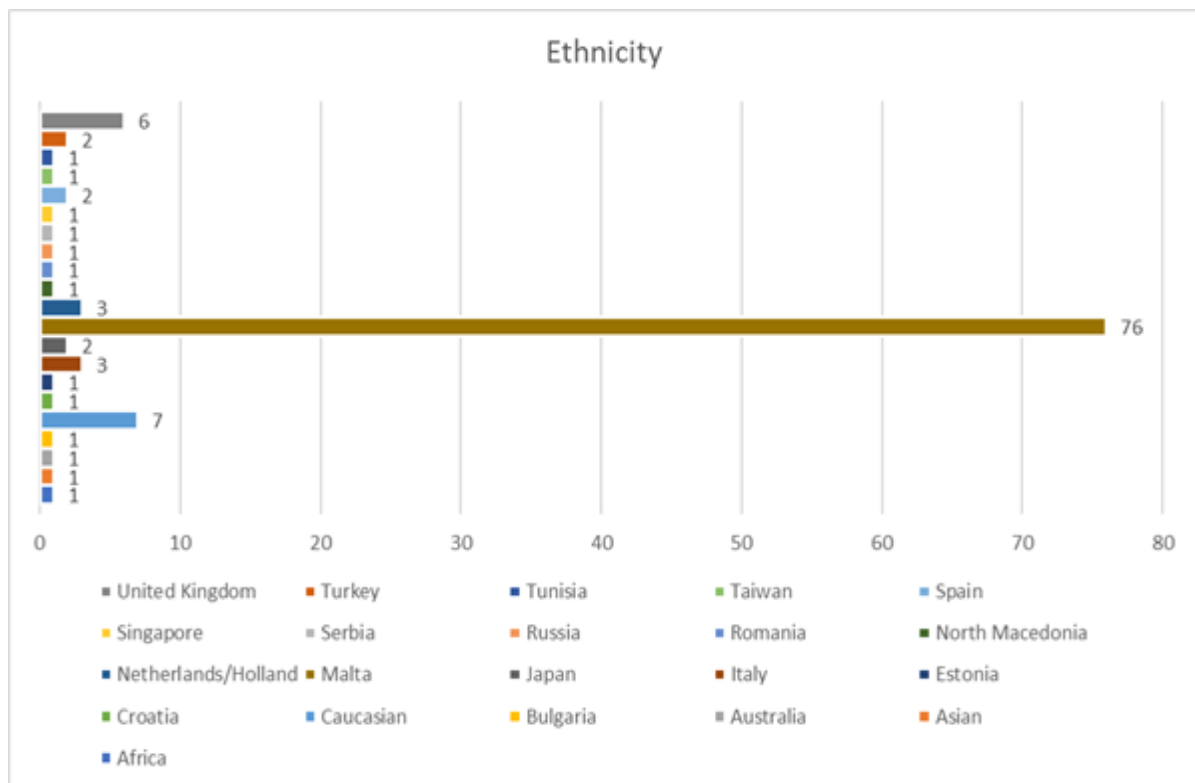


Figure 219: Ethnicity in Gżira activities

Feedback categories reported here exclude some of the other categories reported in the other pilot sites to focus only on the disabilities reported. People suffering from chronic pain or illness was the majority and amounted to 48.7%. Another high incidence of disabilities with respect to the rest is that of people having difficulties with memory and concentration with a percentage of 39.9%.

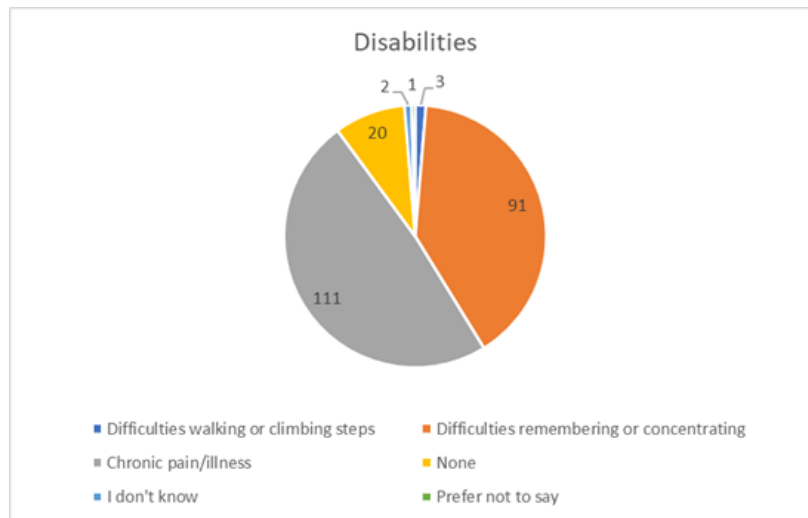


Figure 220: Disabilities in Gžira activities

One may note that 14 of the total responses below have expressed that they do not form part of any religious groups, and this accounts for 70% of the responses.

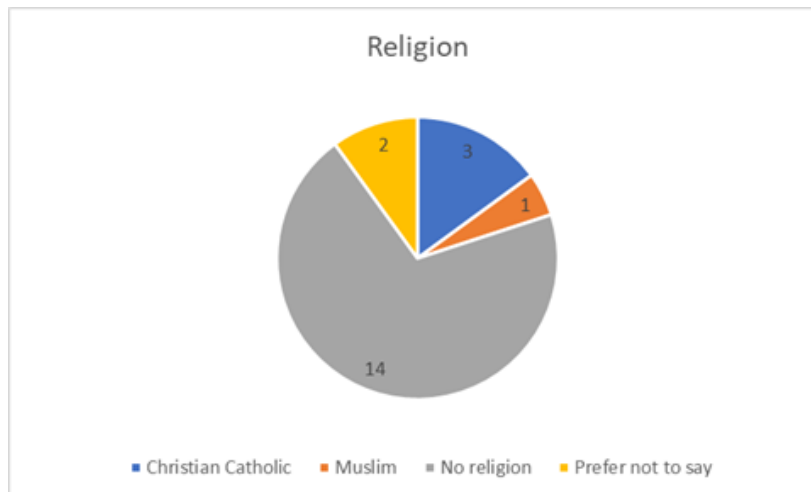


Figure 221: Religions in Gžira activities

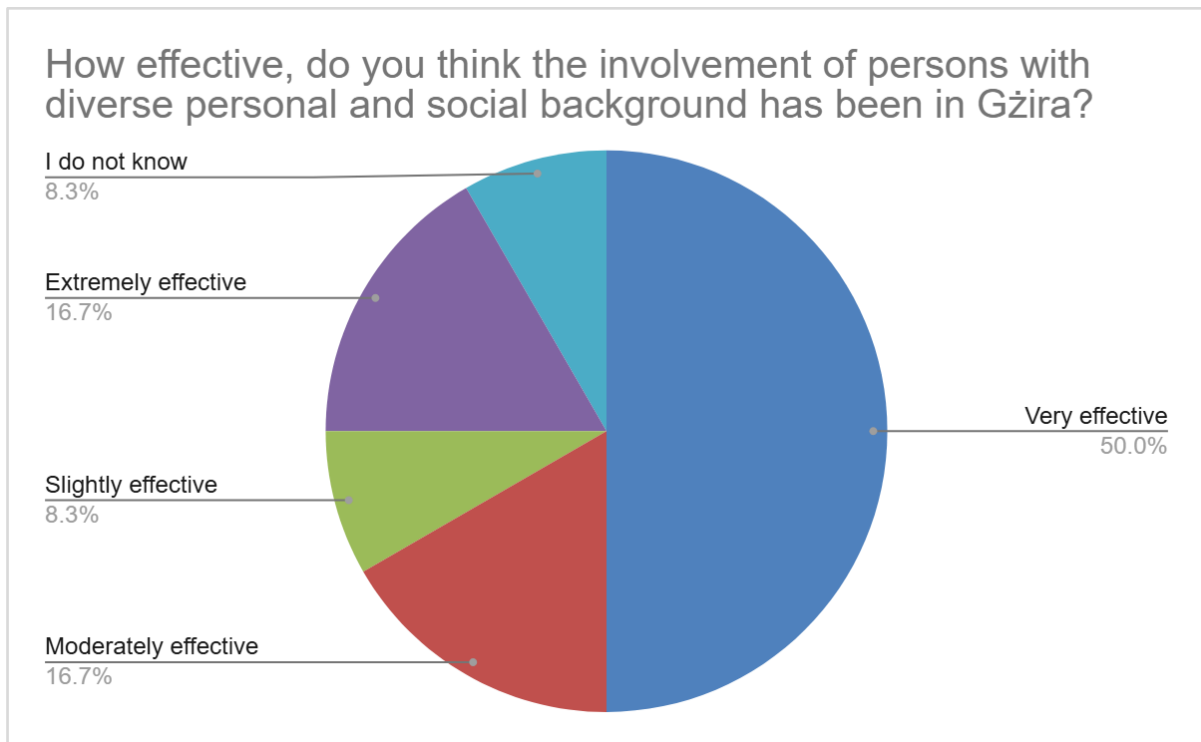


Figure 222: Co-evaluation result of social background participation in Gżira activities

At the final stakeholder event, participants were asked to evaluate how effective the involvement of persons with diverse personal and social background has been in Gżira. The majority of respondents considered the outcome to be very effective (50%).

KPI 8.9 Participation of immigrants

Expected Impact: Greater inclusion of immigrants (Direct Impact)

VS(s): 1,2,3

Evaluation Method: Co-evaluation

The pie chart below shows the exact numbers of people who participated in the pre-implementation survey and outlines how many of these participants have migrated to the island and are living within the pilot site. The percentage of immigrants taking part in the survey is 11.16%.

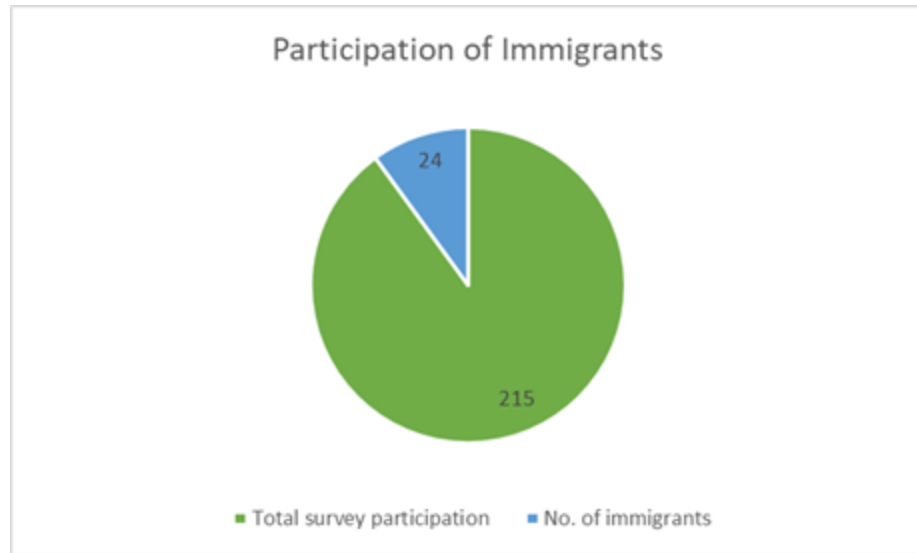


Figure 223: Participation of immigrants in Gżira activities

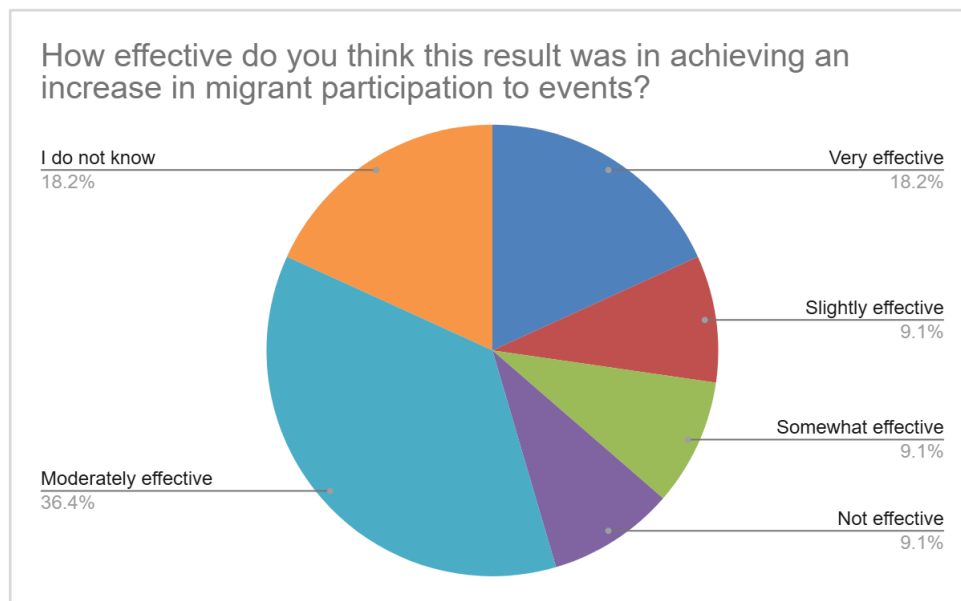


Figure 224: Co-evaluation result for participation of immigrants

At the final stakeholder event, participants were asked to evaluate the effectiveness of increased migrant participation in events in Gżira. The majority of respondents (36.4%) considered the outcome to be moderately effective.

Challenge 9

KPI 9.4 Noise reduction rates (or exposure to noise pollution)

Expected Impact: Increased data on noise pollution exposure (Added value)

VS(s): 2

Evaluation Method: Benchmarking

Lden (day-evening-night noise level), which assesses average noise exposure over a 24-hour period with penalties applied for evening and night-time noise, was calculated on two different dates: 15 December 2021 and 5 February 2025. The values are shown in the table below. For comparison, benchmark levels from the World Health Organization (WHO) and the EU Environmental Noise Directive (2002/49/EC) are also provided.

The recorded values indicate that Rue D'Argens is subject to severe noise exposure — significantly exceeding both WHO health-based guidelines and EU policy thresholds. This level of exposure poses a substantial risk of adverse health effects, including cardiovascular stress, sleep disturbance, and reduced quality of life.

Date: 15/12/2021		
Ld = 58.61 dB	Le = 76.01 dB	Ln = 68.59 dB
Lden = 76.6 dB		
Date: 05/02/2025		
Ld = 71.4 dB	Le = 69.9 dB	Ln = 68.4 dB
Lden = 75.5 dB		

Table 173: Lden values in Rue D'Argens, Gżira

Threshold	Health Implications
> 53 dB	Linked to ischemic heart disease

45–55 dB	Associated with annoyance and stress
< 50 dB	Recommended limit for road traffic noise (WHO)

Table 174: WHO (2018) Health-Based Guidelines

Threshold	Implications
55 dB	Critical threshold for harmful environmental noise
65 dB	High noise zone
< 55 dB	Acceptable exposure

Table 175: EU Benchmark Levels for Lden (Directive 2002/49/EC)

KPI 9.5 Number of hours spent outside

Expected Impact: Increased outdoor presence (Added value)

VS(s): 1

Evaluation Method: Pre & Post

The graph shows the number of people according to the number of hours spent outdoors before (Pre) and after (Post) an intervention. In general, the distributions are quite similar. There is a slight increase in the 0 hours group (from 7 to 9 people) and a decrease in the 'Don't know' category (from 13 to 9 people). In the intermediate ranges (1-5 hours, 5-10 hours, 10-15 hours, 15-20 hours), the differences are minimal, with a slight decrease in the 1-5- and 5-10-hour groups in the Post period. There is also a slight decrease in those who spend more than 20 hours outdoors (from 33 to 31 responses). Overall, the data indicate that outdoor time patterns have remained relatively stable after the intervention, with minor variations.

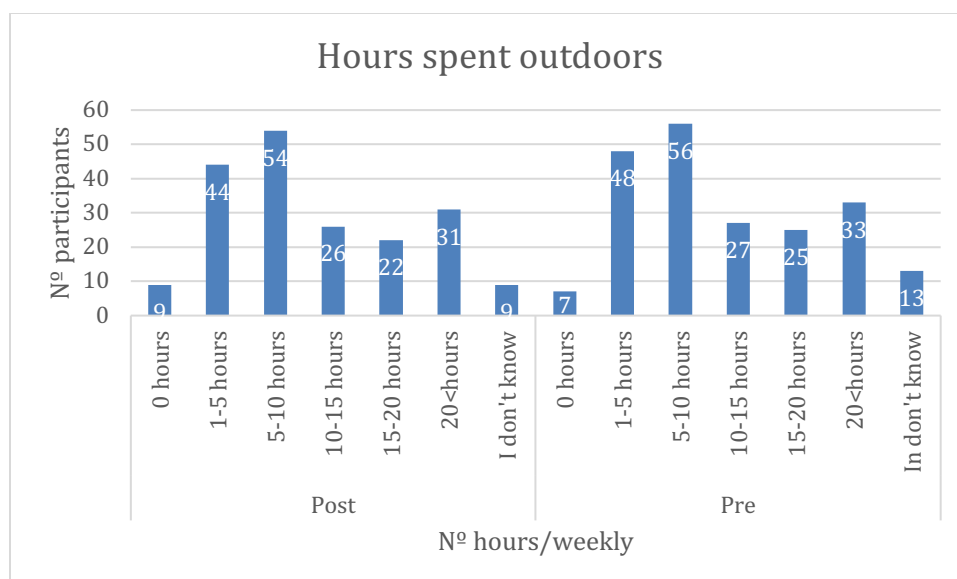


Figure 225: Hours Spent Outdoors in Gżira

KPI 9.8 Feeling of improved quality of life

Expected Impact: Improved quality of life (Direct Impact)

VS(s): 1

Evaluation Method: Pre & Post

The graphical and tabular representation shows the average scores obtained in three of the domains assessed through the WHO Quality of Life (WHOQOL-BREF) scale: Physical Health, Social Relationships and Environment. The WHOQOL-BREF was designed to assess individuals' perception of their quality of life, understood as their position in life in the context of their culture, values, expectations, standards and concerns. In this measure, data were recorded before (Pre) and after (Post) an intervention or assessment period.

In the Physical Health domain, a slight increase in the score is observed (from 3.608 to 3.652), indicating a slightly more positive perception of health after the period assessed. In Social Relationships, the score also shows a slight improvement (from 3.979 to 3.984), suggesting stability or a slight increase in satisfaction with personal relationships. In contrast, the Environment domain shows a decrease (from 3.277 to 3.157), which may reflect a slightly less positive perception of the immediate physical or social environment.

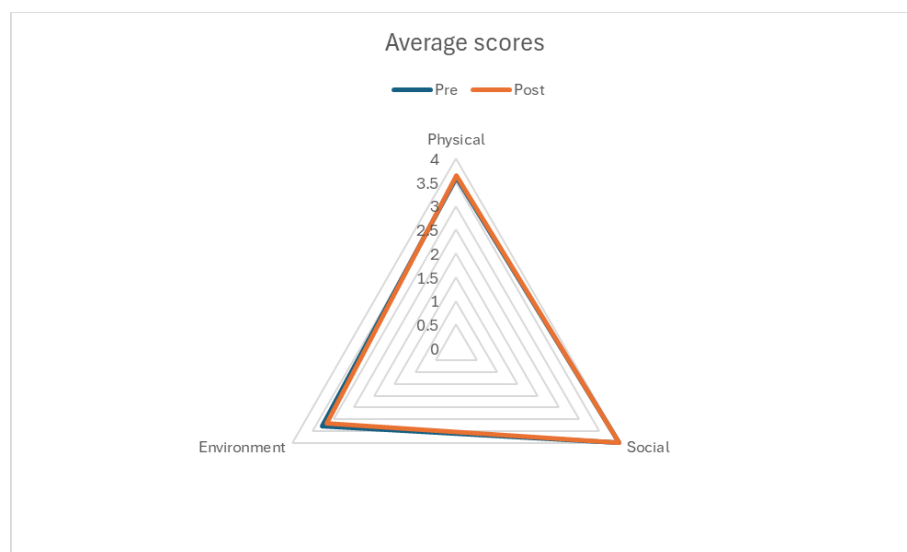


Figure 226: Quality of Life in Gzira

Symptom	% Never or rarely	% At Least Monthly or More Frequently
Allergies	46%	54%
Asthma	83%	17%
Back pain	26%	74%
Difficulties in getting to sleep	34%	66%
Feeling anxious	38%	62%
Feeling depressed	46%	54%
Headache	32%	68%
Irritability or nervousness	28%	72%
Mind fog or difficulty concentrating	41%	59%
Nausea	66%	34%
Sore throat	47%	53%
Stomach pain	49%	51%

Table 176: Symptoms of residents in Gzira

KPI 9.13 Increased residential attachment and residential satisfaction

Expected Impact: Increased residential attachment and satisfaction (Direct Impact)

VS(s): 1

Evaluation Method: Pre & Post

The graphical and tabular representation shows the average scores obtained on the five items that make up the Satisfaction with Life Scale (SWLS), assessed before (Pre) and after (Post) a period or intervention.

Unlike the traditional SWLS scoring procedure (which involves adding up the individual responses of each participant to obtain a total score), in this case the mean of all responses for each item has been calculated in aggregate, both pre and post.

The SWLS measures overall life satisfaction, allowing individuals to integrate different aspects of life (health, relationships, finances, etc.) into their overall assessment. Each item is answered on a 7-point Likert-type scale, where higher scores indicate greater satisfaction. The results show:

A slight but consistent increase in the perception that life is close to the ideal and in the assessment of living conditions. A higher overall satisfaction with life (from 5.0 to 5.2). Stability in the perception of having achieved important accomplishments in life. A slight decrease in the desire to change almost nothing if one could live life over again.

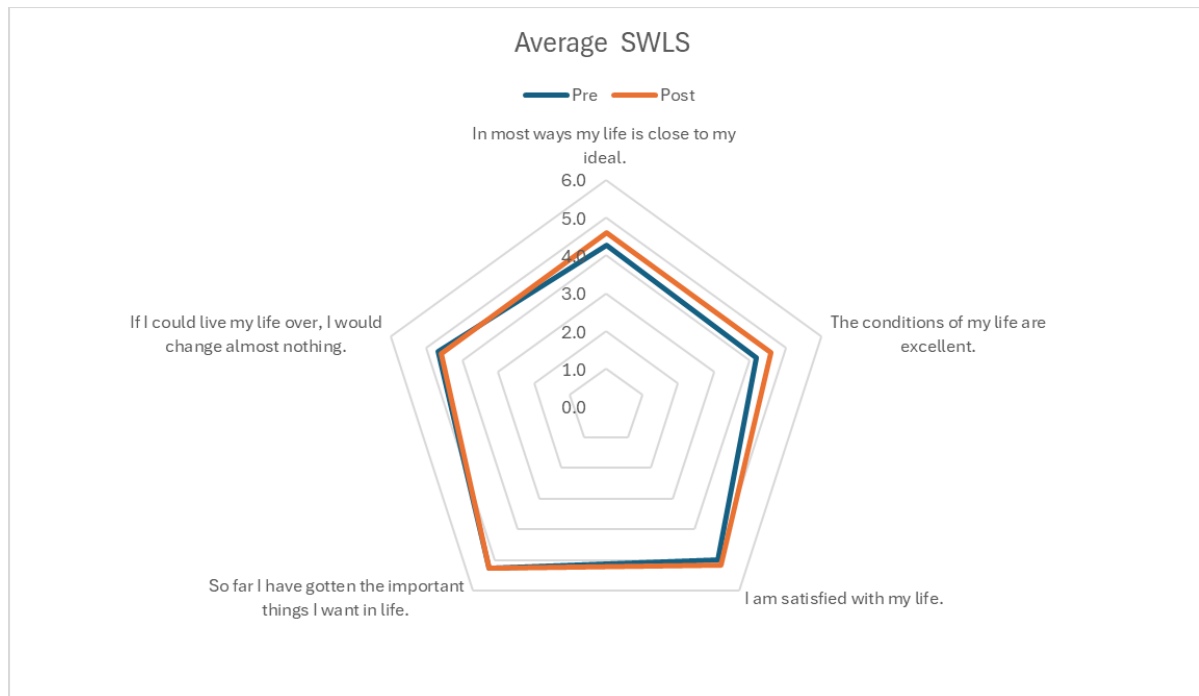


Figure 227: Average of Satisfaction with Life Scale in Gżira

In addition, open-ended responses were collected to the question 'What is affecting your daily environment, personal health and wellbeing in the city?'

Overbuilding and uncontrolled urbanisation

'Endless construction and dust, overbearing shops or offices hoarding parking spaces pretending to be garages.'

Pollution

'Pollution, rubbish in the street, noisy neighbours.'

Traffic and mobility problems

'Traffic congestion and rubbish put out on the wrong days. Airbnbs in summer with rude residents who don't respect the environment.'

Lack of green spaces and nature.

'No trees, no parks, no green spaces. Lots of cars, lots of noise and dirty streets.'

Noise and social and community problems

'Very frustrating, noisy, dirty and disrespectful foreigners.'

The bar chart illustrates a slight decline in the frequency of interactions with neighbours following the intervention. Prior to the intervention, most participants reported interacting daily (53) or weekly (70). However, these numbers decreased to 43 and 60 respectively after the intervention. In contrast, monthly interactions increased from 9 to 18, and both rare and no interactions showed a slight rise.

Similarly, another bar chart depicting social meetings with friends, relatives, or colleagues revealed only minor changes. Before the intervention, the majority of participants met weekly (96) or daily (50). These figures slightly declined to 91 and 45, respectively, after the intervention. While there was a small increase in monthly meetings, overall, social interaction patterns remained relatively consistent between the pre- and post-intervention periods.

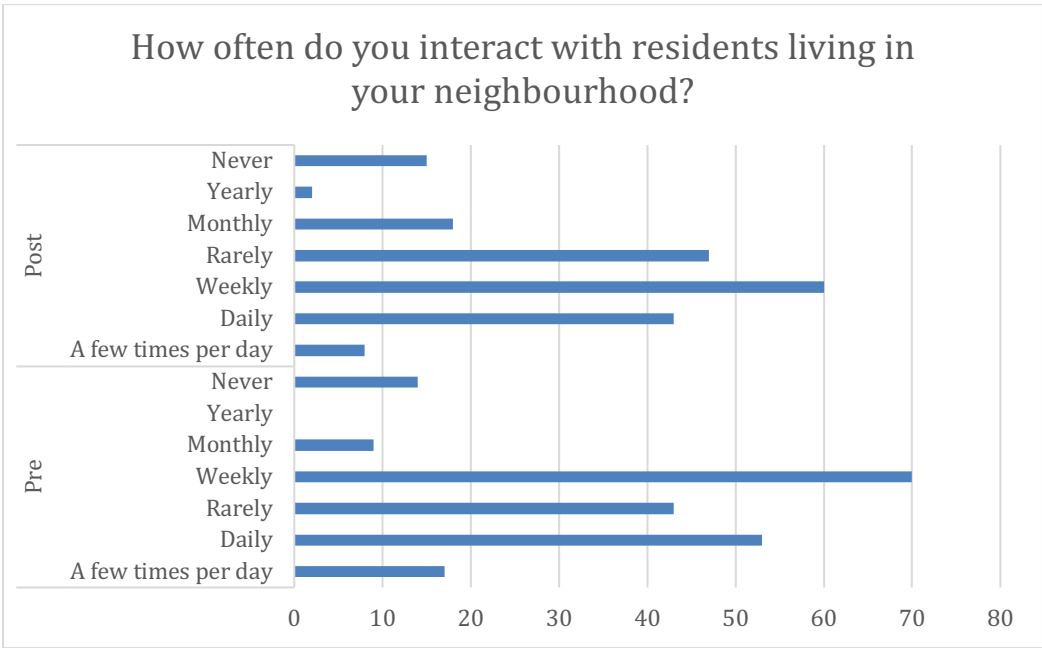


Figure 228: Social interaction in Gžira 1

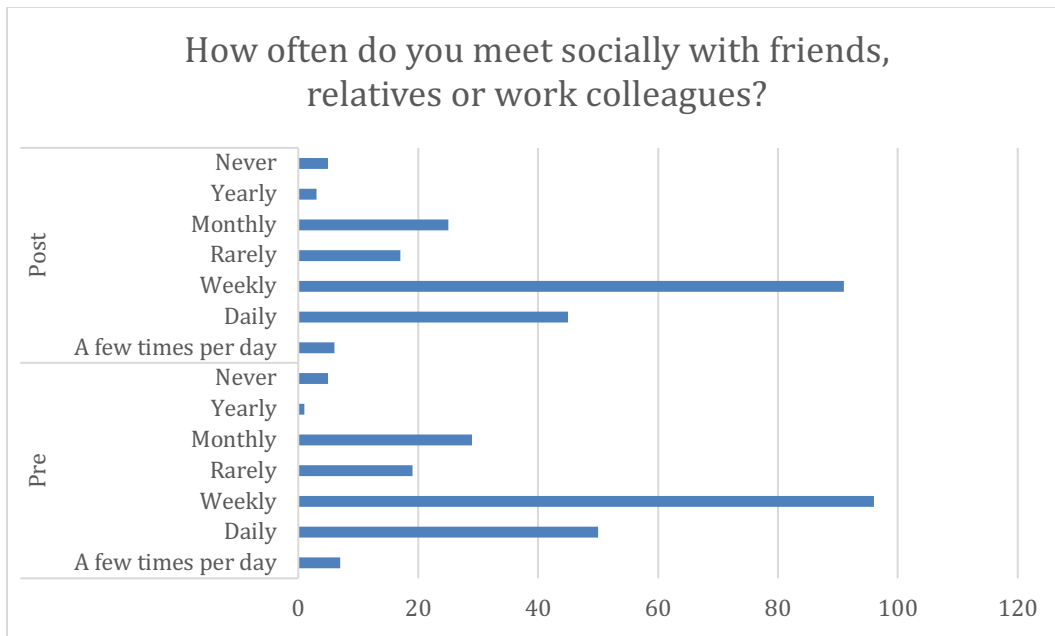


Figure 229: Social interaction in Gzira 2

The bar graphs present two sets of data to compare participants' responses in both phases Feeling of Perceived Help in the Neighbourhood:

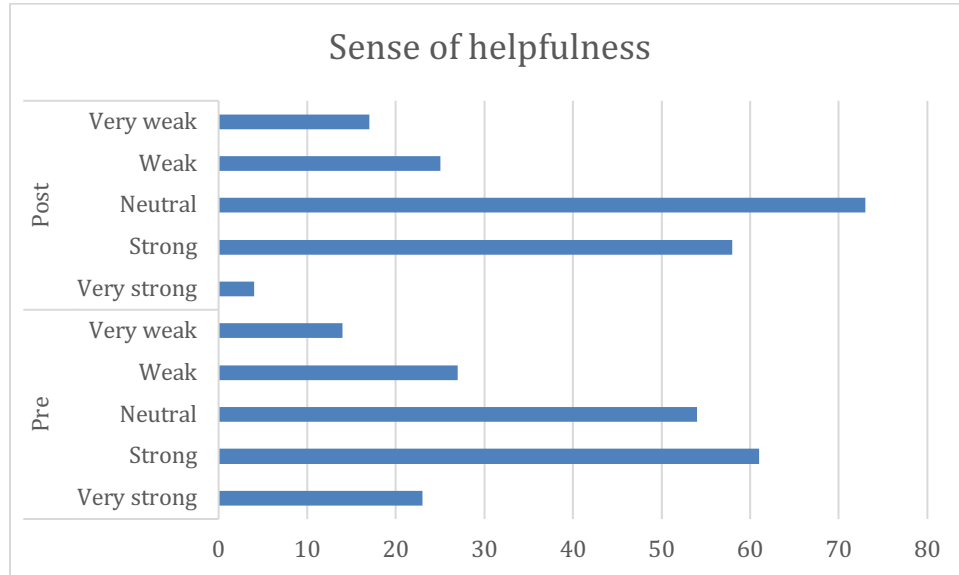


Figure 230: Sense of helpfulness in Gzira

A significant increase is observed in the Neutral category after the survey, while responses in the 'Very strong' and 'Very weak' categories have decreased. A slight

decrease can be noted in the number of participants who considered moving (Yes response) after the intervention.

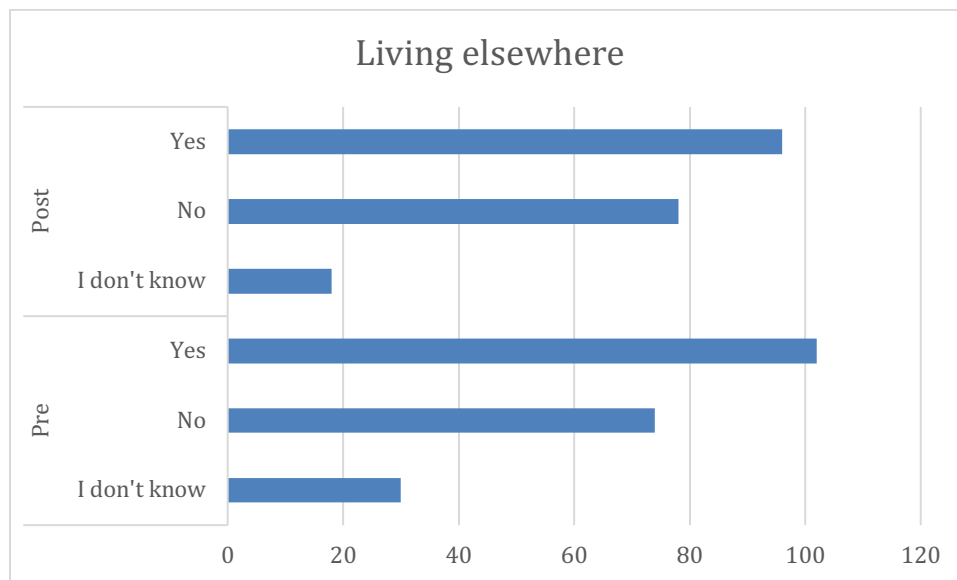


Figure 231: Residents considering living elsewhere in Gżira

Additionally, several participants elaborated on their responses through open-ended comments, which can be grouped into key themes. Many expressed satisfactions with their current place of residence, with statements such as “I love where I live!” and “Born and raised in Gżira —even if I have to leave, I will still visit.” Others raised concerns about noise and overcrowding, citing issues like excessive construction, traffic, and pollution. Some participants indicated a desire to move due to declining safety or quality of life, mentioning a lack of security in their neighbourhoods. Others hoped for better infrastructure or comfort, such as improved housing and access to green spaces. Environmental degradation and the loss of local identity were also noted, with comments like “Gżira has become a concrete jungle” and “Gżira has lost its Maltese identity.” Personal reasons, including proximity to family, work, or university, also played a role in their preferences. Financial difficulties, including high rent or mortgage constraints, were highlighted as barriers to moving. A few participants expressed a preference for quieter, more natural settings, while others specifically cited the overwhelming impact of construction as a reason for dissatisfaction. Finally, some residents made it clear that they did not wish to move, stating they had grown accustomed to their life in Gżira and wanted to avoid the stress of relocation.

KPI 9.19 Increase in walking and cycling around areas of interventions

Expected Impact: Increased outdoor physical activity (Direct Impact)

VS(s): 1

Evaluation Method: Pre & Post

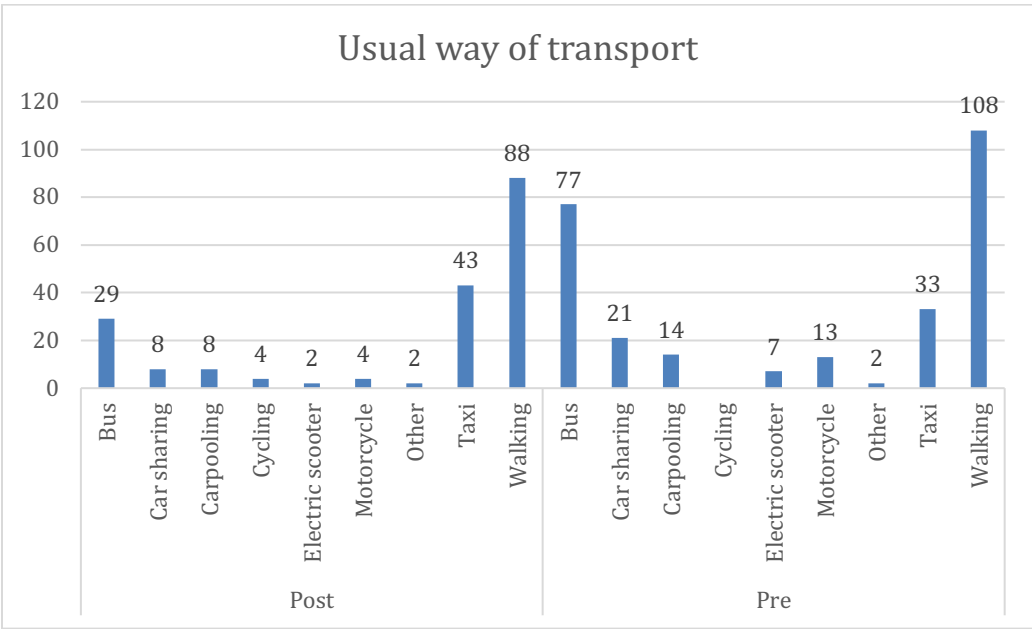


Figure 232: Modes of transport in Gżira

The bar chart shows the distribution of modes of transport used before ('Pre') and after ('Post') a given event or intervention. It shows that 'Walking' was the most common mode of transport both before and after, although it decreased slightly from 108 responses in Pre to 88 in Post. Similarly, Bus use dropped from 77 responses in Pre to 29 in Post, reflecting a significant decrease.

Other transport modes such as Taxi and Carpooling show relevant changes: Taxi use increased from 33 to 43 responses (+30%), while carpooling decreased slightly from 14 to 8 responses. Car sharing also experienced a moderate reduction from 21 to 8 responses. Electric scooter and Motorcycle use remained low in both periods, while 'Other' remained almost unchanged.

A high proportion of residents (127 of ()) indicated that they most frequently travel by car. The next most popular choice was walking, followed by bus. When asked which alternative transport they would be most likely to try, the most popular choice was an

electric vehicle, selected by 90 people. Followed by walking and then alternative or hybrid fuel vehicles. Further data will be collected once the interventions have been completed in Gżira.

Challenge 10

KPI 10.2a New businesses attracted and additional business rates

Expected Impact: Increased business opportunities (Added value)

VS(s): 1

Evaluation Method: Pre & Post

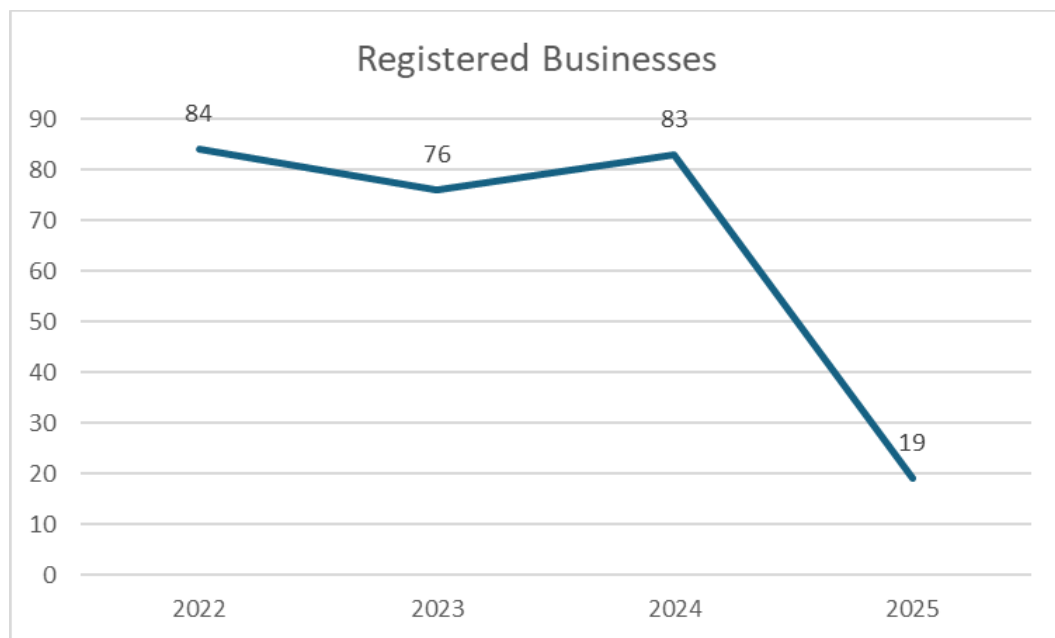


Figure 233: Gżira registered businesses

A business mapping exercise revealed that the number of registered businesses in Gżira remained relatively constant from 2022 to 2024. This period includes the years before and during the implementation in Rue D'Argens, St. Clare Primary School, and Stella Maris School. No increase in businesses has been observed since then. The graph above presents the results for 2025 up to March.

KPI 10.2b Increase in start-up funding attracted by businesses in the area

Expected Impact: Increased business opportunities

VS(s): 1

Evaluation Method: Pre & Post

The KPI was not measured due to unavailability of data specifically for start-up funding in Gżira and its inapplicability to the local context.

KPI 10.5 Definition of parameters for (re)designing of green public spaces based on the well-being of users

Expected Impact: Definition of parameters for (re)designing green public spaces (Direct Impact)

VS(s): 1,3

Evaluation Method: Co-evaluation

KPI 10.5 data is being collected through an internal review of lessons learned during the implementation phase, as well as health and wellbeing data gathered throughout the project. This data has been compiled, with the identified parameters detailed below. VS1 and VS3 are the main solutions incorporated into this KPI, due to their relevance to infrastructure and sociocultural factors.

The main parameters that were developed are included below;

- Low-cost materials and structures
- Modularity
- Multifunctionality
- Participatory planning
- Social Inclusiveness - Designated social spaces

The evaluation method is grounded in the WHO Healthy Cities framework, using five core categories: Environmental Quality, Health & Wellbeing, Social Determinants of Health, Built Environment, and Governance & Participation. These categories were selected to ensure a holistic and balanced assessment of urban interventions, covering both physical infrastructure (e.g. green space, mobility, zoning) and social systems (e.g. equity, inclusion, participation). Each intervention parameter is mapped using a binary alignment matrix, enabling structured visual comparison. To complement this, a qualitative weighted scoring system is applied to thematic groups of parameters (e.g. air quality, accessibility). The score out of 10 reflects performance across four criteria:

- Coverage (30%): how comprehensively the theme addresses its dimension; Alignment with
- WHO Healthy City principles (30%): how closely it reflects international standards and evidence;
- Implementation Potential (20%): how realistic and scalable the measures are in practice; and
- Transformative Impact (20%: the extent to which the measures drive long-term, systemic change. This combined approach enables consistent, transparent comparison across pilot cities while maintaining focus on health, equity, and sustainability outcomes.

Parameter	Environment al Quality	Health & Well- being	Social Determinan ts of Health	Built Environme nt	Governance & Participatio n
Low-cost materials and structures			✓	✓	
Modularity	✓			✓	
Multifunctionality	✓	✓	✓	✓	
Participatory planning			✓	✓	✓
Social Inclusiveness – Social spaces		✓	✓	✓	✓

Table 177: Gzira parameters

1. Circular Design & Material Efficiency

Aligned with WHO Healthy Cities, Circular Economy in Cities (OECD), and Milan Urban Regeneration Models

Low-cost Materials and Structures → Matches Milan's cost-effective, low-carbon material use in urban renewal areas.

Modularity → Supports scalable, adaptable infrastructure principles seen in OECD circular economy pilots.

Multifunctionality → Reflects integrated design strategies promoted by the New European Bauhaus initiative.

Alignment Score: 8/10

2. Participatory Governance & Social Cohesion

Aligned with WHO Healthy Cities, Ouagadougou Participatory Model, and UN-Habitat

Participatory Planning → Strongly reflects best practices from Ouagadougou and Nordic participatory design frameworks.

Social Inclusiveness – Designated Social Spaces → Reinforces principles from the Barcelona Superblocks and Placemaking Europe projects emphasizing inclusivity and shared spaces.

Alignment Score: 9/10

KPI 10.6 Replication of solutions

Expected Impact: High replication potential of Visionary Solutions (Direct Impact)

VS(s): 1

Evaluation Method: Co-evaluation

The graphs below present the number of responses regarding the replicability of various solutions.

- Micro-greening and pop-up parks

This solution is primarily considered to have high replicability (23 responses), followed by very high replicability (18 responses), indicating strong confidence in its scalability.

- Citizen Science on Air Quality to Increase Health & Well-Being Awareness

Similarly, this initiative is also seen as having high replicability (23 responses), with very high replicability following closely behind (18 responses), reflecting a consistent positive outlook.

- Educational Community Garden / Art Playground

This solution received 23 responses indicating high replicability, and 18 responses for very high replicability, underscoring its perceived potential for successful replication.

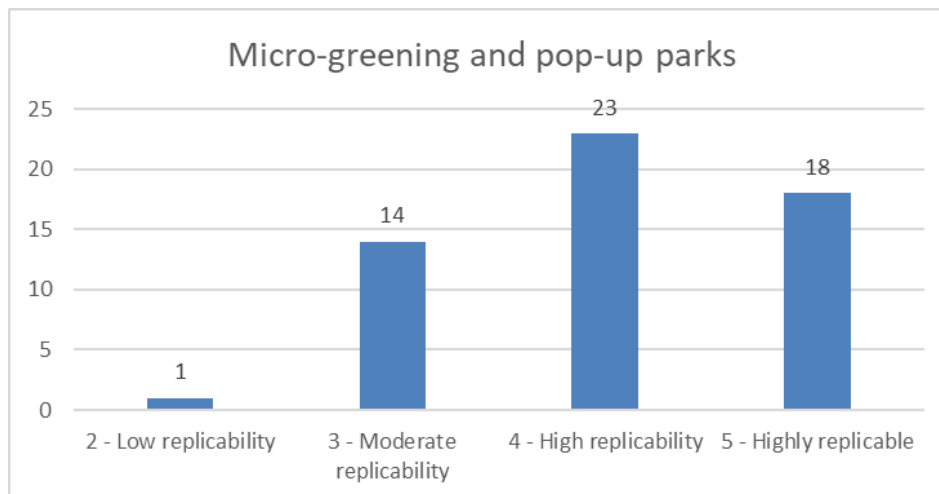


Figure 234: Gzira VS1 replication potential

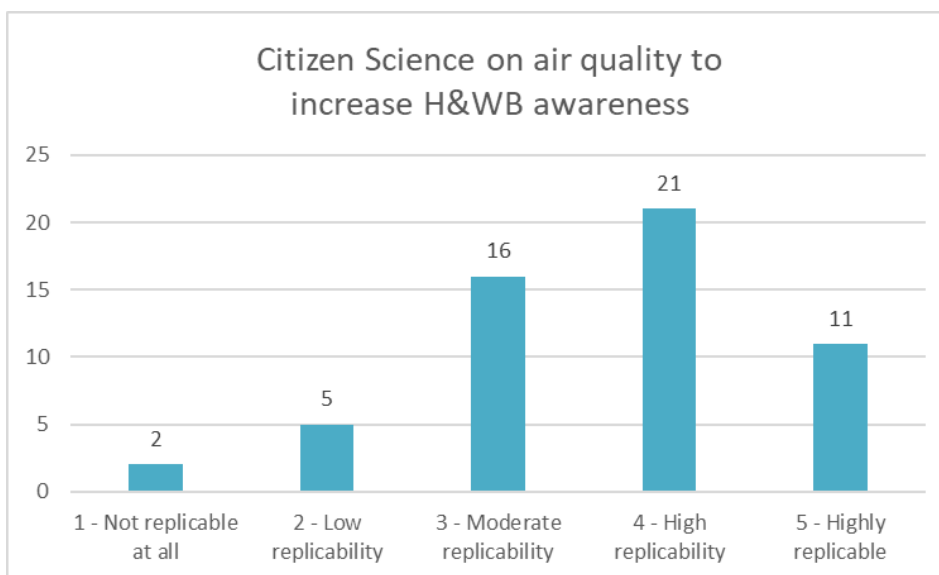


Figure 235: Gzira VS2 replication potential

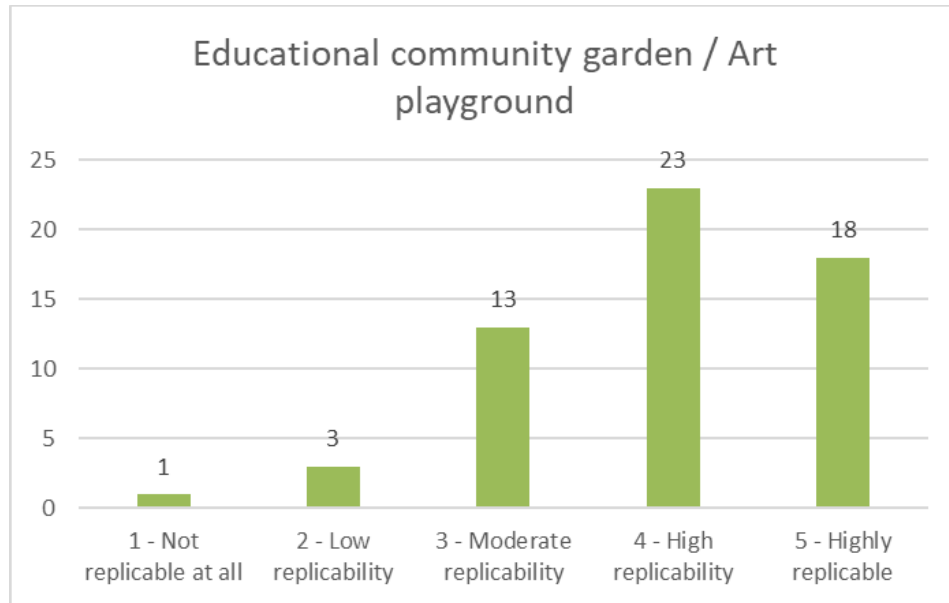


Figure 236: Gzira VS3 replication potential

KPI 10.8 Savings in healthcare spending

Expected Impact: Savings in healthcare spending (Direct Impact)

VS(s): 1

Evaluation Method: Pre & Post

The bar chart below shows the distribution of respondents' monthly health care expenditures, including insurance pre and post intervention. At both points in time, most people report an expenditure of 0, increasing slightly from 35 responses in 'Pre' to 36 in 'Post'. It is also observed that in 'Post' there is a higher concentration of responses in low expenditure ranges, particularly in the 0 to 50 range. Meanwhile, in 'Pre' there were significantly more people with higher expenditures, such as in the 150 range, where there were 17 responses before and only 5 after, showing a drop of 70.6%.

In addition, the number of people reporting spending 150 or more decreased in the 'Post' (from 39 responses in 'Pre' to 26 in 'Post'), representing a reduction of approximately 33%.

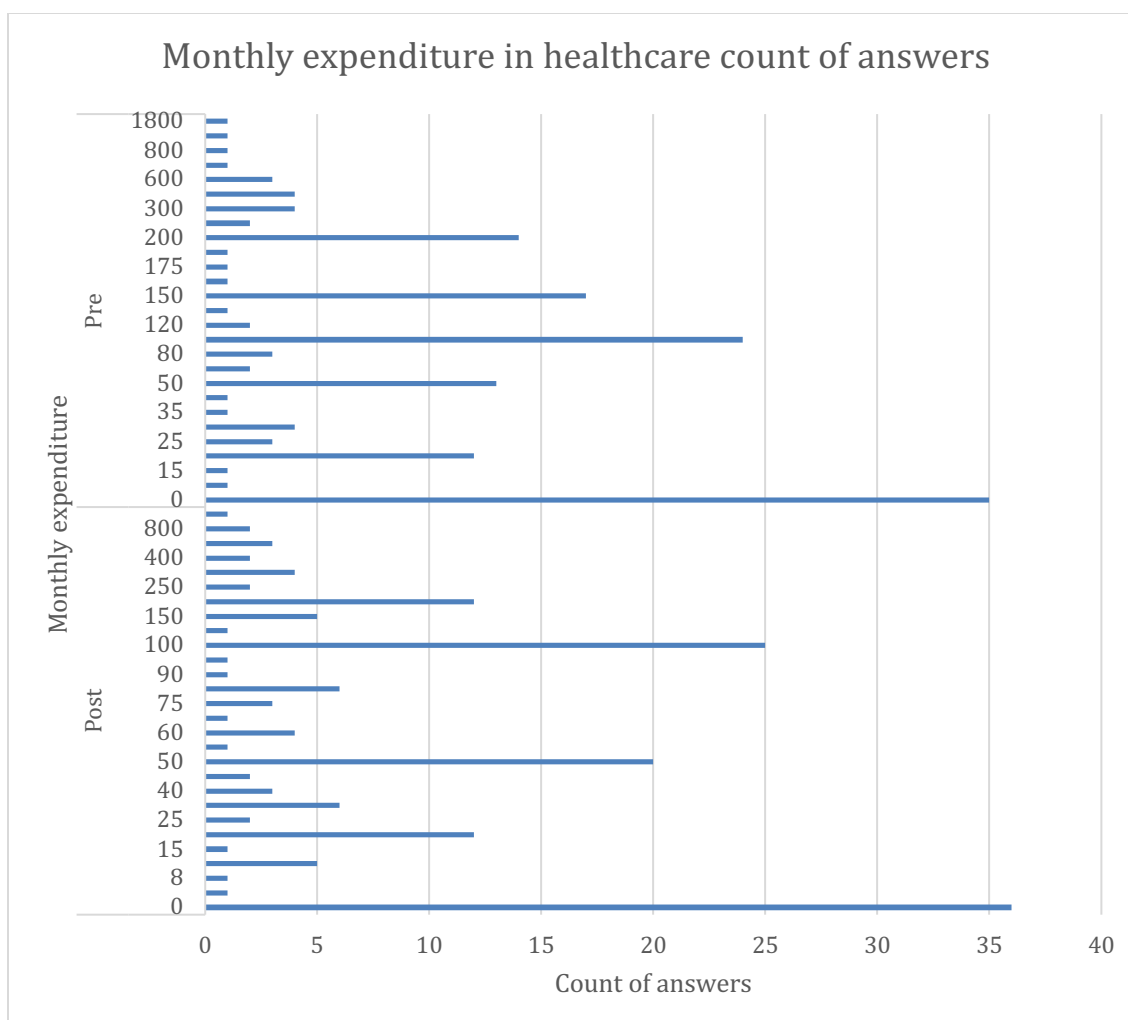


Figure 237: Healthcare Expenditure in Gżira

The annual healthcare expenditure of 220 residents in Gżira is shown above. This figure is based on a self-reported in a survey,

KPI 10.9 Public & private investments during/after the project (Direct Impact)

Expected Impact: Increased public & private investment

VS(s): 1

Evaluation Method: Pre & Post

Gżira received a total investment of €762,852.00, with €457,427.00 in EU funding covering infrastructure (€55,866.00), environmental monitoring (€14,333.00), human resources (€362,228.00), and community engagement (€25,000.00). In-kind contributions totalled

€47,425.00, with additional funding from the Arts Council (€8,000.00) and Project Green Funds (€250,000.00). Future funding opportunities for Gżira are diverse, focusing on enhancing green infrastructure, sustainable mobility, and community engagement. Local Sustainability Grants aim to support the expansion of green spaces, with the potential to add more public benches and shaded areas. European Green Deal Funding offers financial support for enhanced health monitoring technologies, creating opportunities for scaling pilot projects through the integration of advanced tech solutions. Project Green Funding provides assistance for community greening initiatives, helping to create more environmentally friendly spaces within the community.

Vjal Kulħadd, an Infrastructure Malta initiative, supports sustainable mobility projects by helping local councils develop proposals for transforming road designs into safer, more accessible, and eco-friendly spaces. Similarly, European Mobility Week encourages the introduction of sustainable transport measures and the development of new infrastructure to support alternative modes of transportation. The Urban Greening Scheme (2022) focuses on increasing environmental awareness and improving green infrastructure in urban areas through collaboration with local councils. For cultural development, the Regional Cultural Cooperation Programme (ACM) invests in initiatives that promote cultural participation across Malta and Gozo, while the Artistic Research & Development Scheme fosters co-creation, experimentation, and collaboration within communities.

Additionally, the European Regional Development Fund (ERDF) supports the creation of pop-up parks, enabling flexible green spaces to travel between localities. The Giving Back through Community Engagement Grant - APS CSR focuses on arts, lifelong learning, and sustainability projects. Regional Cultural Strategies (ACM) further promote cultural participation through events like pop-up parks. Finally, Horizon Europe and EIT Urban Mobility provide funding for green infrastructure, community engagement events, cultural activities, and innovative urban mobility solutions, ensuring the continued growth and sustainability of Gżira's pilot projects.

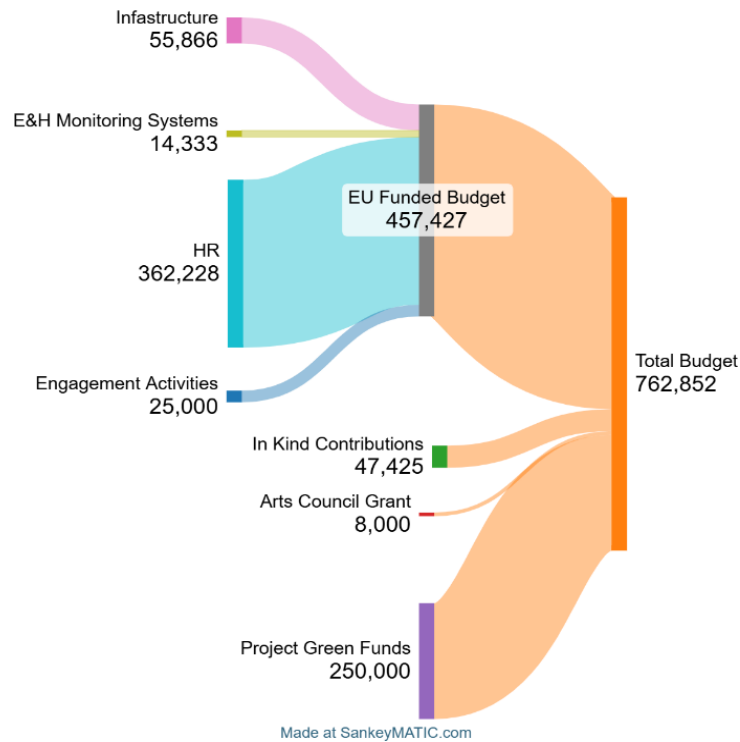


Figure 238: Current public & private investment in Gzira

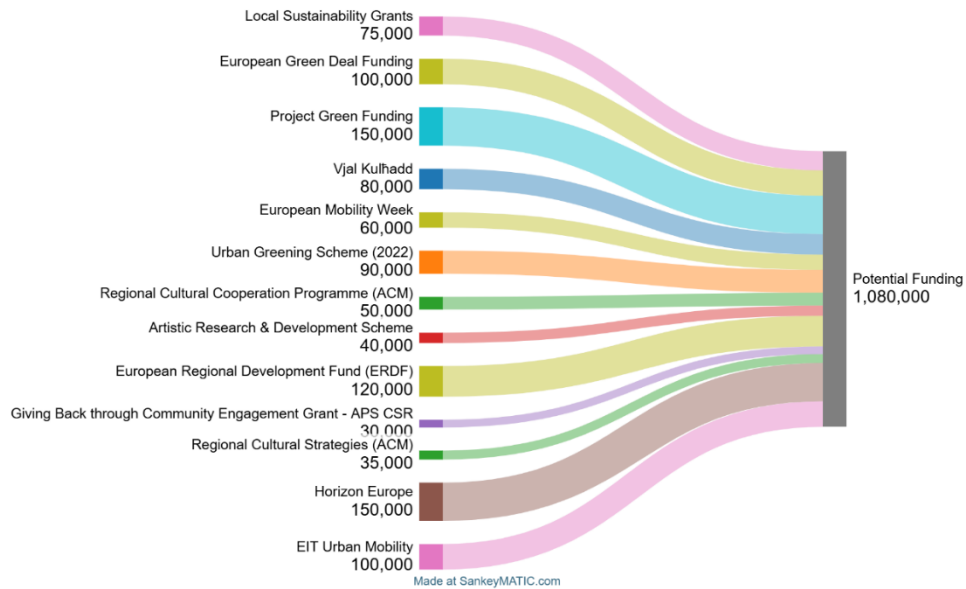


Figure 239: Future public & private investment in Gzira

A2.5 Leuven

Challenge 1

KPI 1.2 Decrease in mean or peak daytime local temperatures

Expected Impact: Increased temperature data (Added value)

VS(s): 2

Evaluation Method: Benchmarking

The graphs illustrate the monthly distribution of maximum and mean air temperatures (°C) recorded by two sensors—142 (blue) and 067 (orange)—from November 2023 to March 2025. Sensor 142 was located in a green area, while sensor 067 was placed in a courtyard surrounded by hard surfaces (refer to methodology section). The comparison highlights the temperature differences between green and hard-surfaced environments.

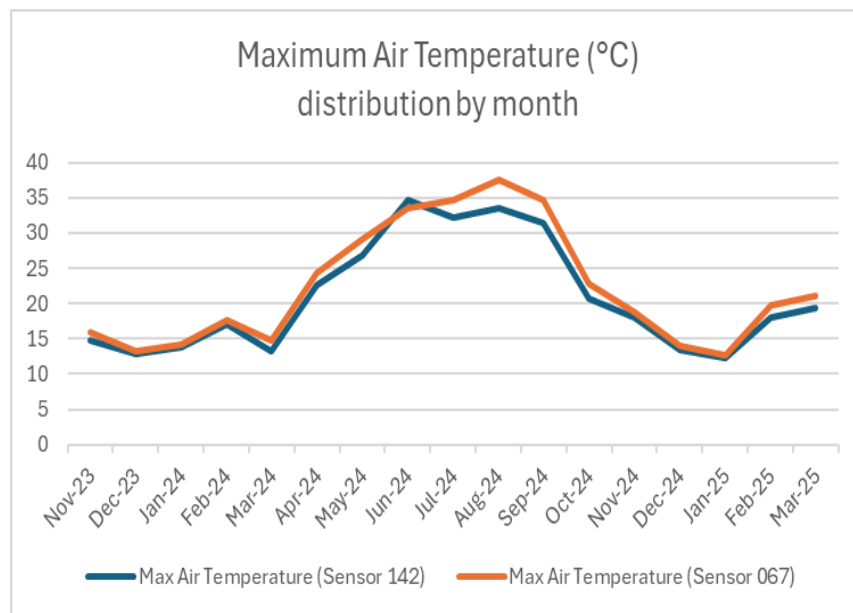


Figure 240: Maximum air temperature in Leuven

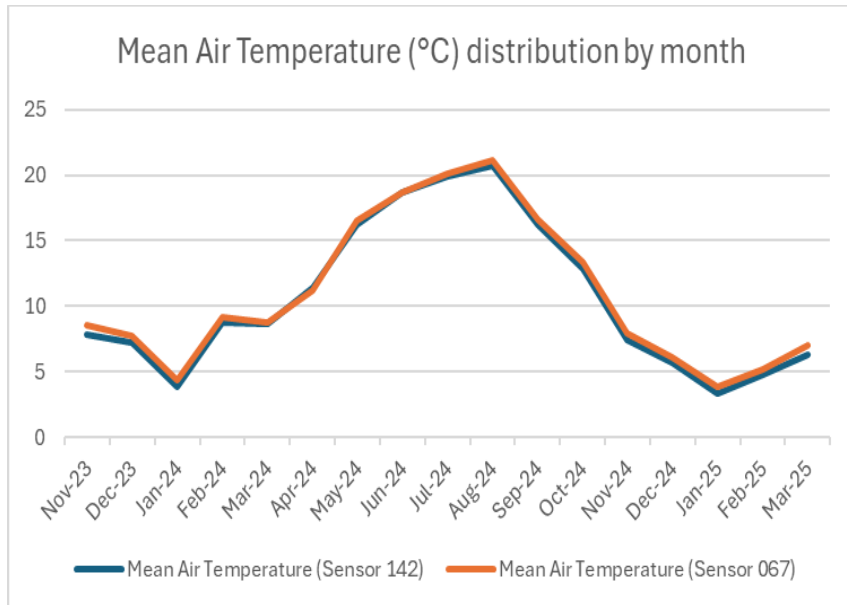


Figure 241: Mean air temperature in Leuven

KPI 1.3 Measures of human comfort

Expected Impact: Increased temperature data on human comfort (Added value)

VS(s): 2

Evaluation Method: Benchmarking

The methodology used for the human thermal comfort in Leuven was Universal Thermal Climate Index (UTCI). This method measures the outdoor environment and human well-being. The graphs below depict the temperature measurements over time, particularly in June, July and August 2023.

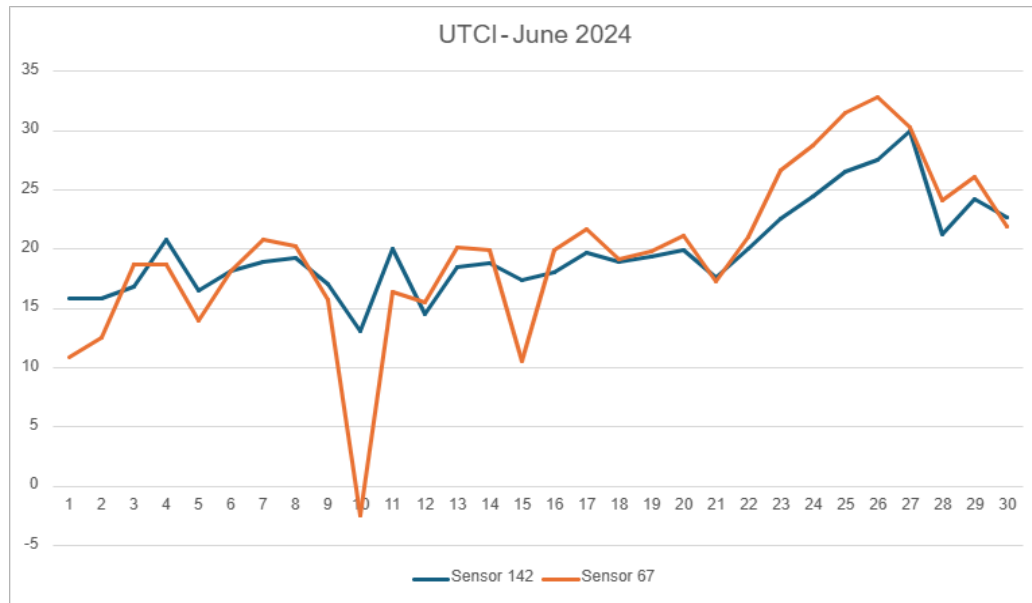


Figure 242: UTCI in Leuven (June 2024)

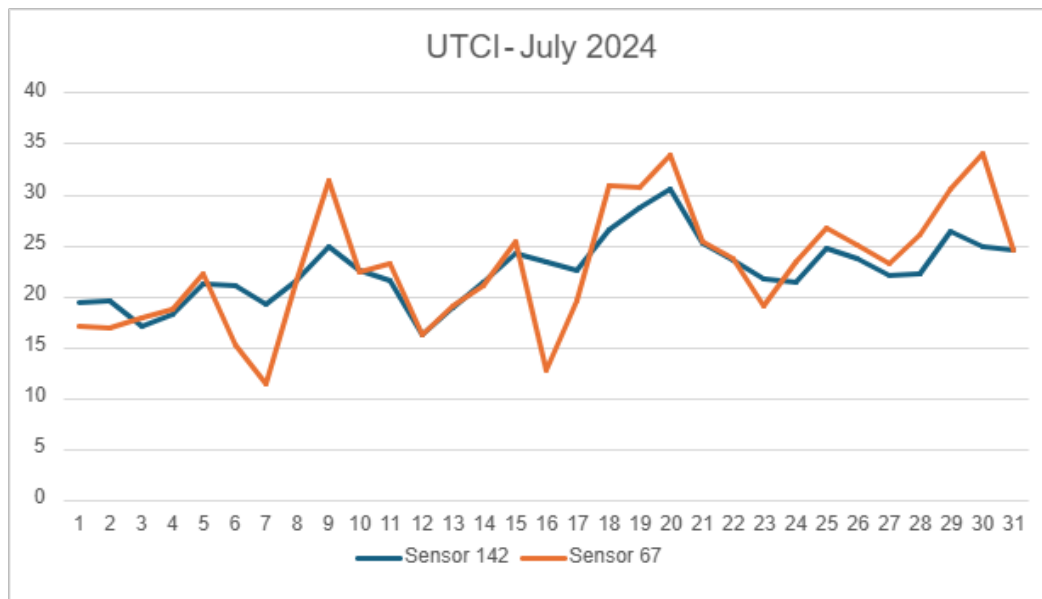


Figure 243: UTCI in Leuven (July 2024)

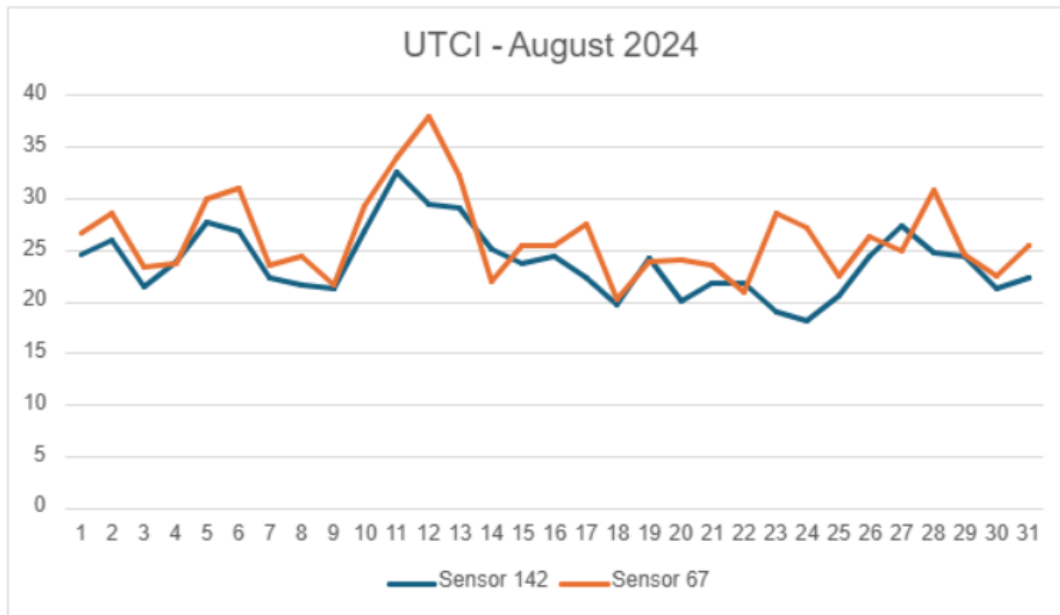


Figure 244: UTCI in Leuven (August 2024)

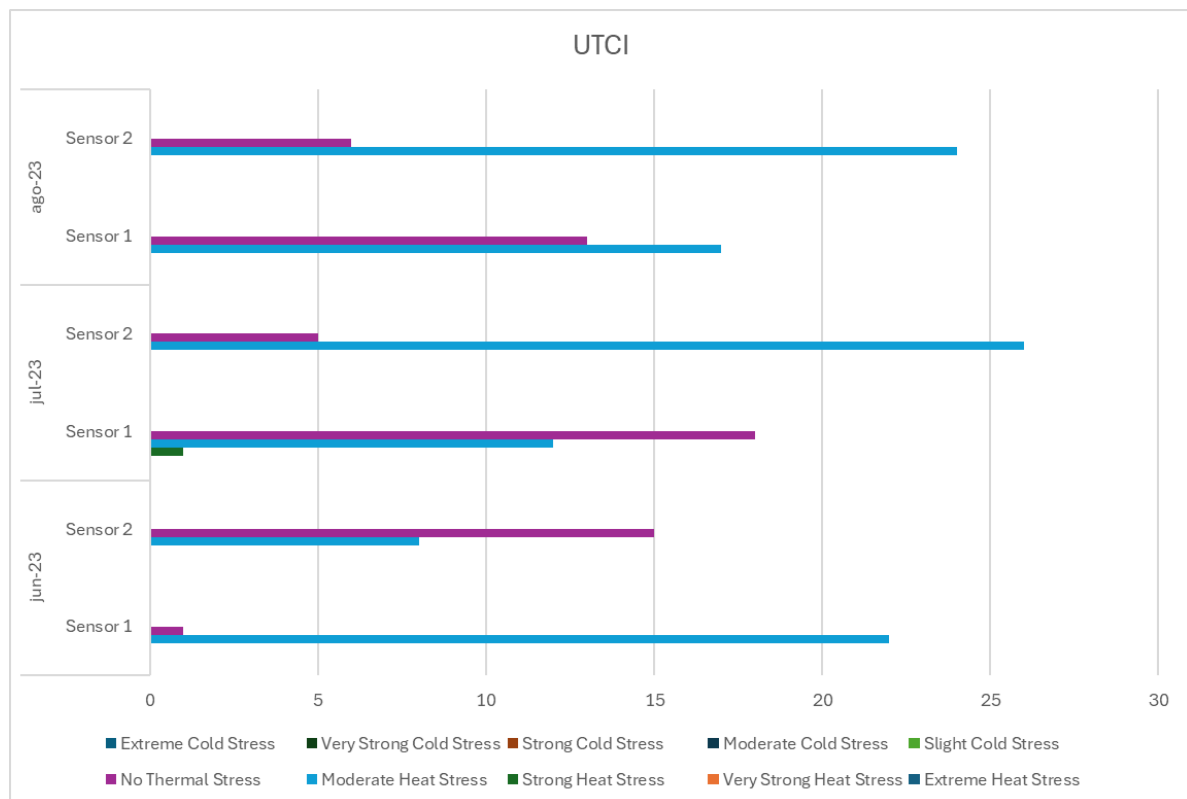


Figure 245: UTCI Thermal Comfort in Leuven

KPI 1.8 Number of temperature and humidity data

Expected Impact: Number of temperature and humidity data added (Direct Impact)

VS(s): 2,5

Evaluation Method: Pre & Post

This indicator measures the amount of data collected on temperature and humidity in the framework of the project. The data are obtained through environmental sensors with different sampling frequencies to ensure an accurate analysis of climatic conditions.

The sampling frequency varies according to the type of data, with records every 15 minutes for solar radiation, humidity, temperature and UV index, while atmospheric pressure is measured every 30 minutes.

To date, values collected on the number of samples taken include:

Type of Data	Sample	Sample Rate
Solar Radiation	50,500	15 mins
Air Pressure	50,500	15 mins
Humidity	50,500	15 mins
Air Temperature (Celsius)	50,500	15 mins
UV Index	50,500	15 mins

Table 178: No. of temperature and humidity data in Leuven

Challenge 2

KPI 2.3 Water quality physical parameters: temperature, odour, taste, turbidity, transparency, colour

Expected Impact: Increased data on water quality physical parameters (Added value)

VS(s): 2

Evaluation Method: Pre & Post

Below are some plots showing the water quality parameters over time from 15 water quality samples taken once every month between October 2023 and December 2024.

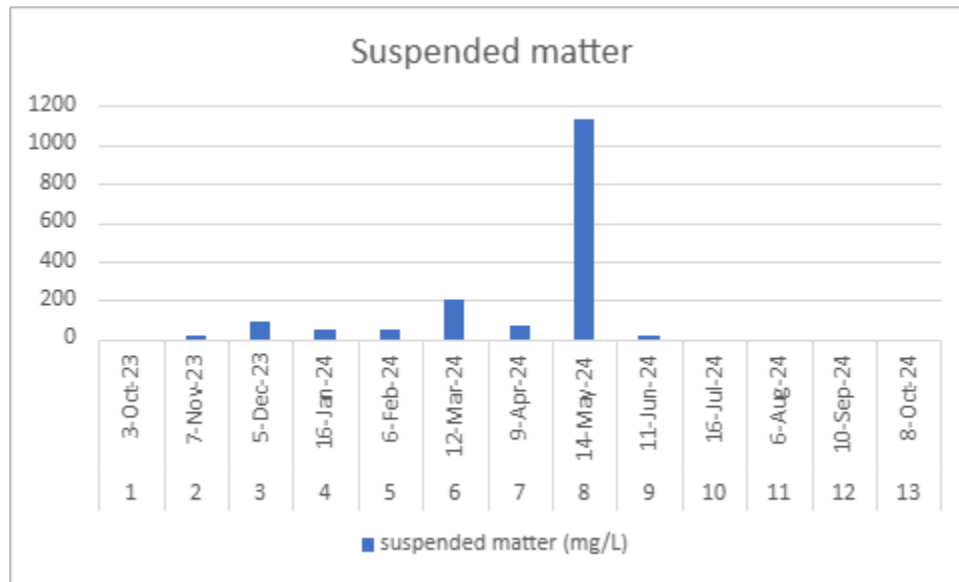


Figure 246: Suspended matter in Leuven

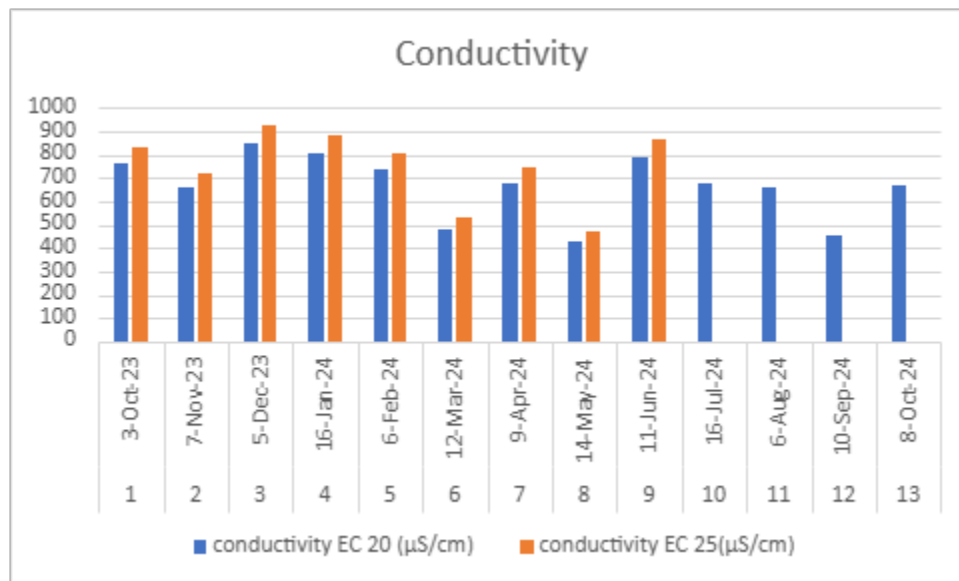


Figure 247: Conductivity measurements in Leuven

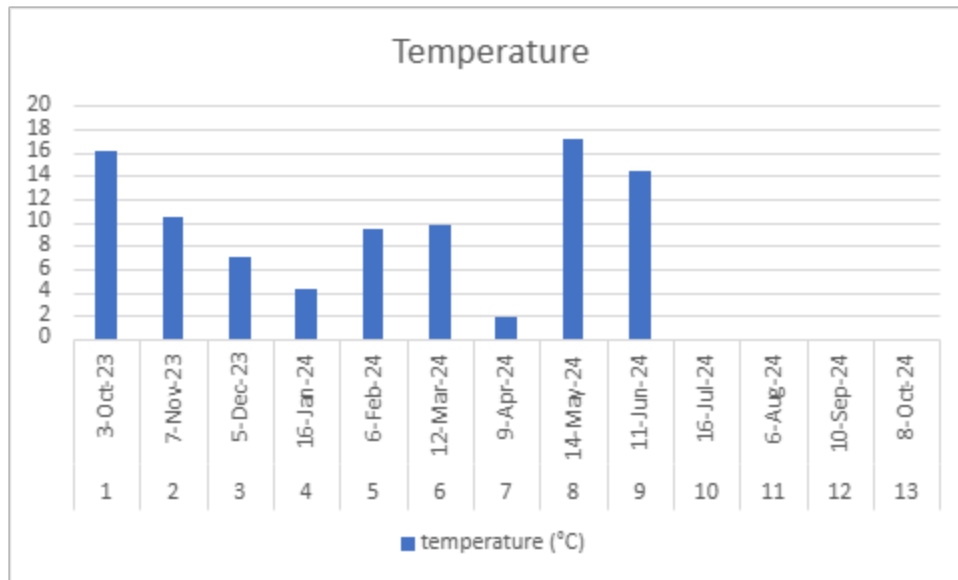


Figure 248: Temperature data in Leuven

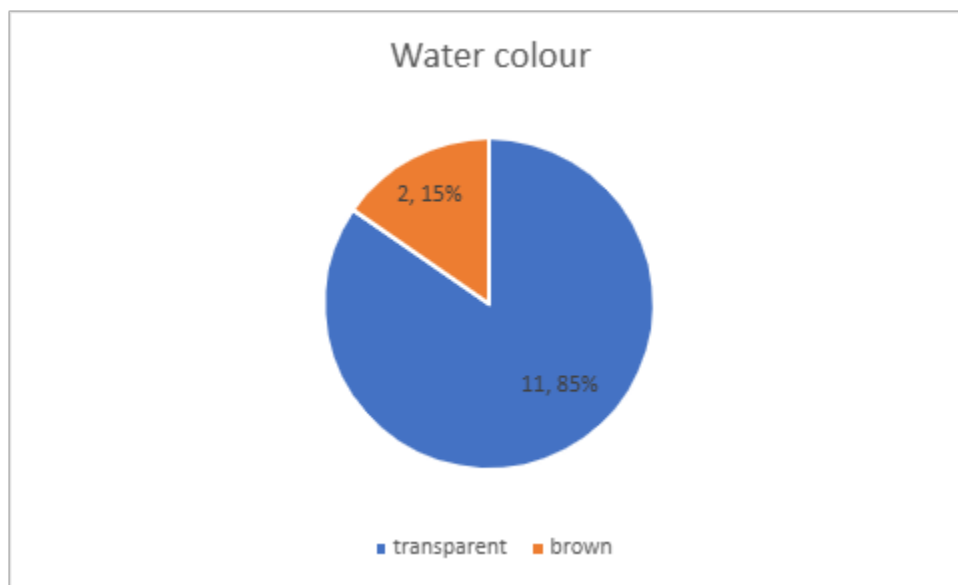


Figure 249: Water colour analysis in Leuven

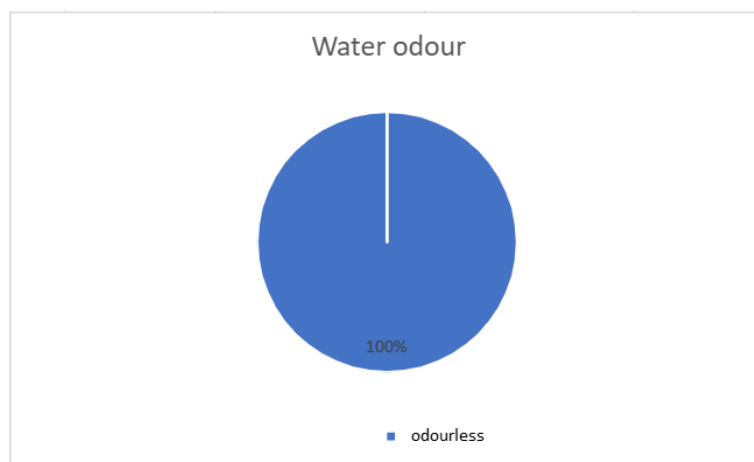


Figure 250: Water Odour in Leuven waters

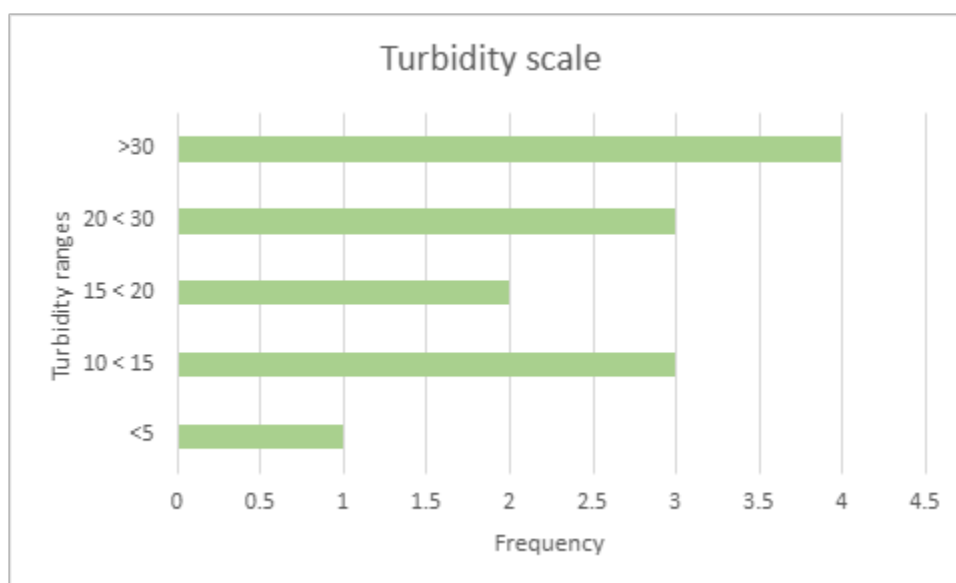


Figure 251: Turbidity scale in Leuven

KPI 2.6 Improved surface water quality (chemical parameters)

Expected Impact: Increased data on water chemical parameters (Added value)

VS(s): 2

Evaluation Method: Benchmarking

Below are some plots showing the water quality parameters over time from 15 water quality samples taken once every month between October 2023 and December 2024.

Water Quality Parameters Over Time (Oct 2023 - Dec 2024)

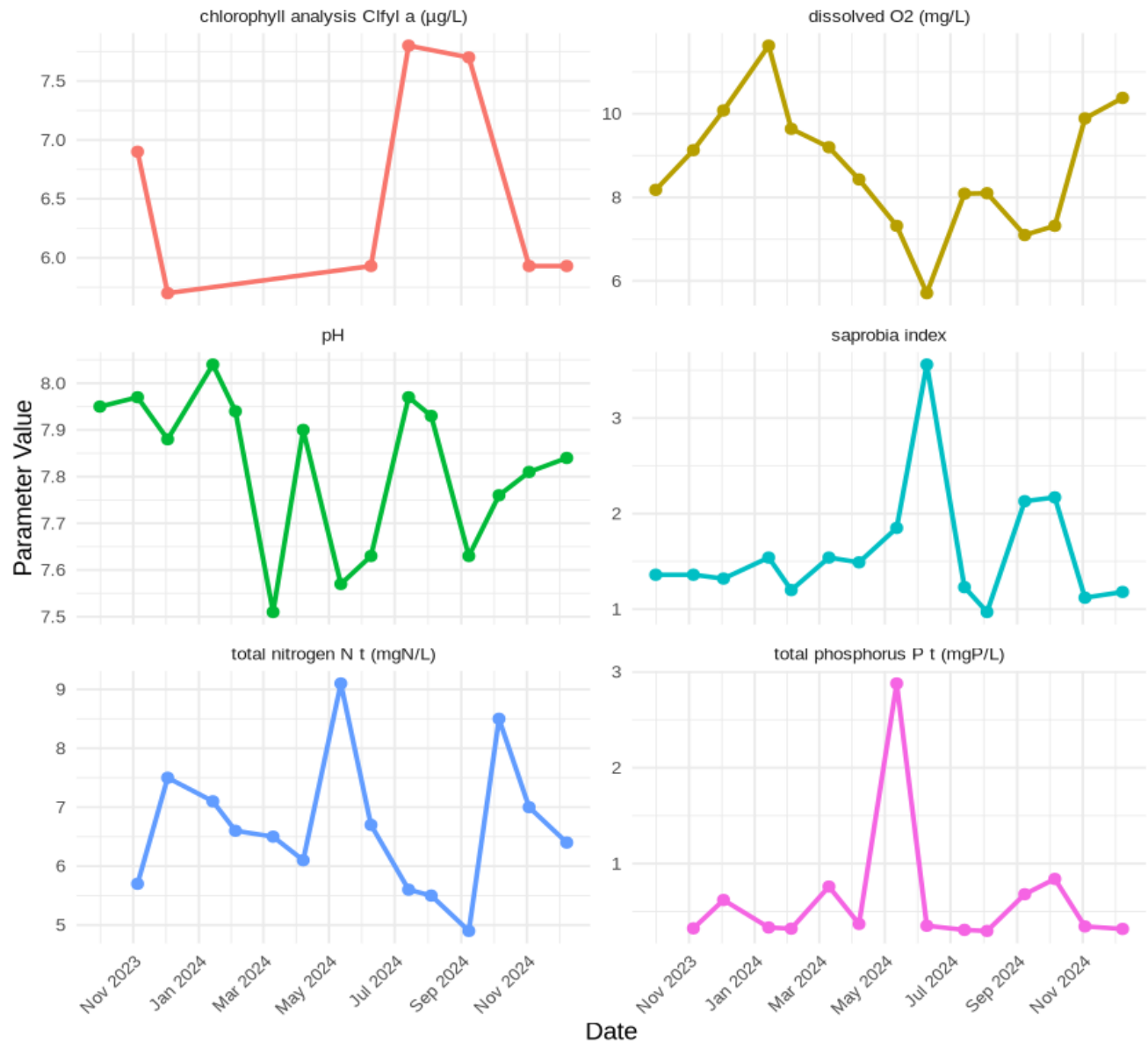


Figure 252: Surface water quality parameters in Leuven

- pH levels remain relatively stable around neutral values (7-8) throughout the monitoring period, indicating consistent water chemistry.

- Dissolved oxygen shows seasonal variation, with higher concentrations during cooler months and some decline during warmer periods, which is typical for aquatic systems.
- Total nitrogen displays fluctuating levels with several peaks, particularly in early 2024, suggesting periodic nutrient inputs possibly from agricultural or urban runoff.
- Total phosphorus shows elevated concentrations at certain points, with notable spikes that could indicate eutrophication risks during those periods.
- Chlorophyll-a levels vary significantly, with higher concentrations corresponding to algal blooms, particularly during warmer months when nutrient availability supports phytoplankton growth.
- Saprobia index fluctuates between moderate pollution levels, indicating varying degrees of organic contamination throughout the monitoring period.

Challenge 4

KPI 4.2 Accessibility of urban green spaces for population

Expected Impact: Increased accessibility of urban green spaces (Added value)

VS(s): 1-3

Evaluation Method: Benchmarking

Benchmarks used:

- Walking distance - 300m
- Walking time - 5 minutes

The ease of access to urban green spaces from public transport stops is evaluated. Greater accessibility from public transport stops facilitates access to these spaces even when distances are greater, generating environmental, social and welfare benefits.

To measure accessibility, two parameters were used, walking distance (meters) and walking time (minutes), with the benchmarks at 300m and 5 min respectively. The

measurements suggest a moderate overall accessibility, with opportunities for improvement, only Leuven Sint-Rafaëlkliniek (146m, 1 min) and Leuven Dirk Boutslaan North Entrance 2 (290m, 3 min) meet the benchmarks.

Although several stops exceed the threshold, there is not a significant difference in Leuven Bankstraat (382m, +82m above benchmark) and Leuven Dirk Boutslaan - East Entrance (434m, +134m above benchmark) , being within an acceptable range. However, in cases such as Leuven Sint-Michielskerk (536m, +236m above benchmark), the distance could represent a barrier for certain users.

Bus Station	Park Entrance	Walking Distance (m)	Walking time (min)	Classification
Leuven De Bruul	Entrance North 1	353	6	Moderate
Leuven Dirk Boutslaan	Entrance North 2	290	3	Low
Leuven Sint-Rafaëlkliniek	Entrance West	146	1	Low
Leuven Sint-Michielskerk	Entrance South 1	536	6	Moderate
Leuven Bankstraat	Entrance South 2	382	5	Moderate
Leuven Dirk Boutslaan	Entrance East	434	5	Moderate

Table 179: Accessibility of urban green spaces for population

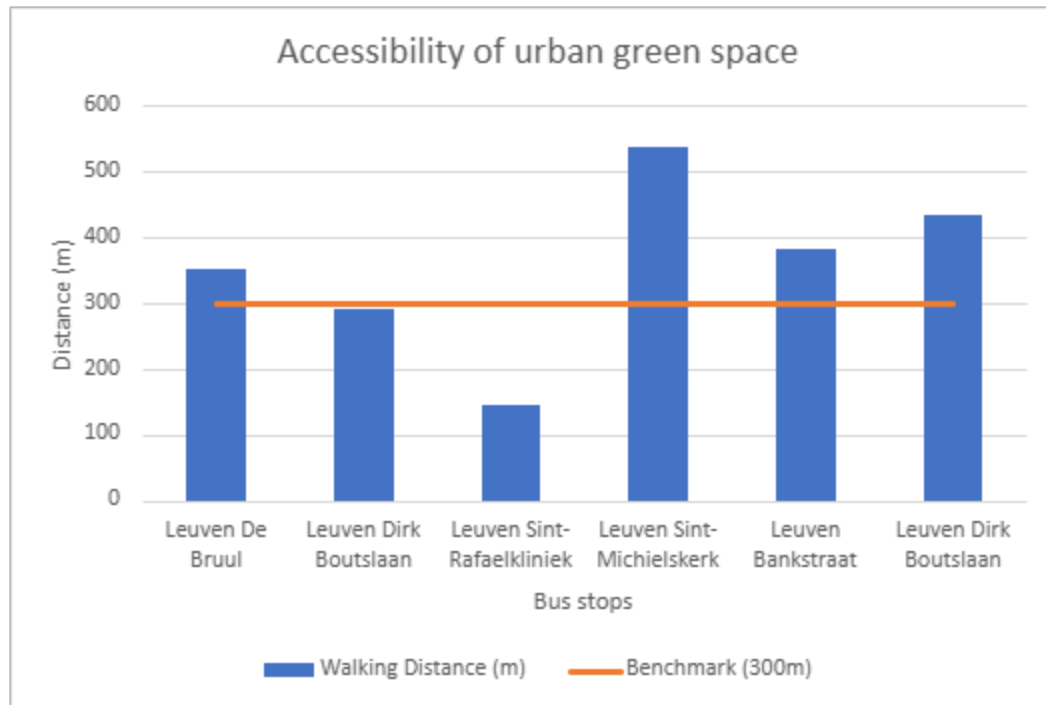


Figure 253: Accessibility of urban green spaces for population in Leuven (distance)

KPI 4.3a Recreational or cultural value of green spaces (number of visitors)

Expected Impact: Increased recreational and cultural value of green spaces (Direct Impact)

VS(s): 1-3,5

Evaluation Method: Pre & Post

The bar chart below displays the number of visitors attending events at the Olevodroom between March and October 2024. In May alone, the pilot recorded over 12,000 visitors. According to the pilot's records, a total of 24,846 people attended events during the Olevodroom's first operating season.

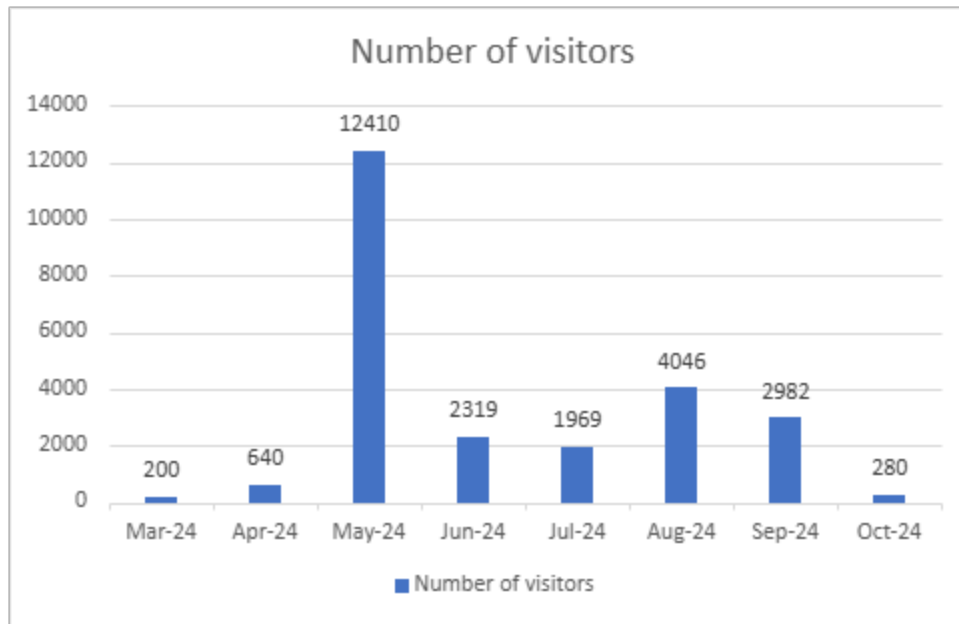


Figure 254: No. of visitors in green space in Leuven

KPI 4.3b Recreational or cultural value of green spaces (activities in green spaces)

Expected Impact: Increased recreational and cultural value of green spaces (Direct Impact)

VS(s): 1-3, 5

Evaluation Method: Pre & Post

The bar chart below displays the number of recreational activities and cultural events held at the Olevodroom between March and October 2024. August was the busiest month, with a total of 30 activities organised. A total of 89 activities were organised targeting all age groups. These consisted of a variety of activities such as music events, circus performances, open dance lessons, after school activities for children, theatre, sports, community gatherings and even city camping on the site.

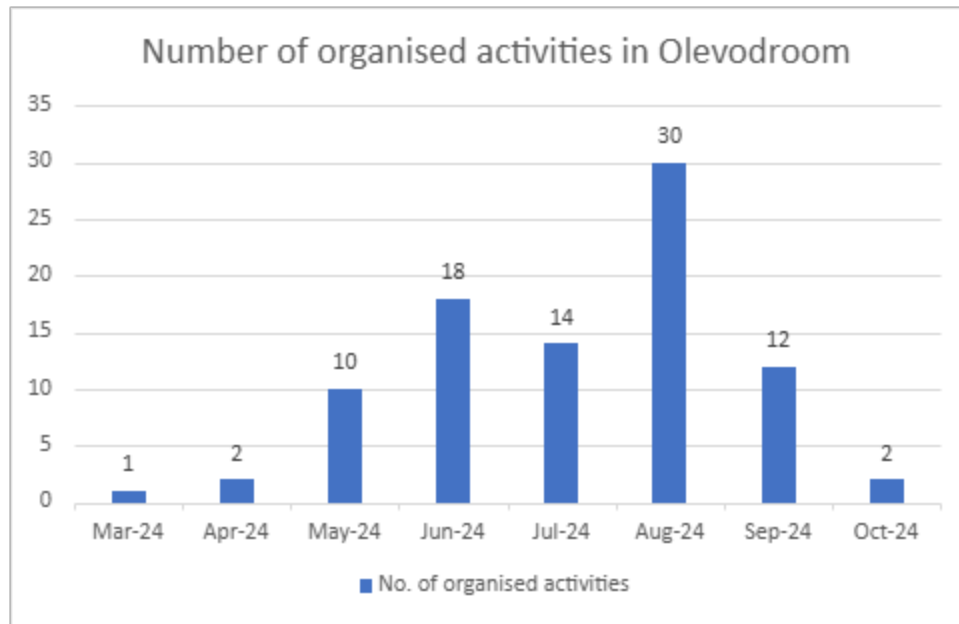


Figure 255: No. of activities in Olevodroom

KPI 4.14a Increased connectivity to green infrastructure

Expected Impact: Increased connectivity to green infrastructure (Direct Impact)

VS(s): 1-3

Evaluation Method: Pre & Post

This KPI seeks to assess the accessibility of green spaces, before and after the intervention: increased connectivity to these brings social and environmental benefits, improving mobility and inclusion in urban planning.

All measured sites show a significant reduction in distance, indicating an improvement in accessibility across the board. Of particular note is the reduction of Handbooghof Park, from 469m to 62m; and Janseniuspark reflecting the shortest distance after the intervention, 36m compared to 222m.

Green Space	Pre-Intervention Closest Distance (m)	Post-Intervention Distance to Hertogensite (m)
Handbooghof Park	469	62

Botanical Garden	222	201
Joris Helleputteplein	369	164
Janseniuspark	222	36

Table 180: Distance to green space

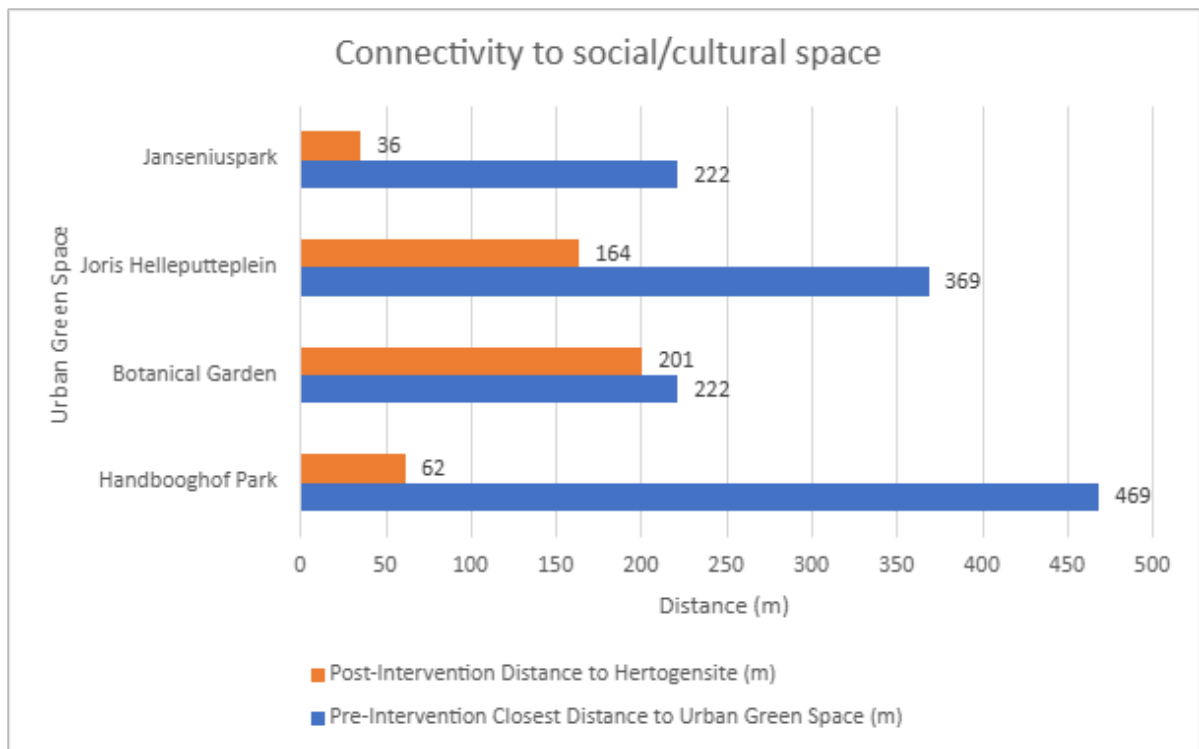


Figure 256: Connectivity to social/cultural space in Leuven

Challenge 5

KPI 5.5 Physical air quality indicators

Expected Impact: Increased (physical) air quality data (Added value)

VS(s): 2, 5

Evaluation Method: Pre & Post

One Sensestick Microclimate SMC30 Sensor was installed in Leuven city sensor to collect information about microclimatic conditions including humidity, air temperature and air pressure over time. The results are shown below.

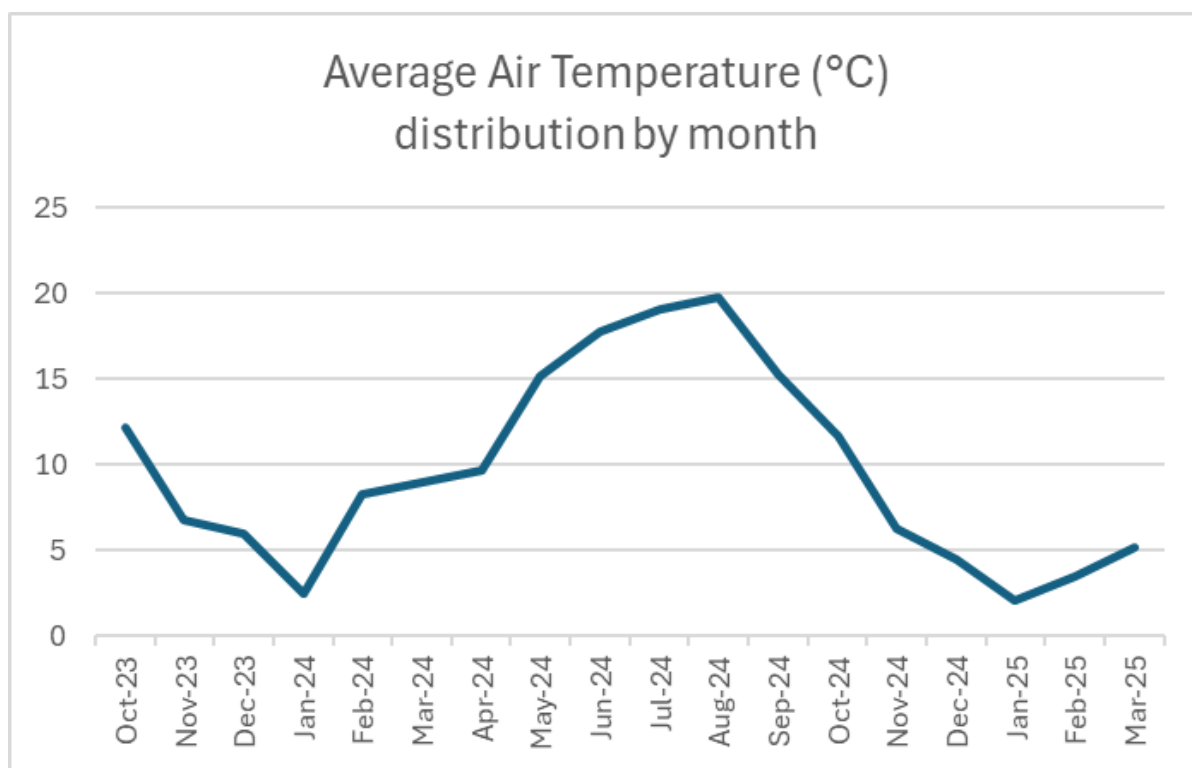


Figure 257: Physical air quality measurements in Leuven (average air temperature 1)

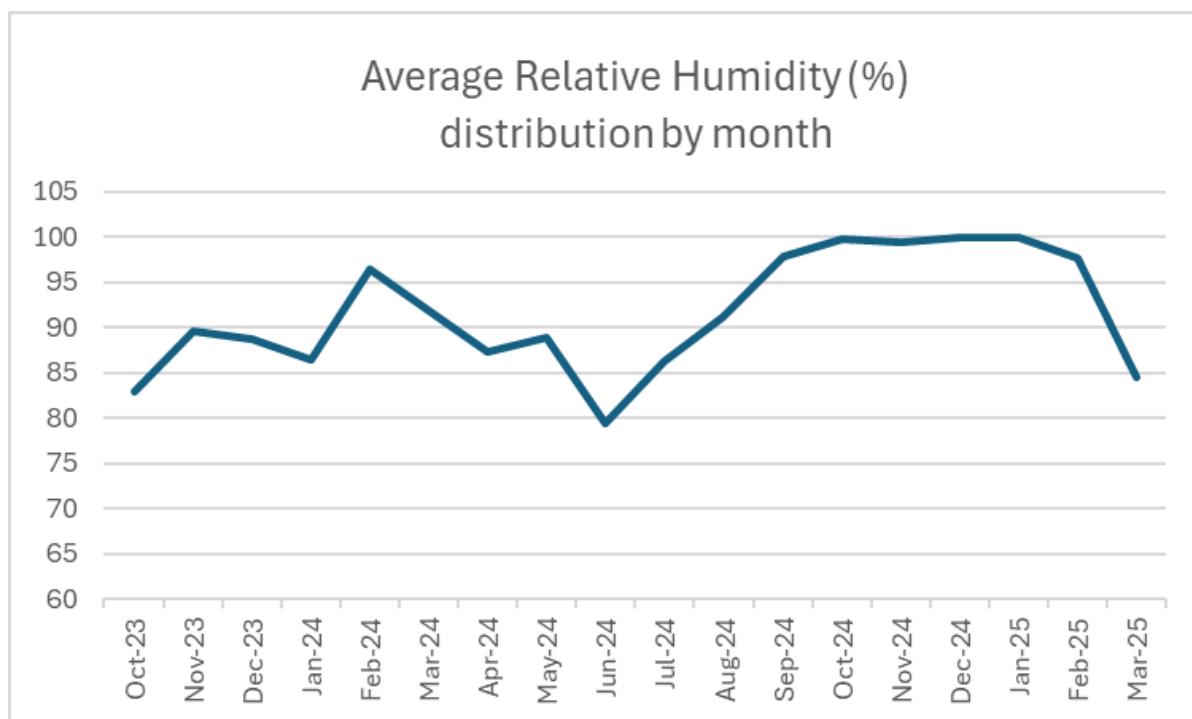


Figure 258: Physical air quality measurements in Leuven (average relative humidity 1)

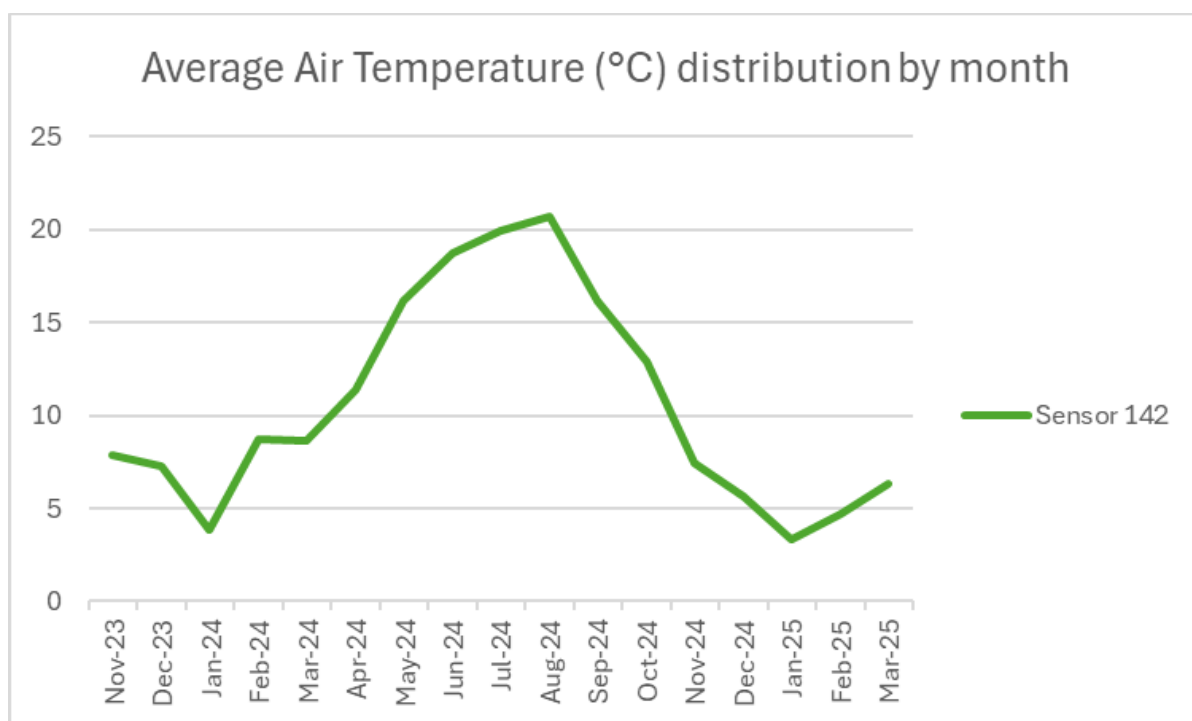


Figure 259: Physical air quality measurements in Leuven (average air temperature 2)

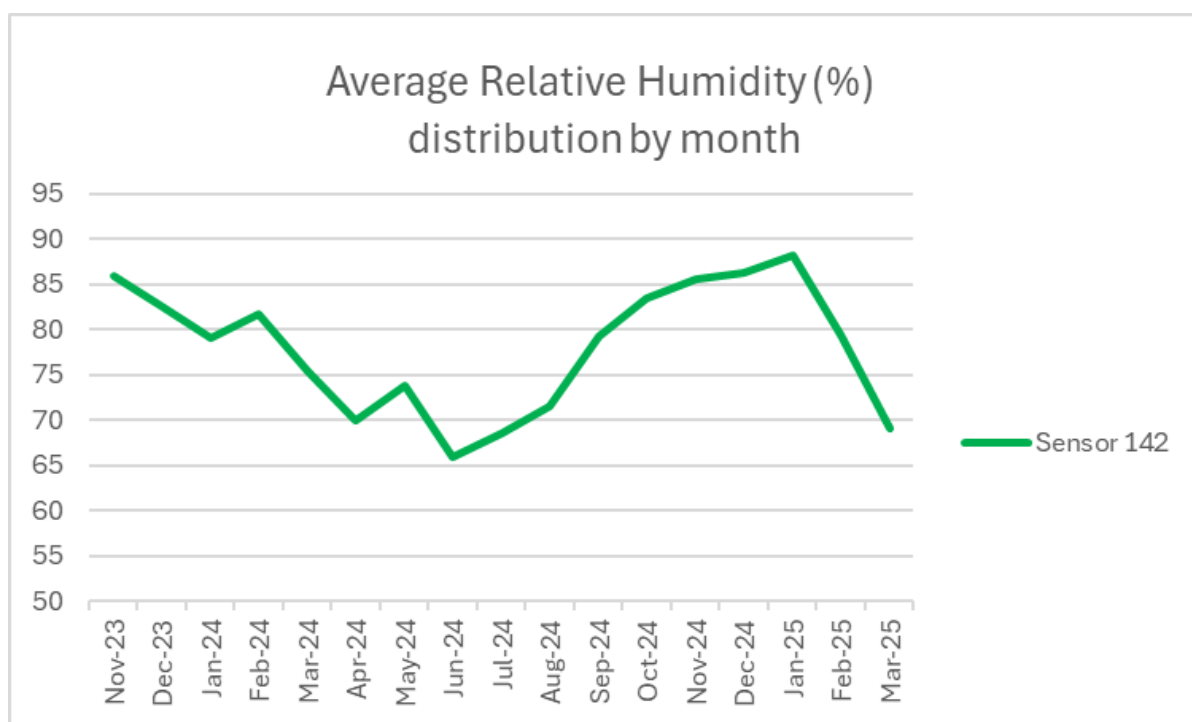


Figure 260: Physical air quality measurements in Leuven (average relative humidity 2)

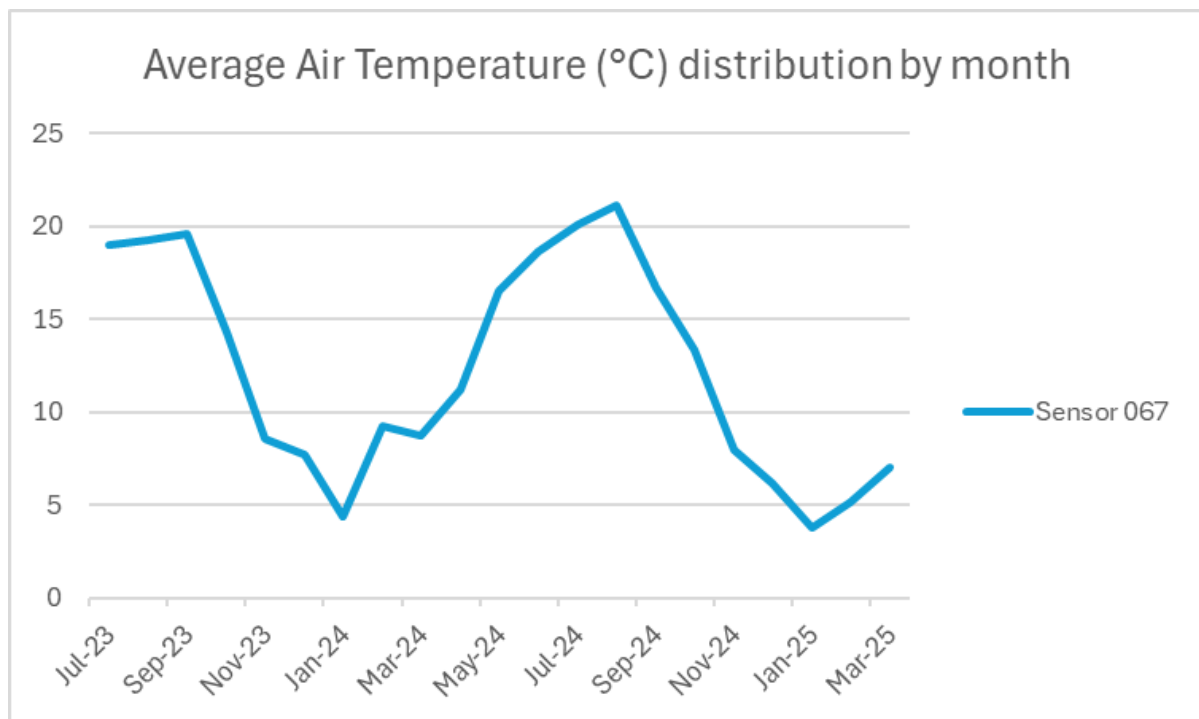


Figure 261: Physical air quality measurements in Leuven (average air temperature 3)

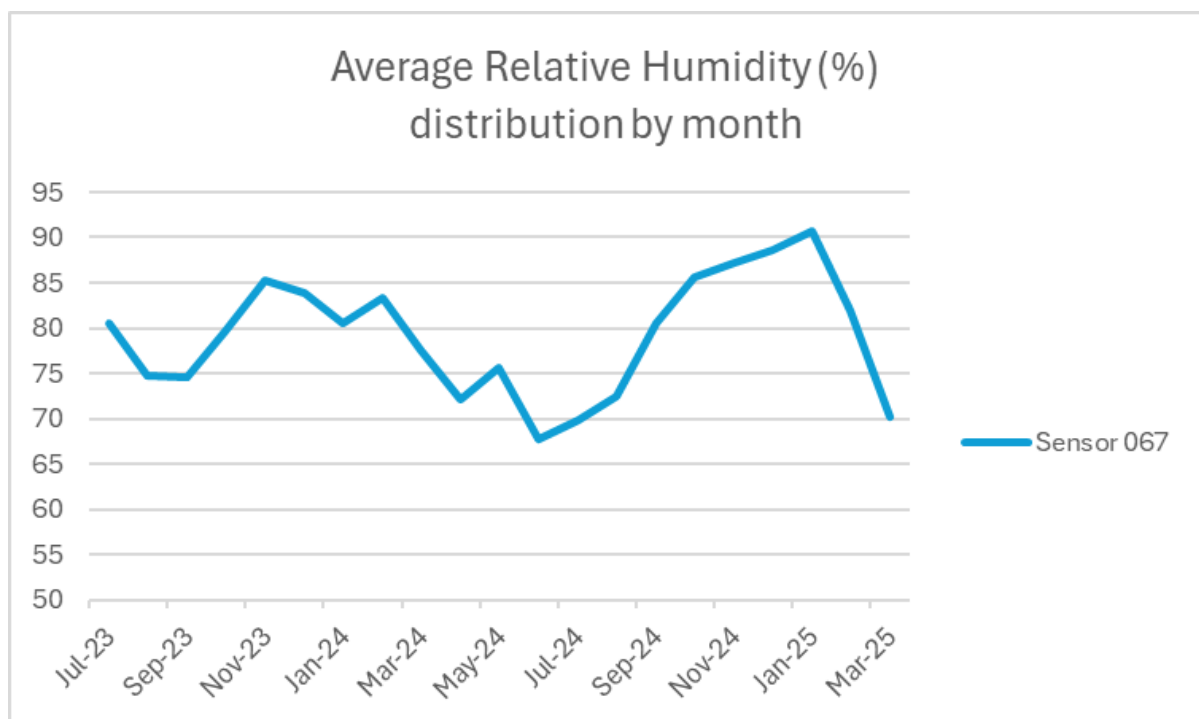


Figure 262: Physical air quality measurements in Leuven (average relative humidity 3)

KPI 5.6 Chemical air quality indicators

Expected Impact: Increased (chemical) air quality data (Added value)

VS(s): 2, 5

Evaluation Method: Benchmarking

The graph shows the daily average concentrations of PM2.5 (in yellow) and PM10 (in black) measured in micrograms per cubic metre ($\mu\text{g}/\text{m}^3$) over a period from 5 October 2023 to 2 November 2023 during which 20,918 data were collected. A significant peak occurred around 27 October 2023, when both pollutants peaked.

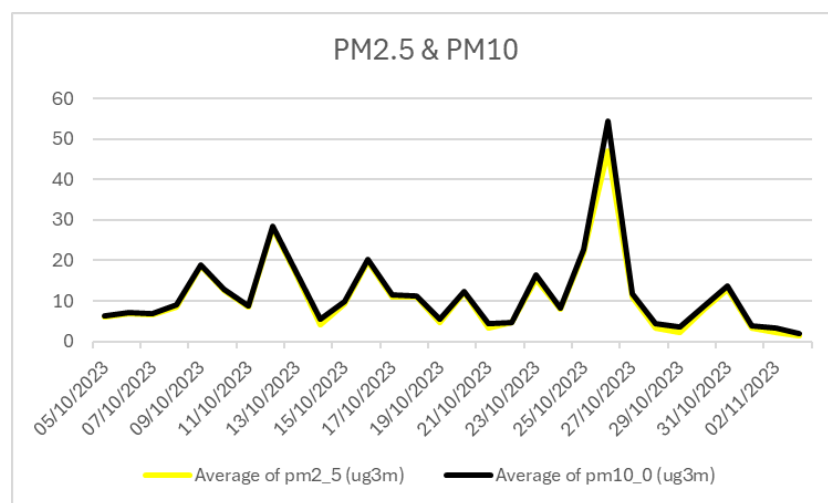


Figure 263: PM2.5 & PM10 in Leuven

KPI 5.15 No. of air quality data

Expected Impact: Number of air quality data added (Direct Impact)

VS(s): 2, 5

Evaluation Method: Pre & Post

The table shows the data collection of three sensors during one year. The sensors 'Leuven cool 042' and 'Leuven cool 067' recorded data every 5 minutes, generating 105,120 data each. The air quality sensor recorded data every hour, totalling 8,760 data. The grand total of data collected is 219,000.

Type of Data	Sample	Sample Rate
PM1	1389	30 mins
PM10	1389	30 mins
PM2.5	1389	30 mins
Solar Radiation	50,500	15 mins
Air Pressure	50,500	15 mins
Humidity	50,500	15 mins
Air Temperature (Degrees Celsius)	50,500	15 mins
UV Index	50,500	15 mins

Table 181: No. of air quality data added

Challenge 6

KPI 6.6 Use of reclaimed/recycled building materials

Expected Impact: Increased reclamation of building materials (Direct Impact)

VS(s): 1-3

Evaluation Method: Pre & Post

Wood:

Approximately 80% of the wood used in constructing the Olevodroom was reclaimed from the Velodroom. The remaining 20% remains on site for potential reconstruction of the Olevodroom elsewhere. These spare boards will be used to replace any broken elements. Leftover wood that could not be reused structurally will be repurposed by the artist and Decoratelier into other artistic objects or structures. Smaller wood pieces (under 20 cm) were used as shims/traps beneath the structure.

Steel and other materials (screws, bolts, etc.):

90% of steel was reclaimed with 33 steel uprights and 120 steel beams reused. 80% of other materials such as screws and bolts from the Velodrome were used for the realization of the Olevodroom.

KPI 6.8 Access of residents/employees by foot to open space: sports centre, recreation area, or green space

Expected Impact: Increased accessibility of sport and recreation facilities (Direct Impact)

VS(s): 1-3

Evaluation Method: Benchmarking

	Itinerary	Departure points identified on 300m buffer zone	Walking Distance (km) from departure point to the park entrance N
Entrance NORTH	1	P18	0.4
	2	P17	0.39
	3	P16	0.41
	4	P15	0.39
	5	P14	0.37
	6	P13	0.43
	7	P12	0.4
	8	P31	0.41
Entrance EST	9	P30	0.39
	10	P32	0.42

	11	P33	0.36
Entrance SOUTH	12	P29	0.42
	13	P23	0.55
	14	P22	0.42
	15	P28	0.36
	16	P34	0.38
	17	P35	0.4
Entrance WEST	18	P36	0.4
	19	P39	0.41
	20	P38	0.29
	21	P37	0.36

Table 182: Access of residents/employees by foot to open space in Leuven

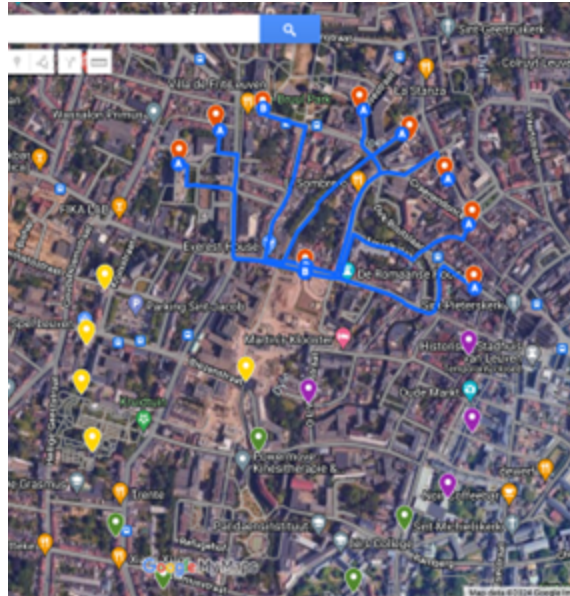


Figure 264: Map with accesses (Leuven) 1

Map featuring the walking itineraries departing from a 300-buffer zone towards the future North entrance to the park (orange pins)

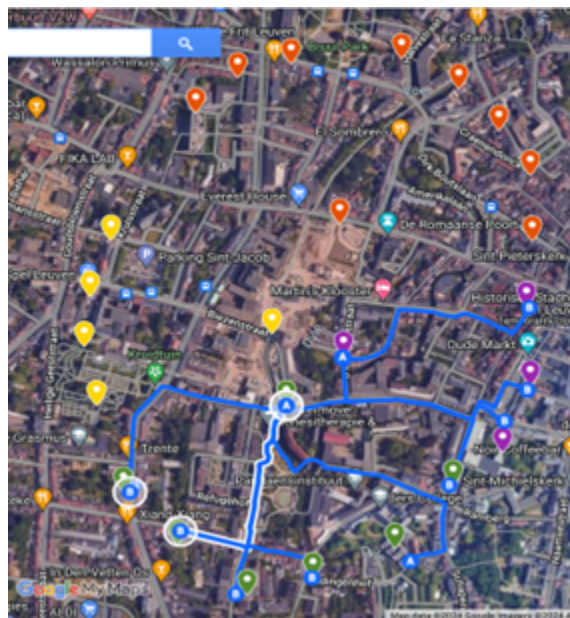


Figure 265: Map featuring the walking itineraries departing from a 300-buffer zone towards the future East (purple pins) and South (green pins) entrance of the park

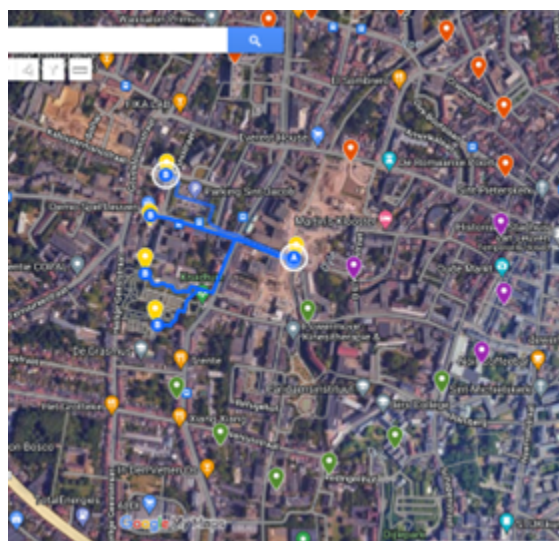


Figure 266: Map featuring the walking itineraries departing from a 300-buffer zone towards the future West entrance of the park (yellow pins)

KPI 6.9 Access of residents to cultural facilities on foot

Expected Impact: Increased accessibility of cultural facilities (Direct Impact)

VS(s): 1-3

Evaluation Method: Benchmarking

The main entrance of the Olevodroom was identified, and a 300-metre radius circle was defined around this point. Walking distances from various departure points along the circumference to the entrance were then calculated. Finally, these distances were compared to identify the longest walking route (refer to KPI 6.8)

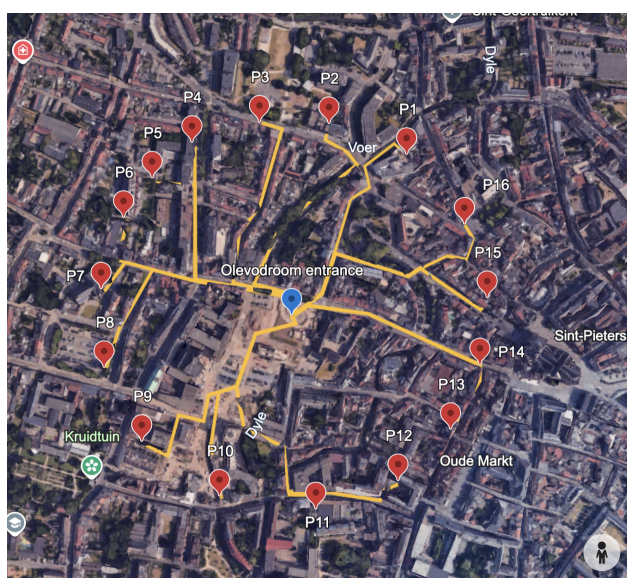


Figure 267: Access of residents to cultural facilities in Leuven

Challenge 7

KPI 7.1 Openness of participatory processes

Expected Impact: Increased and improved participation (Direct Impact)

VS(s): 1-3

Evaluation Method: Co-evaluation

The bar chart below illustrates the total number of participants involved in the co-creation phase and cultural events organized by the Leuven pilot site. These activities encompass both the previous Velodroom and Olevodroom activities. They included stakeholder meetings, neighborhood gatherings, construction camps, and all other events held within the Leuven pilot site.

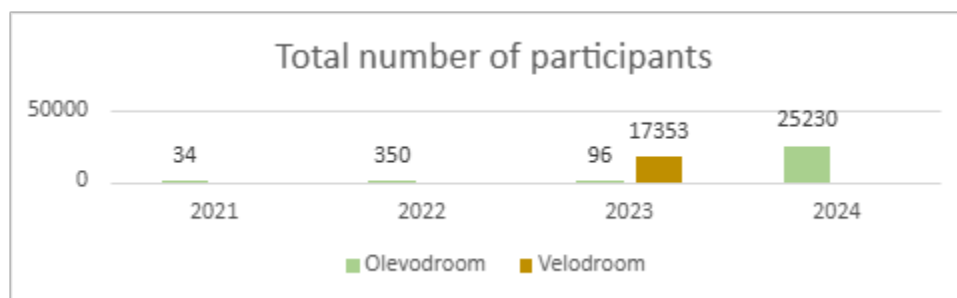


Figure 268: No. of People Taking Part in Participatory Processes in Leuven

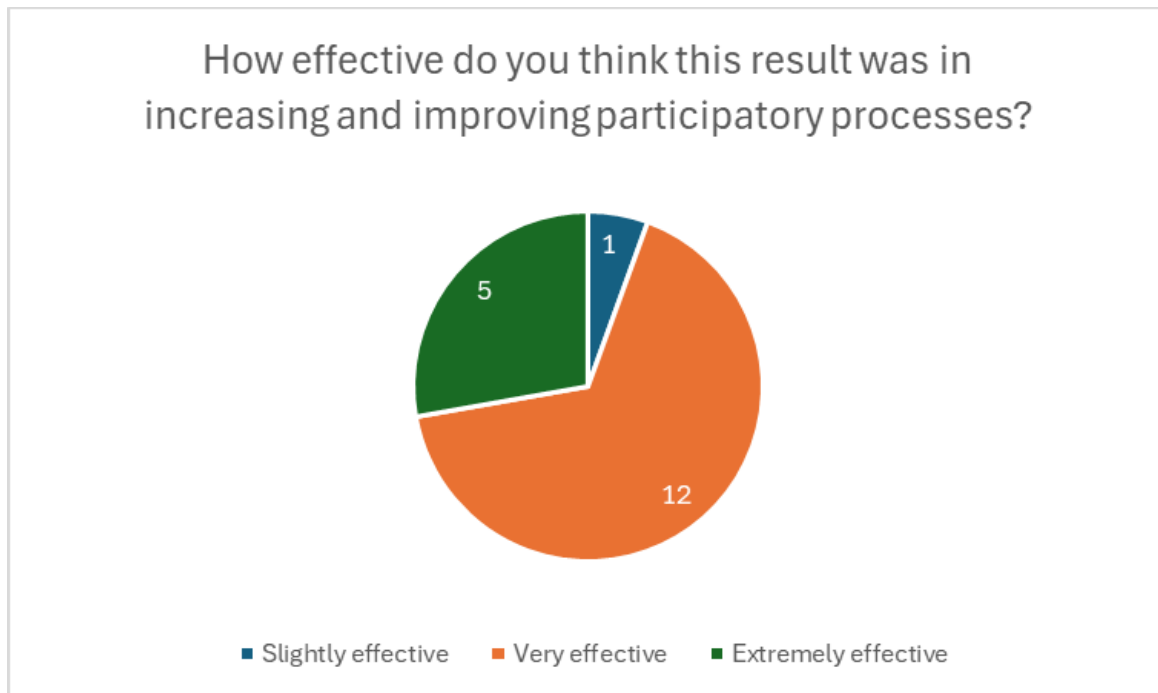


Figure 269: Openness of participatory processes co-evaluation result in Leuven

At the final stakeholder event, participants were asked to evaluate how effective the project had been in increasing and improving participation. The majority of respondents (12) rated the results as very effective.

KPI 7.8 Citizen participation in and co-creation of the design, implementation and evaluation of project interventions

Expected Impact: Increased and improved participation (Direct Impact)

VS(s): 1-3, 2

Evaluation Method: Co-evaluation

The bar chart below illustrates the total number of citizens involved in the co-creation of the project intervention. The data includes various bottom-up activities such as neighbourhood chats and gatherings, site visits as well as more structured workshops.

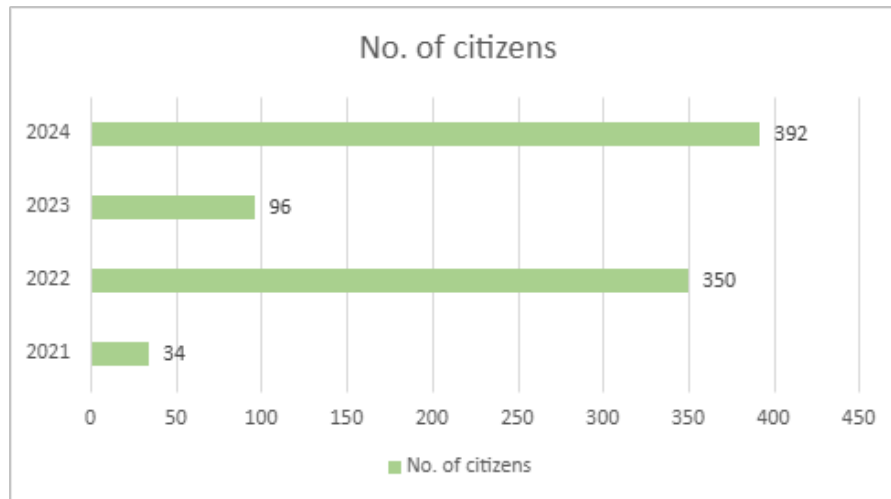


Figure 270: Total no. of Citizens in Activities in Leuven

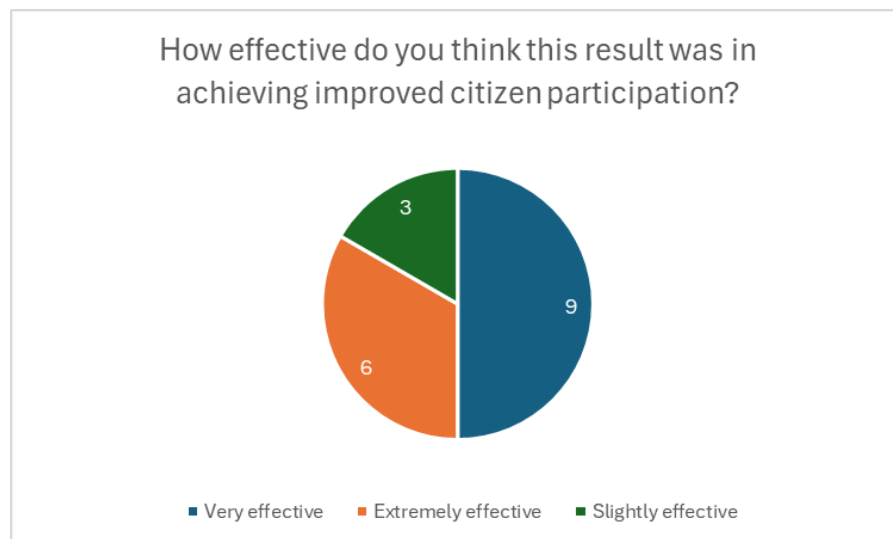


Figure 271: Co-evaluation result of citizen participation in Leuven

At the final stakeholder event, participants were asked to evaluate how effective the project had been in increasing and improving participation. The majority of respondents (9) rated the results as very effective.

KPI 7.11 Number of individuals that is aware of the project's objectives, content and processes

Expected Impact: Increased and improved participation (Direct Impact)

VS(s): 1-3, 2,4,5

Evaluation Method: Pre & Post

The Leuven pilot representatives carried out several dissemination activities for the VARCITIES project. The most impactful was a 2023 article in the City of Leuven Magazine, which is estimated to have reached over 70,000 people.

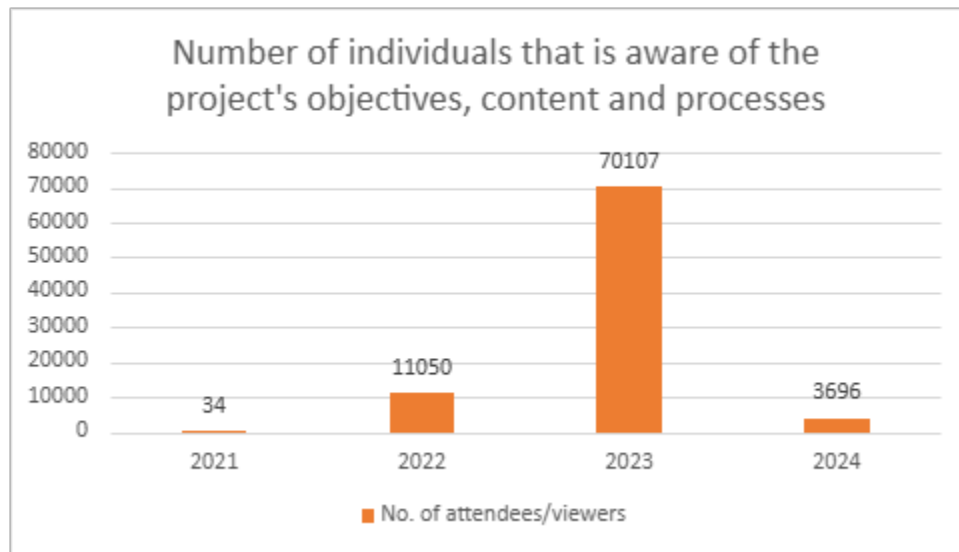


Figure 272: Total no. of People Aware of the Project in Leuven

KPI 7.16 No of persons involved (on average) in the project activities

Expected Impact: Increased and improved participation (Direct Impact)

VS(s): 1-3

Evaluation Method: Pre & Post

The bar chart below illustrates the number of participants by event type. This does not include the various cultural activities, which—as reported under other KPIs—attracted over 24,000 participants.

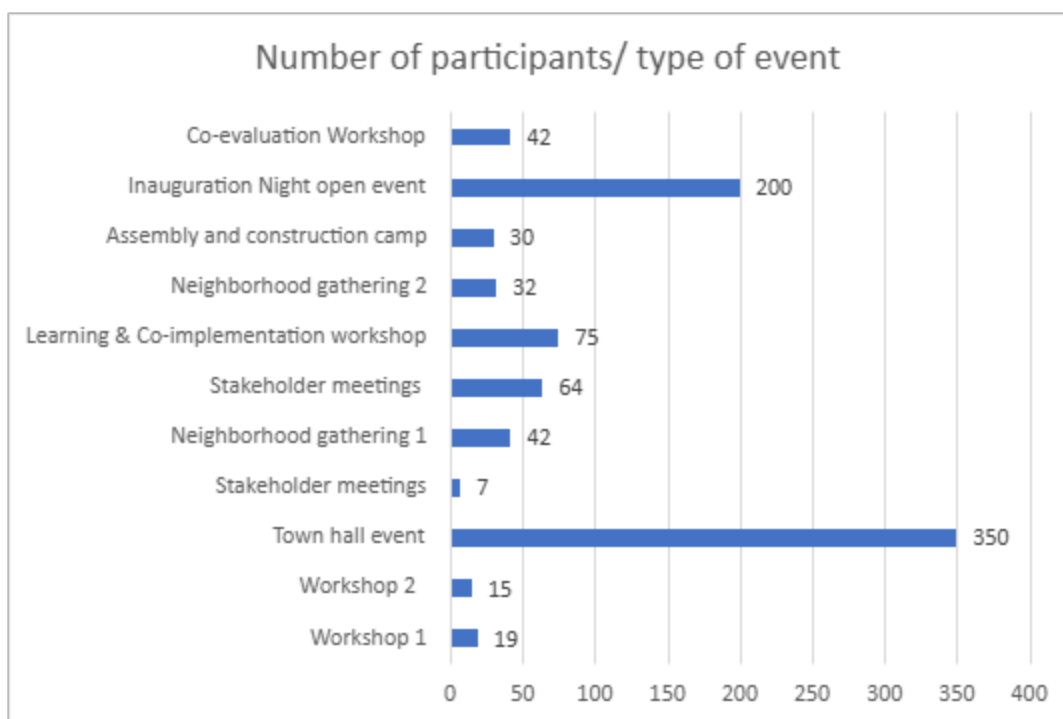


Figure 273: No. of People per Activity in Leuven

KPI 7.17 No. of activities involving children

Expected Impact: Increased and improved participation (Direct Impact)

VS(s): 1-3

Evaluation Method: Pre & Post

The bar chart below shows the number of activities involving children under 12 years old and those aged 12–18. A total of 36 activities were organised for the under-12 age group, and 44 activities were organised for youth aged 12 to 18.

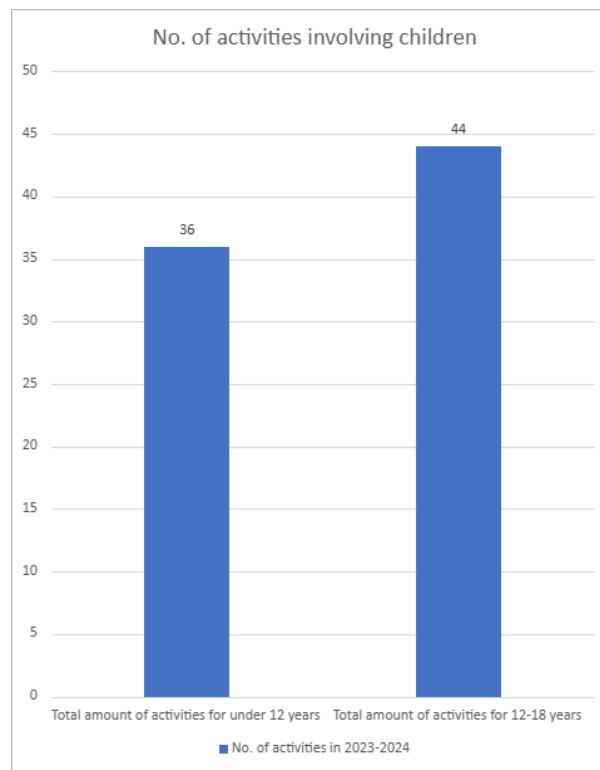


Figure 274: No. of activities involving children in Leuven activities

Challenge 8

KPI 8.5 Personal and social background of people who participated in the project's activities

Expected Impact: Fair participation to project activities (Direct Impact)

VS(s): 1-3

Evaluation Method: Pre & Post

From the results obtained, the highest-ranking category represented in Leuven activities was that of people belonging to the over 65 age group. The percentage calculated is equal to 32.7%. Overall, a similar representation from stakeholders was reported for the '31-50' and slightly lower is the '51-65' age group category.

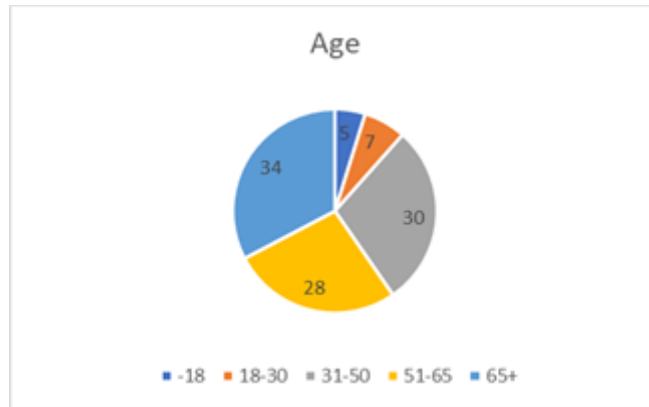


Figure 275: Age groups in Leuven activities

The chart below evidently shows that participation of males was significantly higher than females and other non-binary gender categories. The percentage calculated from the results is 64.2%. Further activities may improve representation from the minority groups reported hereunder.

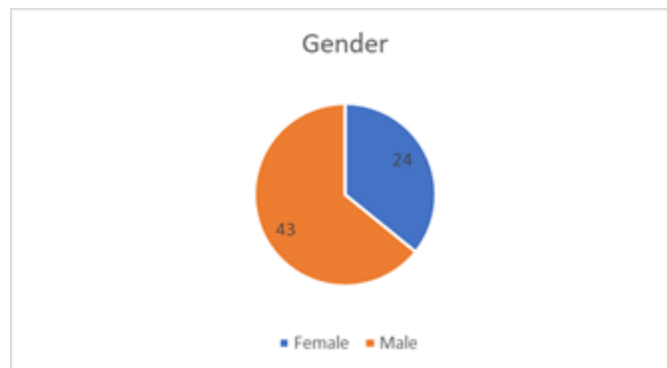


Figure 276: Genders in Leuven activities

The chart below shows that 100% representation from the participants was reported in relation to the 'Heterosexual/straight' category. Other categories could have the possibility of being included in the feedback process with other events which will be organised in the future.

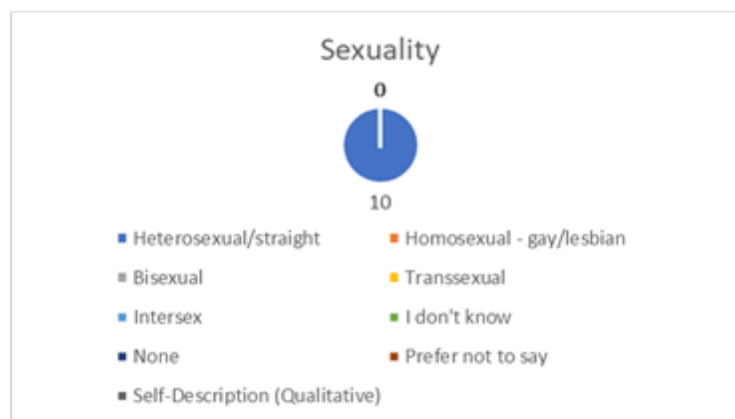


Figure 277: Sexual orientation in Leuven activities

100% of the responses below show that participants are coming from a privileged socio-economic background in Leuven. Other participants falling in the underrepresented category might be included in the collection of feedback during the social engagement process of the upcoming year.

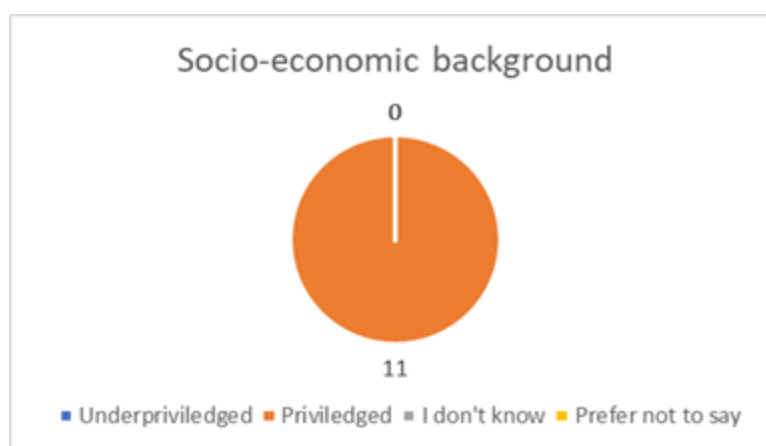


Figure 278: Socio-economic background in Leuven activities

50% of the participants below have stated that they have obtained a master's degree, while the following category is that of people with a PhD. Both categories are almost equally represented.

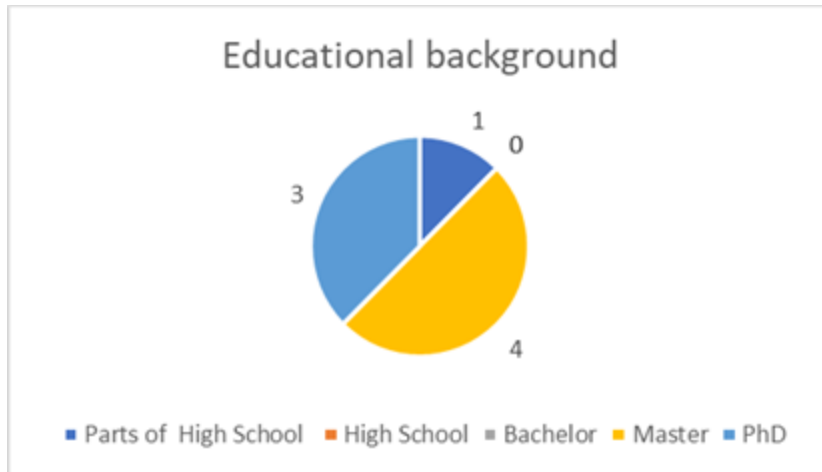


Figure 279: Educational background in Leuven activities

75% of the participants have reported to be in full-time employment which stands out in relation to the categories. It is noteworthy that 25% of the participants are retired and have provided very useful feedback representing their category.



Figure 280: Employment status in Leuven activities

The income bracket most prevalent to the responses submitted reflects the high participation of people with the highest income category, while the rest prefer not to say. The possibilities of providing equal opportunities to people belonging to other income groups can be considered in future events to achieve more equality in the results.

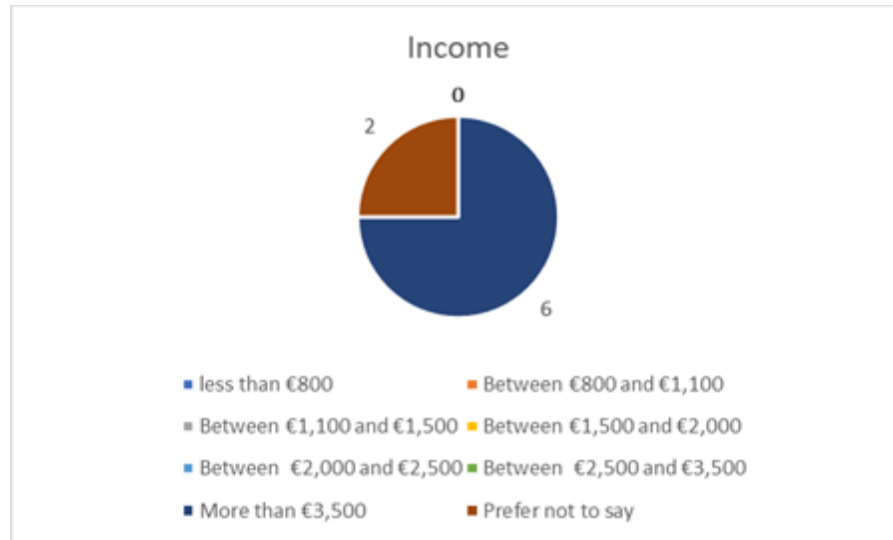


Figure 281: Income in Leuven activities

Among the results shown below and similarly to other pilot sites, the highest percentage of respondents was that of people who do not suffer from any of the disabilities mentioned below. 90.9% of the responses state that none of the disabilities are affecting their daily life, however only one person reported that they have difficulties seeing, which is 9.1% of the total.



Figure 282: Disabilities in Leuven activities

The 2 categories represented in the pie chart included hereunder are that of the 'Christian Catholic' category and non-religious participants. Both were represented equally with 50% reported for each category.

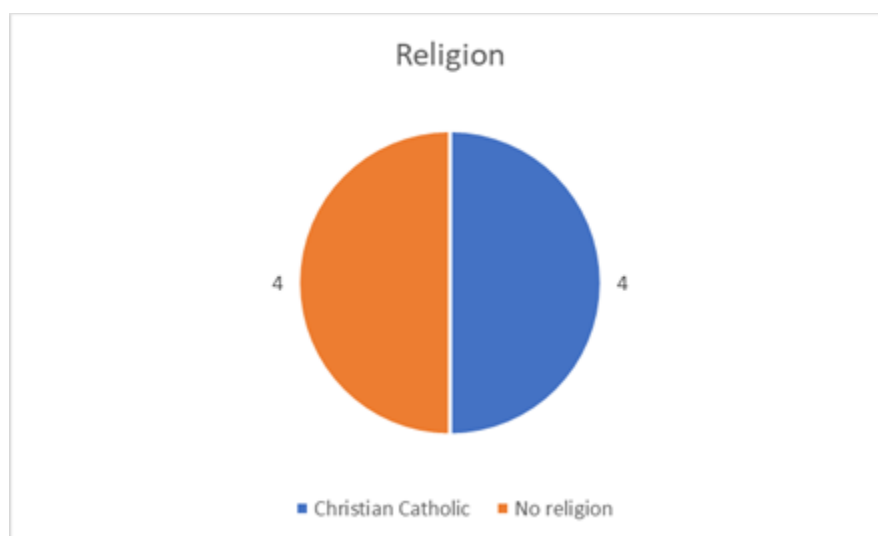


Figure 283: Religions in Leuven activities

KPI 8.10 Accessibility of open public spaces and buildings for families with baby carriages and individuals with restricted mobility

Expected Impact: Greater inclusion of families with babies and individuals with restricted mobility (Direct Impact)

VS(s): 1-3

Evaluation Method: Pre & Post

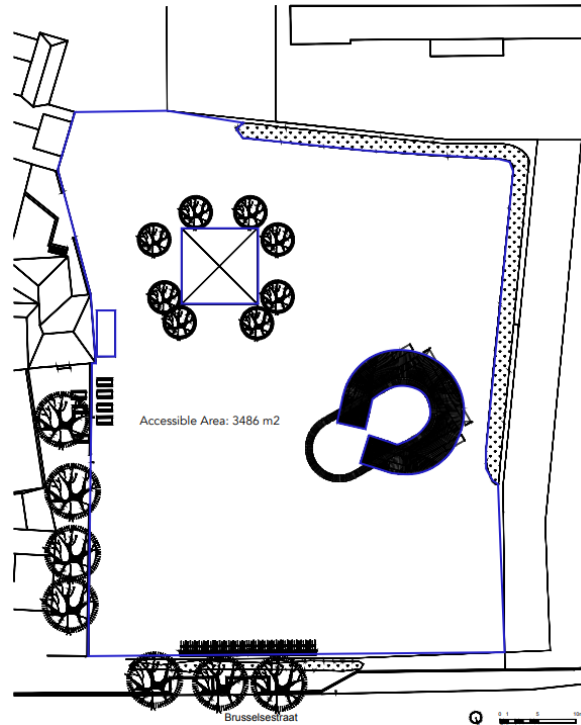


Figure 284: Accessibility of open public spaces and buildings for families with baby carriages and individuals with restricted mobility in Leuven

Challenge 9

KPI 9.4 Noise reduction rates (or exposure to noise pollution)

Expected Impact: Increased data on noise pollution exposure (Added value)

VS(s): 4

Evaluation Method: Benchmarking

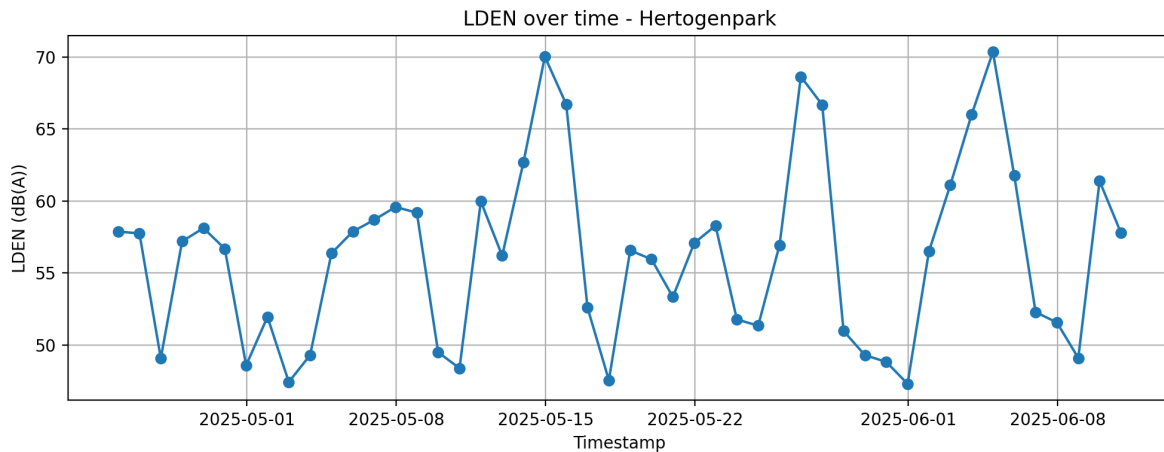


Figure 285: Lden over time - Hertogenpark

This graph shows the Day-Evening-Night noise level (Lden) measurements at Hertogenpark from 24 April 2025 to 10 June 2025. The Lden metric represents the average sound level over a 24-hour period, with penalties applied for evening (19:00-23:00) and night-time (23:00-07:00) hours to account for increased noise sensitivity during these periods.

Over the 48 measurement days, the LDEN values ranged from 47.3 dB(A) to 70.4 dB(A), with an average of 56.3 dB(A) which is slightly higher than the 55dB EU Benchmark Level for Lden (Directive 2002/49/EC).

KPI 9.5 No of hours spent outdoors, time people spend in the facility

Expected Impact: Increased (data on) outdoor presence (Direct Impact)

VS(s): 1-3

Evaluation Method: Pre & Post

The graph below illustrates the amount of time participants reported spending outdoors. The majority of responses, both pre-implementation (blue) and post-implementation (orange), fall within the 1–5-hour range. The number of responses gradually decreases for higher time intervals, with only a few participants indicating 15–20 hours or more than 20 hours at the pre-implementation phase.

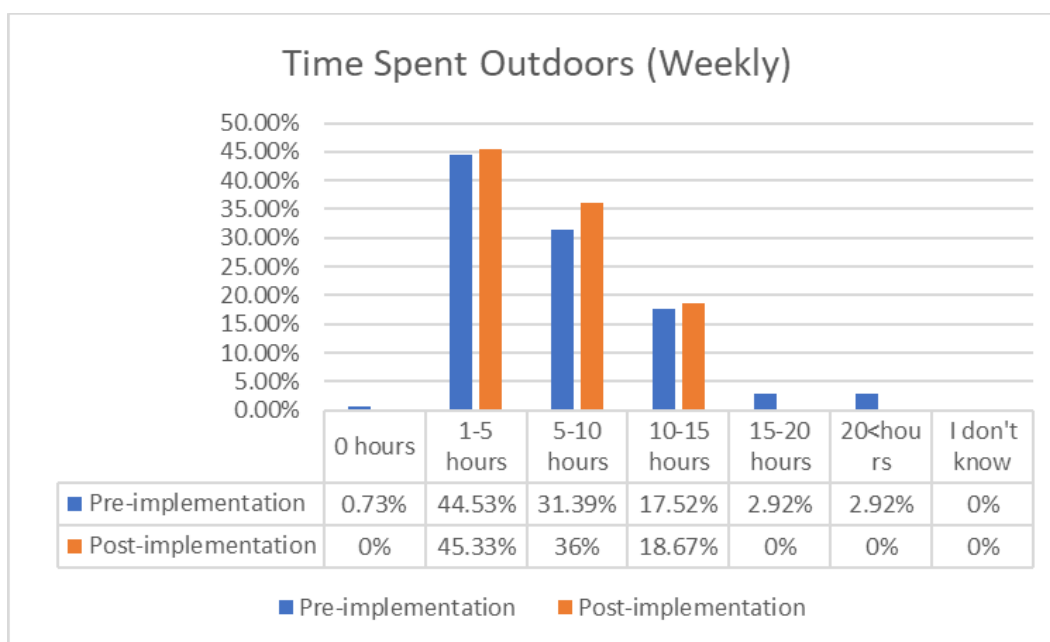


Figure 286: Hours spent outdoors in Leuven

KPI 9.6 Perceived well-being before and after the visit of public space

Expected Impact: Increased health and wellbeing (Direct Impact)

VS(s): 1-3, 5

Evaluation Method: Pre & Post

This graph illustrates the emotional states of visitors before and after experiencing the intervention site, the Oleodroom. After the visit, no participants reported feeling a poor emotional state. The number of neutral responses decreased, while those reporting a good emotional state increased by 10%, indicating a positive shift.

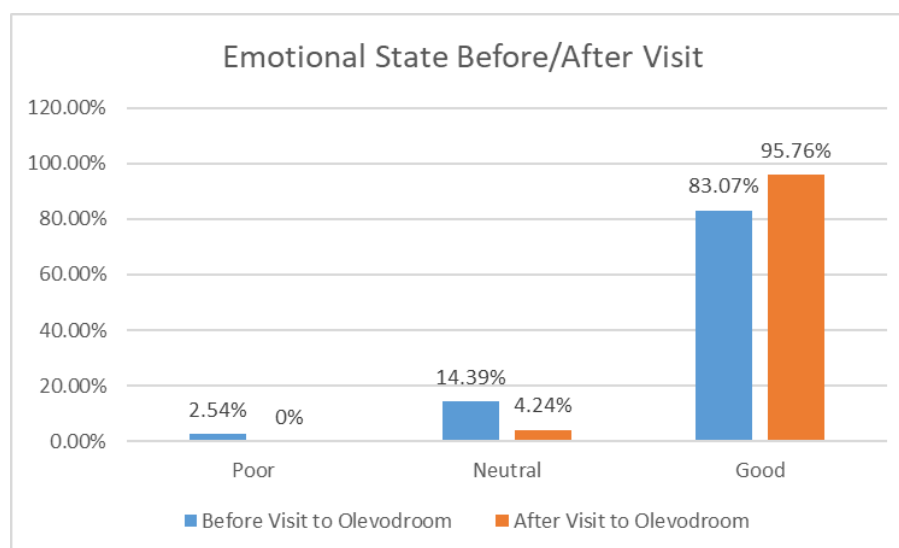


Figure 287: Emotional state before/after visit in Leuven

KPI 9.8 Feeling of improving the quality of life (the Quality-of-Life questionnaire)

Expected Impact: Improved quality of life (Direct Impact)

VS(s): 1-3, 4

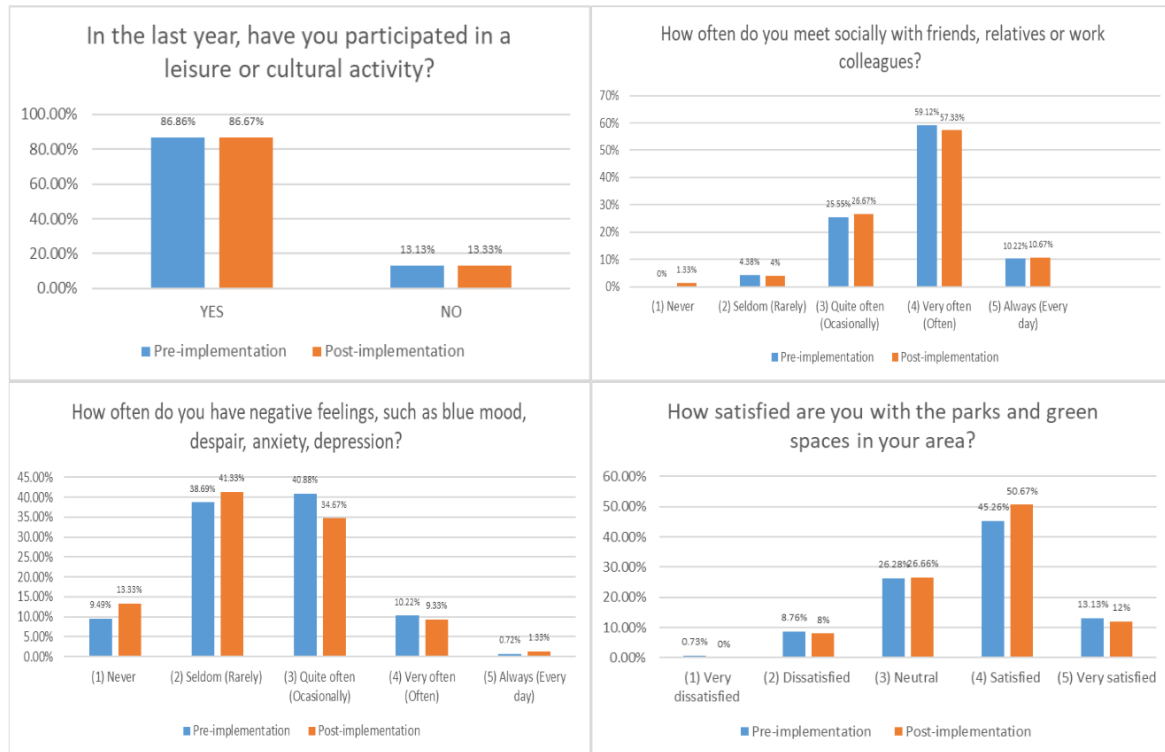
Evaluation Method: Pre & Post

Data collected in the quality-of-life questionnaire before and after the implementation phase reveal a multidimensional improvement in perceived quality of life among participants.

Firstly, overall quality of life showed a noticeable shift towards more positive ratings. Although the proportion of respondents who rated their quality of life as 'Good' remained relatively stable (52.55% pre-implementation vs. 52.67% post-implementation), there was a significant increase in those who rated it as 'Very Good' (from 24% to 29.93%), indicating a shift from neutrality to a greater sense of well-being. The number of respondents who consider their life 'Neither good nor bad' decreases from 22.7% to 16%, confirming this upward trend.

In terms of standard of living, the percentage of people who say they are 'Very satisfied' rises from 17.33% to 27.74%, and those who feel 'Satisfied' remain in the majority, with a slight increase (from 50.36% to 60%). This suggests a tangible improvement in the perception of material and economic conditions.

In terms of health, satisfaction also increased. The percentage of respondents who were 'Very satisfied' with their health increased from 21.17% to 27.33%, while those who were 'Satisfied' remained relatively stable, with a slight decrease from 54.67% to 52%. This is consistent with the data on the need for medical treatment, which showed no increase.



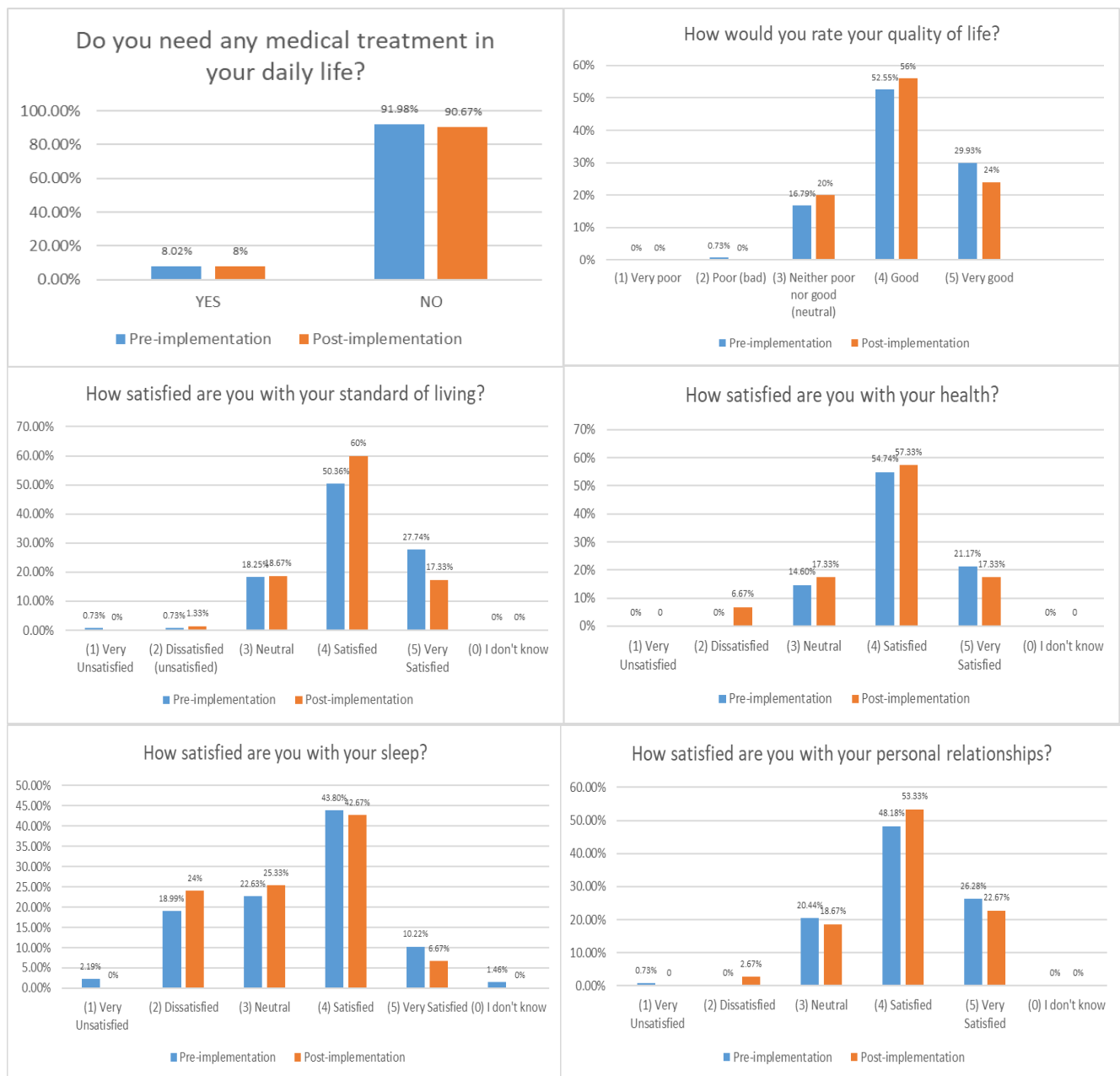


Figure 288: Quality of Life in Leuven

KPI 9.13 Residential attachment and satisfaction

Expected Impact: Increased residential attachment and satisfaction (Direct Impact)

VS(s): 1-3, 4

Evaluation Method: Pre & Post

After implementation, overall satisfaction with the environmental conditions in the neighbourhood remained mostly positive, although with slight changes. The percentage of respondents who said they were very satisfied decreased slightly, from 29.63% to 28.38%, while those who said they agreed (but not strongly) decreased from 40% to 37.84%.

On the other hand, 'slightly agree' responses increased slightly (from 18.52% to 20.27%) and neutral responses (from 8.15% to 10.81%). Negative responses remained minimal in both periods, not exceeding 3%.

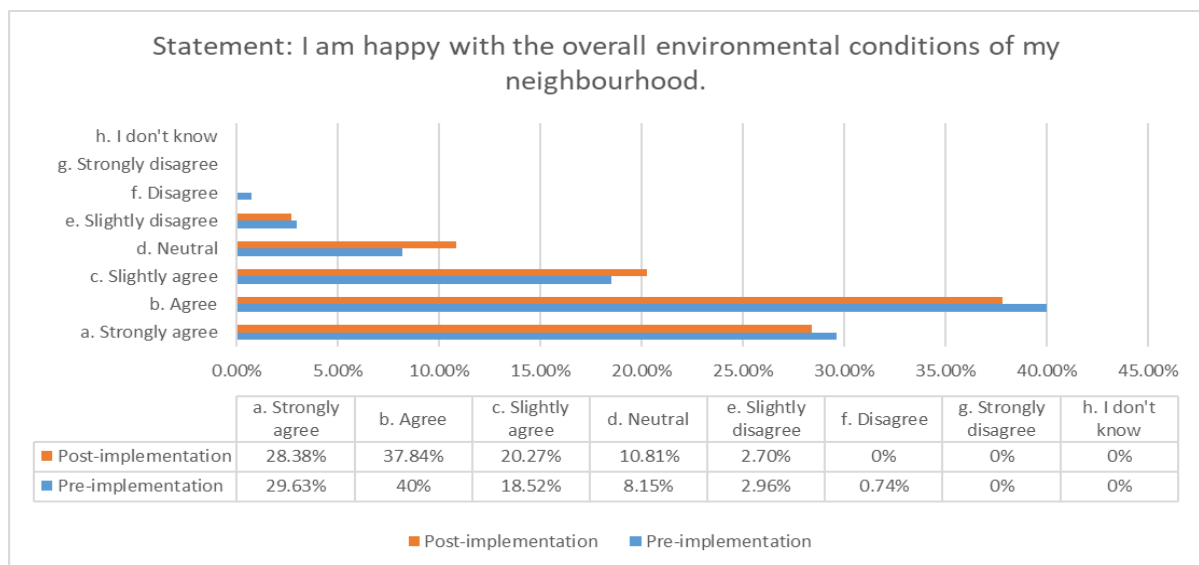


Figure 289: Residential attachment and satisfaction in Leuven 1

Post Implementation, a slight decrease is observed in almost all negative factors reported. The most reported problems continue to be noise pollution (62.16% post vs. 66.42% pre) and air pollution (29.73% post vs. 28.47% pre).

Significant improvements are noted in the perception of the aesthetics of the environment (22.97% post vs. 6.57% pre) and a slight improvement in the lack of infrastructure and green spaces. Perception of social isolation is not mentioned at any stage, which can be interpreted as not being perceived as a problem.

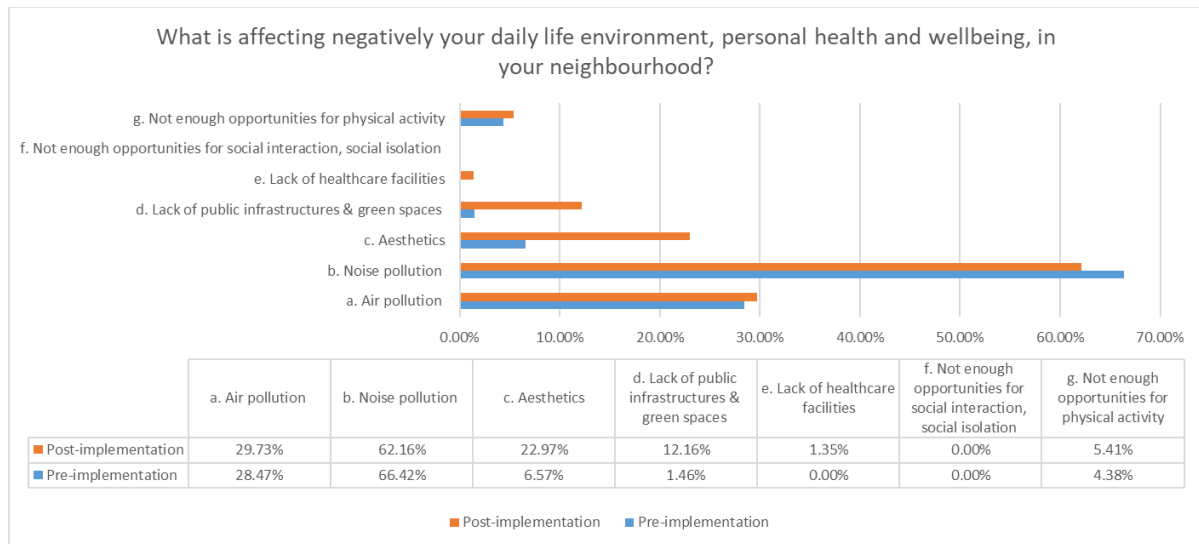


Figure 290: Residential attachment and satisfaction in Leuven 2

Post implementation, the neutral perception of the sense of community increased considerably (64.86% post vs. 47.45% pre), while weak (14.86% post vs. 20.44% pre) and very weak (0.00% post vs. 10.95% pre) opinions decreased. There is also a slight decrease in the strong category and a slight increase in very strong.

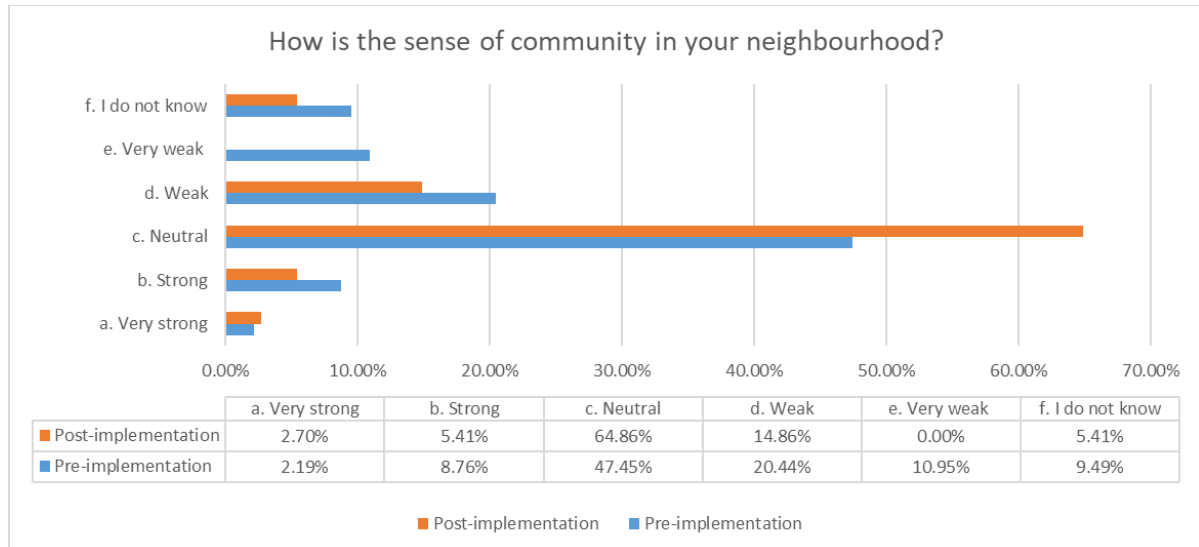


Figure 291: Residential attachment and satisfaction in Leuven 3

After implementation, an increase in the frequency of social interaction between neighbours is observed. Daily interactions increased from 23.36% to 29.73% and weekly interactions from 30.66% to 31.08%, reflecting an improvement in community

connectedness. In addition, the percentage of people who interact rarely (from 21.17% to 16.22%) or never interact (from 5.84% to 4.05%) decreased.

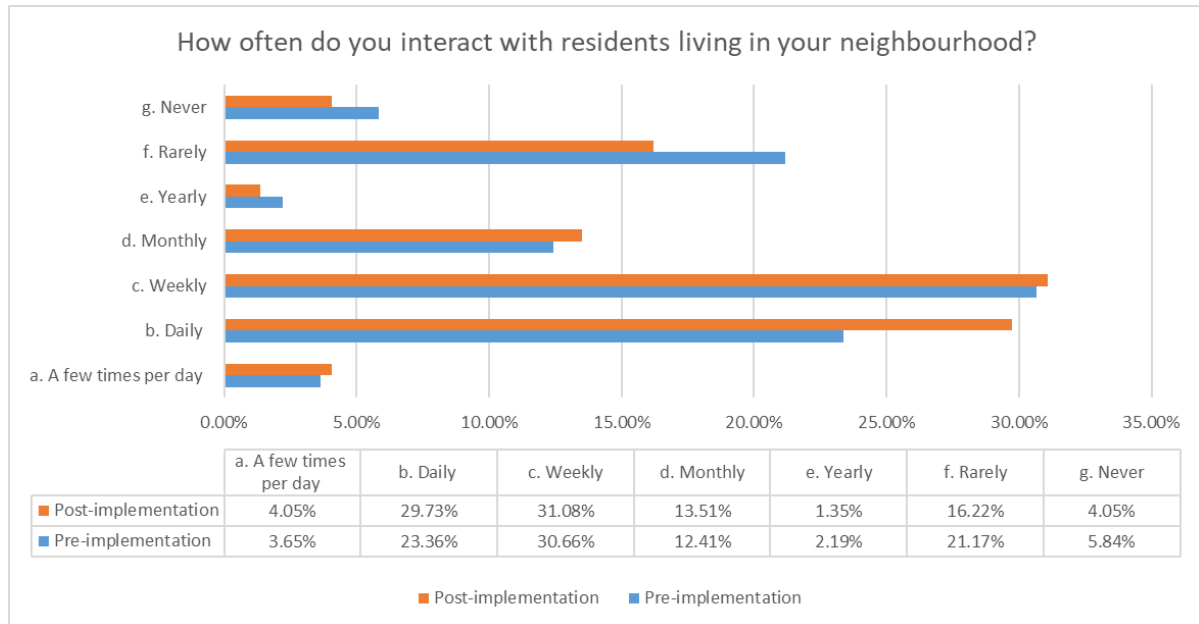


Figure 292: Residential attachment and satisfaction in Leuven 4

Post-implementation, the majority of people report participating occasionally (44.59%) or rarely (29.73%) in cultural events. Some 17.57% participate regularly, while only a small percentage do not participate at all (8.11%) or 'all the time' (1.35%, although this option was not valid).

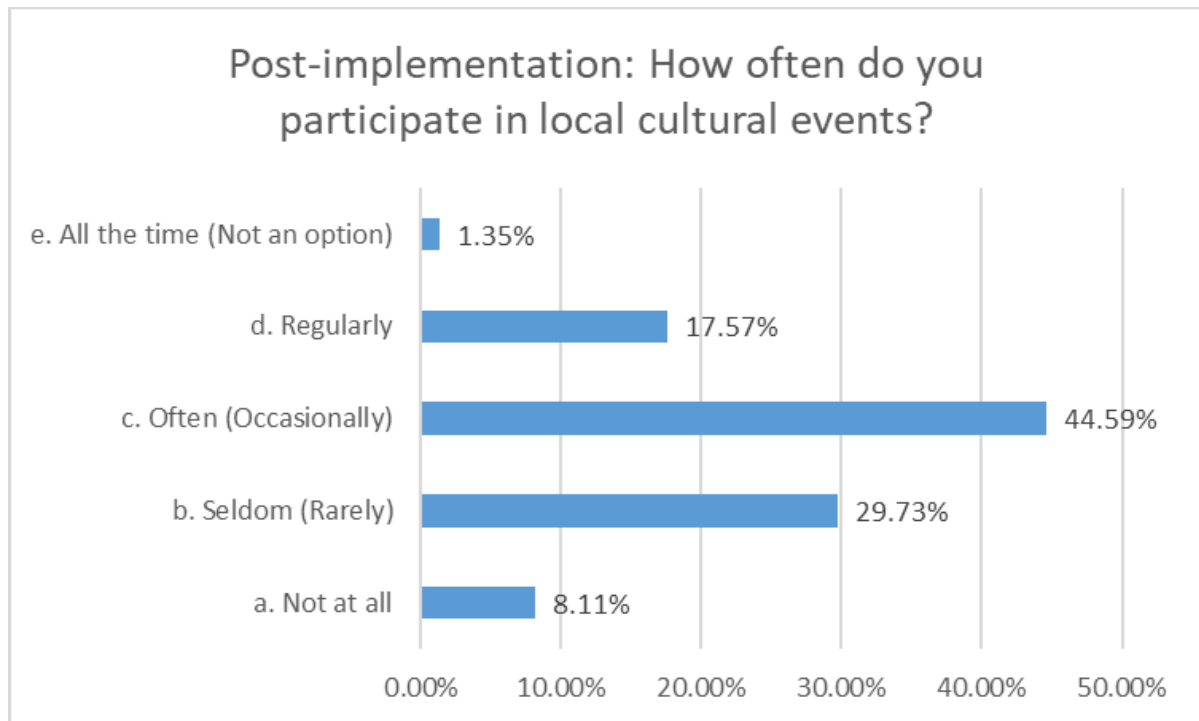


Figure 293: Residential attachment and satisfaction in Leuven 5

Post- implementation, the sense of security remains relatively stable, with a slight improvement in neutral perception (28.38% post vs. 23.36% pre). The percentage of people who feel very safe decreased (21.62% post vs. 27.08% pre), but the percentage who feel safe increased slightly (47.30% post vs. 45.98% pre). Perceptions of insecurity remained very low in both stages, with similar values.

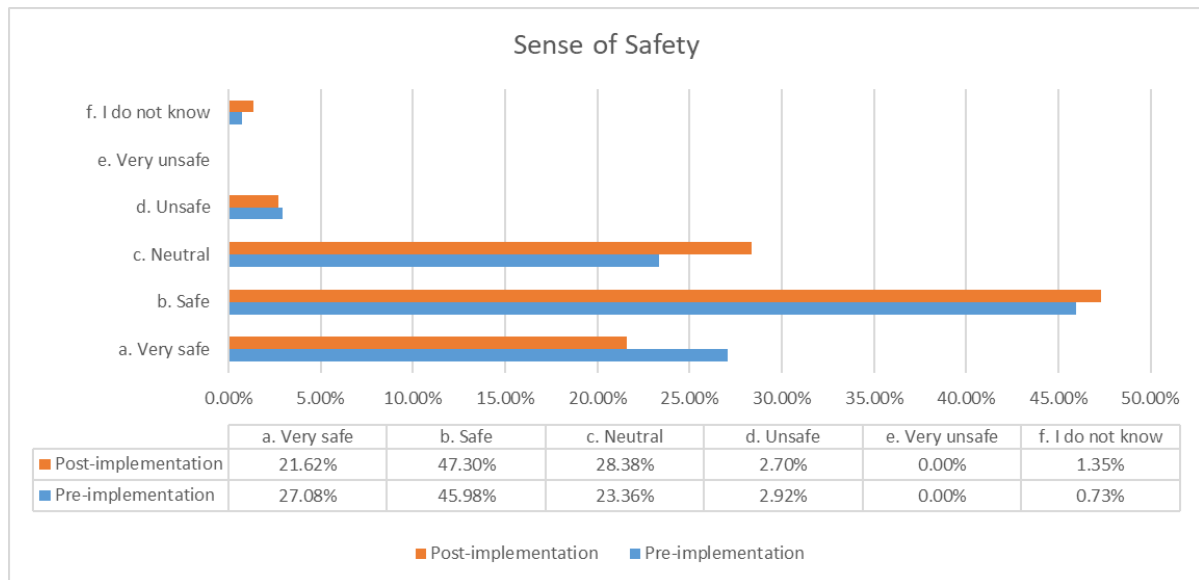


Figure 294: Residential attachment and satisfaction in Leuven 6

Post-implementation, the willingness to consider living elsewhere increased significantly. The percentage of respondents who answered 'YES' increased from 29.63% to 64.86%, while the percentage of respondents who answered 'NO' decreased significantly, from 62.96% to 24.32%. The proportion of respondents who were not sure ('don't know') also increased slightly, from 7.41% to 10.81%.

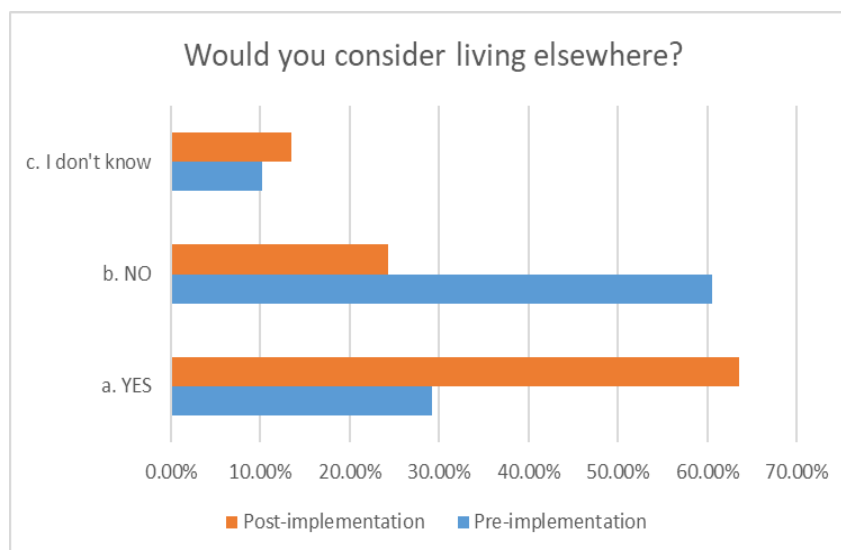


Figure 295: Residential attachment and satisfaction in Leuven 7

KPI 9.16 Number / share of people being physically active (min. 30 min 3 times per week)

Expected Impact: Increased outdoor physical activity (increased of data gathering of data of people being physical active) (Direct Impact)

VS(s): 1-3, 5

Evaluation Method: Pre & Post, Benchmarking

The graphs show changes in physical activity levels before and after implementation. In cycling, the proportion of people cycling between 1 and 5 hours per week increased from 41.58% to 45.81%, while non-cyclists decreased from 45.45% to 41.58%. In walking, the group walking between 1 and 5 hours per week increased from 63.64% to 69.44%, and non-walkers decreased from 2.02% to 1.39%.

With regard to vigorous physical activity in the last week, the proportion of people who did no activity at all fell from 54.74% to 45.71%. Those who engaged in vigorous activity at least 3 days per week - meeting the benchmark - increased from 16.19% to 22.37%.

Finally, in terms of time spent on leisure time activities, the percentage of people exercising more than 30 minutes decreased from 59% to 51%, while those exercising for less than 30 minutes increased from 41% to 49%.

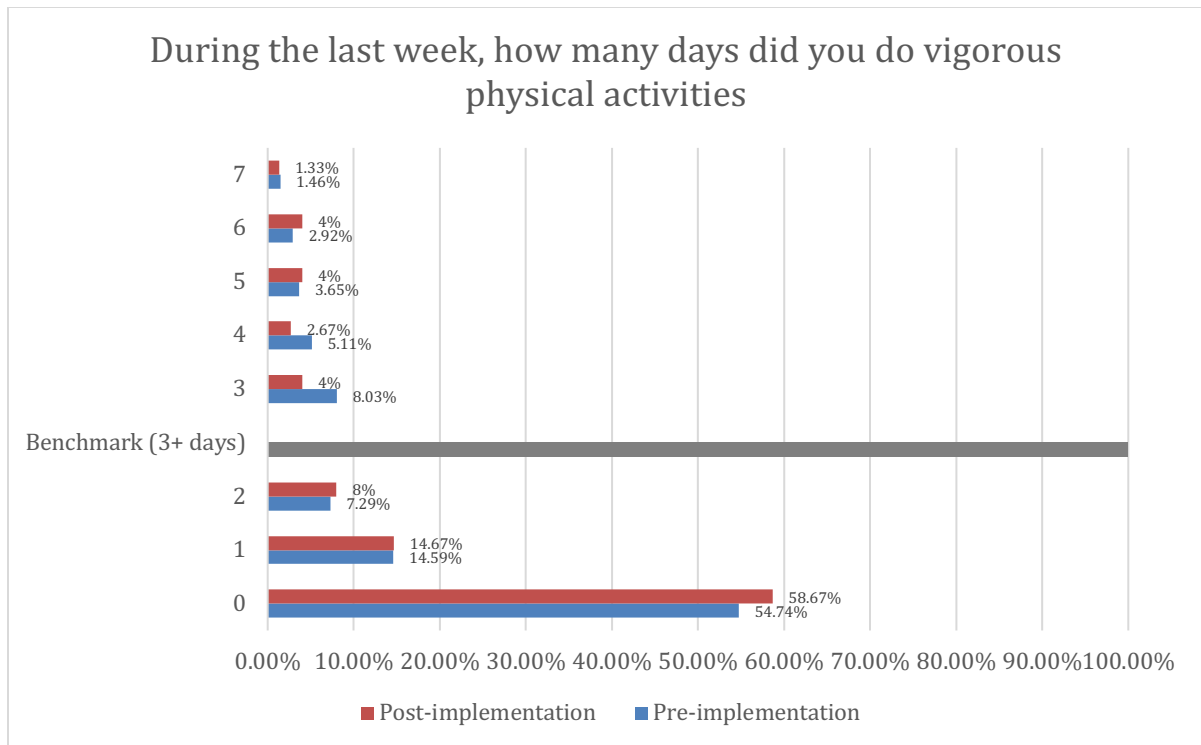


Figure 296: Outdoor physical activity in Leuven 1

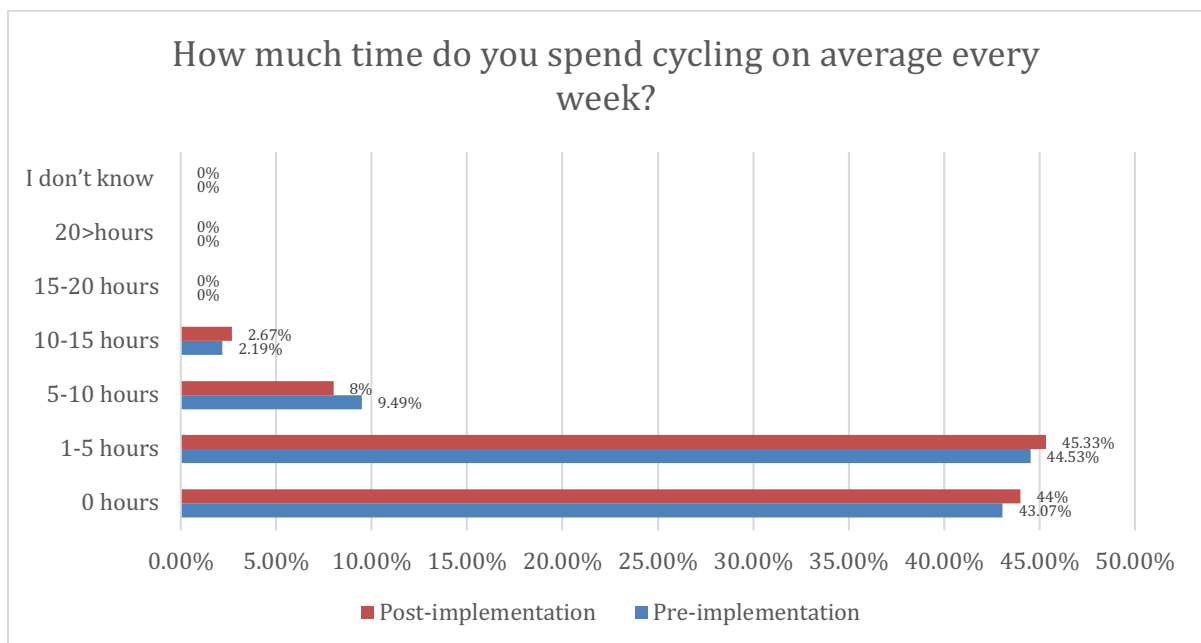


Figure 297: Outdoor physical activity in Leuven 2

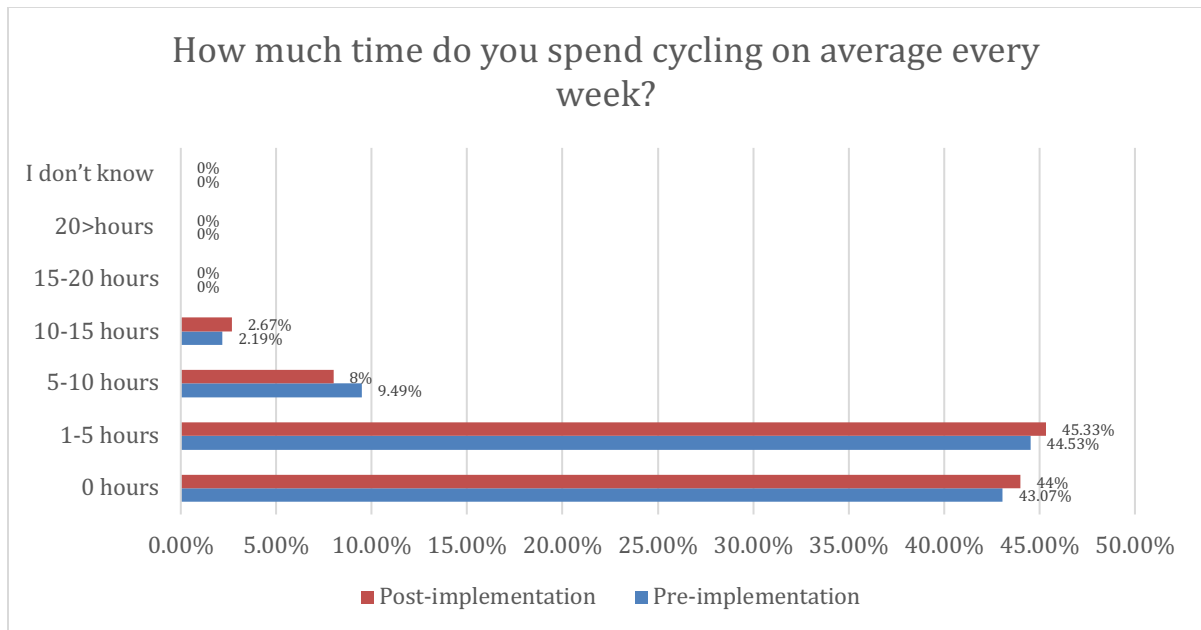


Figure 298: Outdoor physical activity in Leuven 3

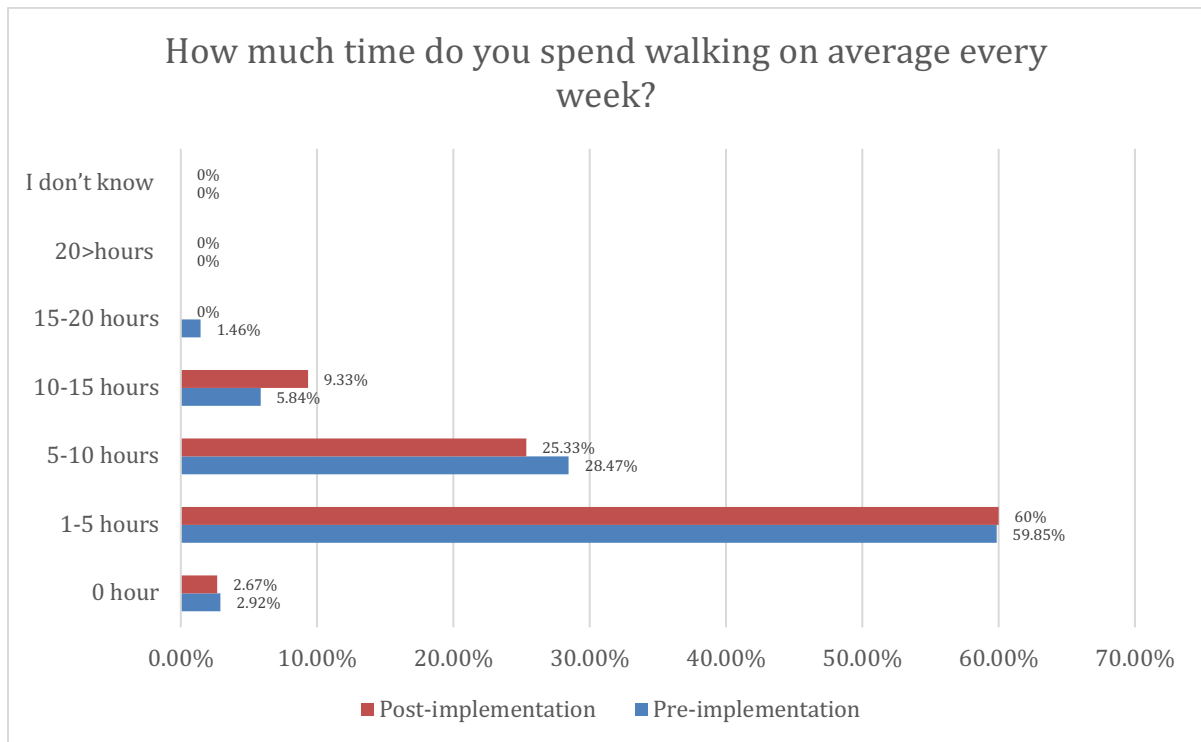


Figure 299: Outdoor physical activity in Leuven 4

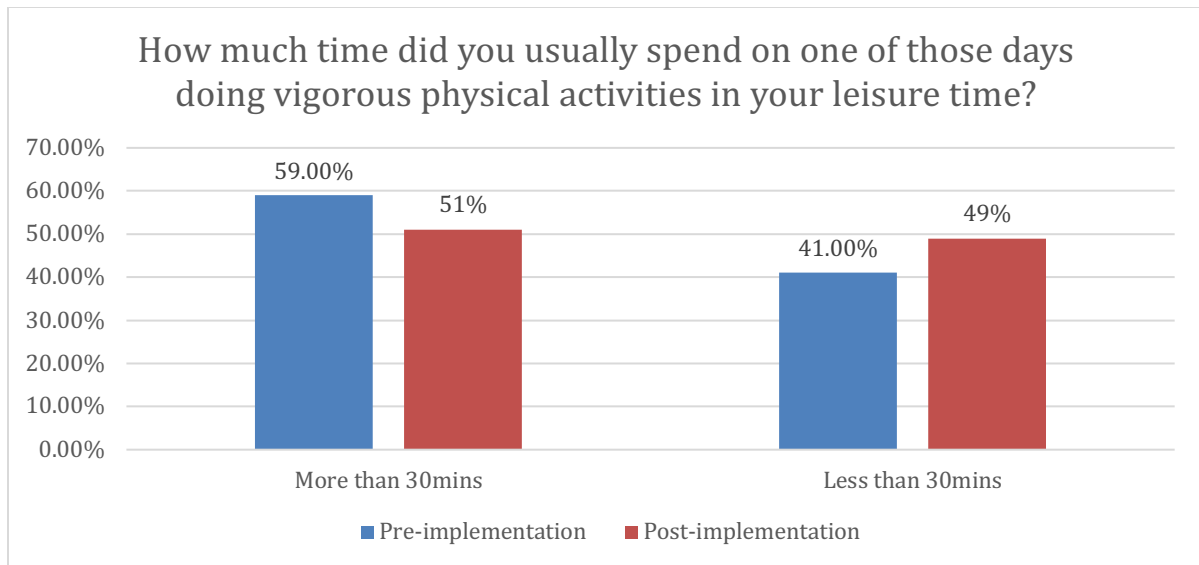


Figure 300: Outdoor physical activity in Leuven 5

KPI 9.19 Increase in walking and cycling in and around areas of interventions

Expected Impact: Increased outdoor physical activity (increased of data gathering of data of people being physical active) (Direct Impact)

VS(s): 1-3, 5

Evaluation Method: Pre & Post

The corresponding graphs show the measured increases in walking and cycling in the intervention areas.

In terms of walking, the percentage of people who walk between 1 and 5 hours per week remains stable, slightly increasing from 59.86% to 60%. A slight decrease is also observed in those who walk between 5 and 10 hours, from 27.74% to 25.33%, while those who walk between 10 and 15 hours increase from 6.57% to 9.33%.

Regarding cycling, the percentage of people who cycle between 1 and 5 hours a week rises from 44.53% to 45.33%. In addition, the group cycling between 5 and 10 hours decreases slightly from 9.94% to 8%. It is important to note that the group reporting 0 hours of cycling disappears, decreasing from 43.07% to 0%.

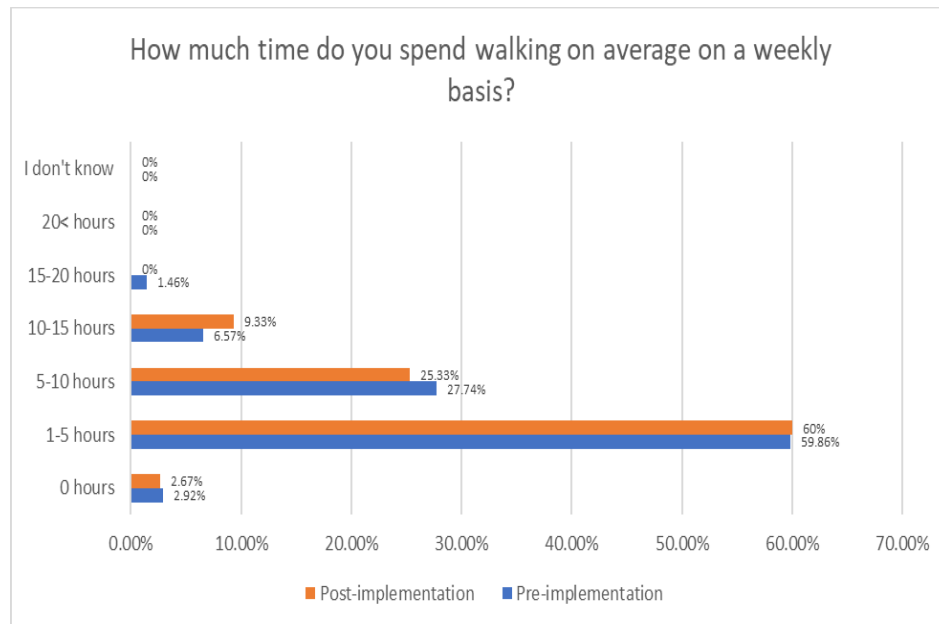


Figure 301: Data on walking frequency in Leuven

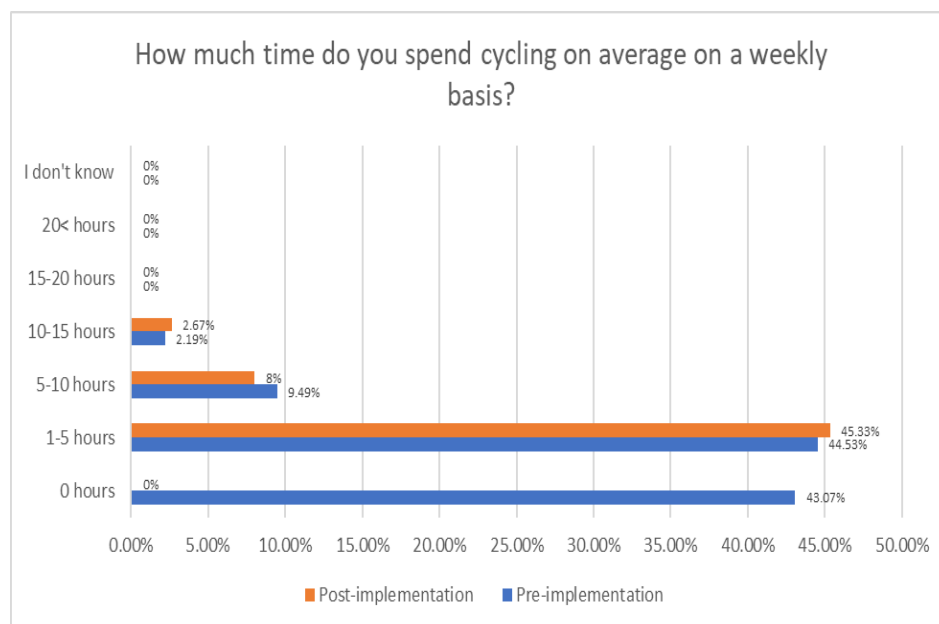


Figure 302: Data on cycling frequency in Leuven

KPI 9.36 Number of noise data

Expected Impact: Increase number of noise data (Direct Impact)

VS(s): 4

Evaluation Method: Pre & Post

Sensor name	Starting Date	Finish date	Frequency	total no. of data*
Hertog 1 gebouw	25/04/2025	24/06/2025	15min	5684

*Monitoring is still ongoing

Table 183: Noise sensor in Leuven

KPI 9.37 Number of health and lifestyle data

Expected Impact: Increased number of added health and lifestyle data (Direct Impact)

VS(s): 1-3

Evaluation Method: Pre & Post

		Number of collected data	Number of questions
ID 9.5	Combined Survey, part C. About your Physical Activity	212	1
ID9.6	Quick satisfaction survey	313	3
ID9.8	Combined Survey, part B. About your Quality of life	212	8
ID9.13	Combined Survey, part A. About your Neighborhood	212	7
ID9.16	Combined Survey, part C. About your Physical Activity	212	11
ID9.19	Combined Survey, part C. About your Physical Activity	212	2
	Total	1373	

The health and lifestyle data are the following:

General health	Medical assistance in daily life
	General health rate
Mental health	Sleep satisfaction
	Negative emotions frequency
Social relations	Social interaction frequency
	Participation in leisure or cultural activities
Residential & Neighborhood Environment	Green space availability
	Social interaction frequency in the Neighborhood
	Participation in cultural events in the Neighborhood
	Satisfaction with the Neighborhood Environment
	Sense of community
	Frequency of interaction with neighbors
	Frequency of participation in local, cultural events
	Willingness to move to another region
Quality of life and well-being	Causes of discomfort in daily environment, health and well-being
	Safety
	Quality of life rates
	Sleep satisfaction
	Standard of living satisfaction
	Satisfaction of health

	Personal relationships satisfaction
Physical activity	Duration of outdoors presence
	Duration of walking
	Duration of cycling
	Frequency and duration of strenuous Physical Activity
	Frequency and duration of moderate Physical Activity
	Sitting duration on a weekday
	Sitting duration on a weekend day
	Frequency of vehicle use
	Duration of vehicle use

Table 184: No. of health and lifestyle data collected in Leuven

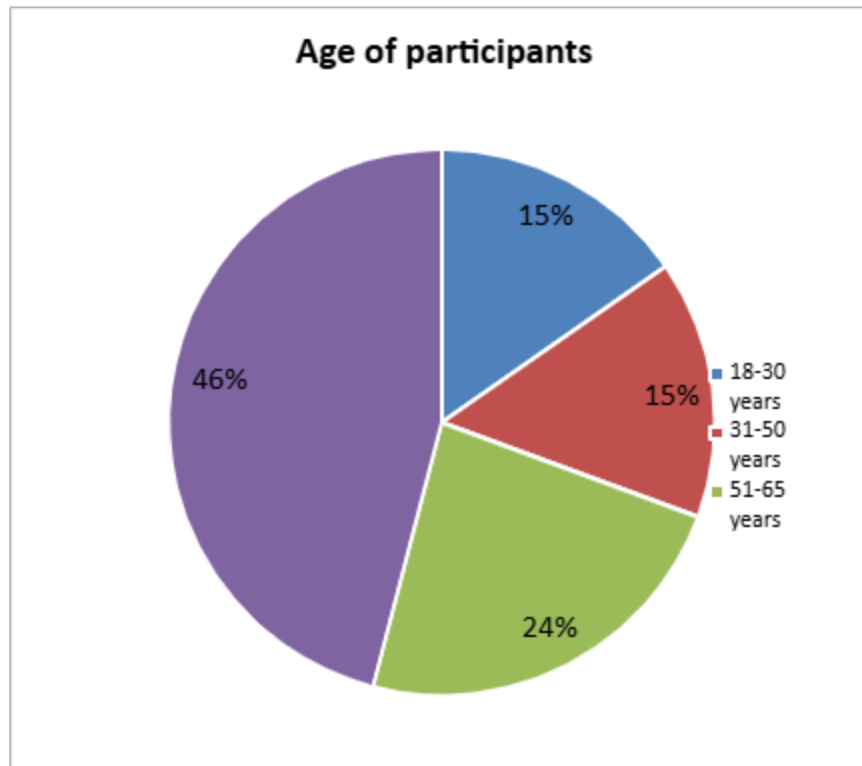


Figure 303: Age of participants who contributed to health and lifestyle data

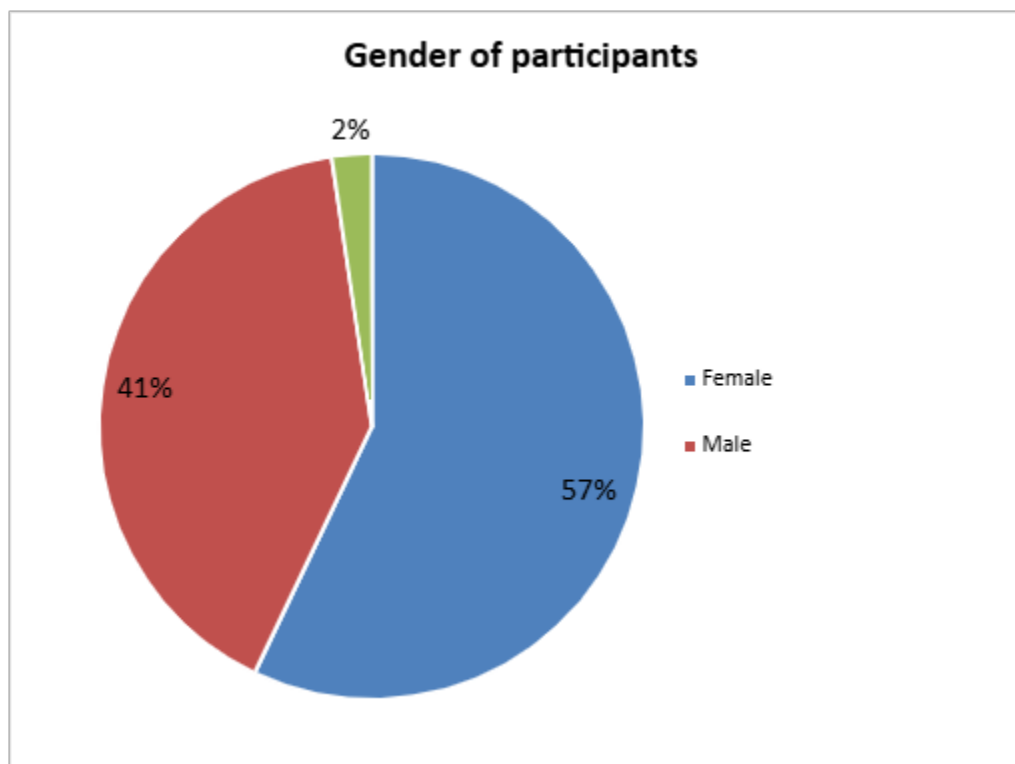


Figure 304: Gender of participants who contributed to health and lifestyle data

Challenge 10

KPI 10.1 No. of jobs created; gross value added (Direct Impact)

Expected Impact: Increased job opportunities

VS(s): 1-3,2,4,5

Evaluation Method: Pre & Post

Type	Description	Duration	No. of created jobs
Direct jobs (paid by VARCITIES)	Olevodroom manager (0,5) + production (0,5)	2 years	2 x 0,5 pers.
	Nina communication (0,4)	1 year	1 x 0,40 pers.
	Artist design & implementation of Olevodroom	6 months	5 pers.
	Youngsters participated in the construction lab	16 workdays in total	approximately 18 pers.
	Gaultier (Youngster) production during activities	3 months – 1 day a week	1 pers.
	Jan (sound + light technician)	3 months – 1 day a week	1 pers.
Indirect jobs	Artists who performed in the events held in the Olevodroom	day's pay	for approximately 260 pers. (estimated : 130 activities with +/- 2 pers. = 260 pers.)
	Leuven Pilot Team	5 years (VARCITIES project duration)	Total = 20%?= 0,2 persons
	Staff working at the Olevodroom bar	2 years - 4 days a week	2 pers.

Table 185: No. of jobs created in Leuven

KPI 10.5 Definition of parameters for (re)designing of green public spaces based on the well-being of users (Direct Impact)

Expected Impact: Definition of parameters for (re)designing green public spaces based on the well-being of users

VS(s): 1-3

Evaluation Method: Pre & Post

- Flexibility and Adaptability
 - Emphasize lightweight, modular, and temporary structures that can be easily relocated, repurposed, or upgraded to meet the changing needs of the community.
 - Design for adaptability to engage diverse groups across adjacent neighbourhoods and accommodate evolving community dynamics.
 - Avoid permanent, heavy constructions to safeguard green spaces and maintain ecological integrity.
 - Favour solutions that simplify permit processes, reducing bureaucratic hurdles.
- Diverse Space Provision
 - Create a mix of open and sheltered areas to support a variety of activities while accommodating different weather conditions and user preferences.
- Multifunctionality
 - Implement an open-plan layout that facilitates a broad range of events and activities, such as cultural performances, exhibitions, recreational workshops, and social gatherings, fostering a vibrant, multifunctional community space.
- Accessibility and Inclusivity
 - Prioritize universal accessibility, ensuring all individuals, regardless of age or ability, can fully engage with the space.
 - Incorporate inclusive design features to reflect and celebrate the diversity of the community.
- Circularity in Construction
 - Utilize sustainable, reusable, and recyclable materials to minimize waste and environmental impact.

- Design with disassembly in mind, enabling components to be reused or repurposed in future projects.
- Incorporate renewable energy sources and water management systems to enhance ecological sustainability.
- Community Involvement
 - Actively engage the local community in the design and implementation process to ensure the space reflects their needs and aspirations.
 - Facilitate workshops, co-creation sessions, and participatory planning to foster a sense of ownership and connection among users.
 - Encourage ongoing community stewardship to maintain and evolve the space over time.

The evaluation method is grounded in the WHO Healthy Cities framework, using five core categories: Environmental Quality, Health & Wellbeing, Social Determinants of Health, Built Environment, and Governance & Participation. These categories were selected to ensure a holistic and balanced assessment of urban interventions, covering both physical infrastructure (e.g. green space, mobility, zoning) and social systems (e.g. equity, inclusion, participation). Each intervention parameter is mapped using a binary alignment matrix, enabling structured visual comparison. To complement this, a qualitative weighted scoring system is applied to thematic groups of parameters (e.g. air quality, accessibility). The score out of 10 reflects performance across four criteria:

- Coverage (30%): how comprehensively the theme addresses its dimension; Alignment with
- WHO Healthy City principles (30%): how closely it reflects international standards and evidence;
- Implementation Potential (20%): how realistic and scalable the measures are in practice; and
- Transformative Impact (20%: the extent to which the measures drive long-term, systemic change. This combined approach enables consistent, transparent comparison across pilot cities while maintaining focus on health, equity, and sustainability outcomes.

Parameter	Environmental Quality	Health & Well-being	Social Determinants	Built Environment	Governance & Participation
Flexibility and Adaptability	✓		✓	✓	
Diverse Space Provision	✓	✓	✓	✓	
Multifunctionality	✓	✓	✓	✓	
Accessibility & Inclusivity	✓		✓	✓	✓
Circularity in Construction	✓			✓	✓
Community Involvement		✓	✓		✓

Table 186: Leuven parameters

To evaluate these urban design parameters, we grouped them into themes reflecting their purpose and impact (e.g. Spatial Resilience, Social Equity, Circular Urbanism, Governance & Participation). For each parameter we explain its relation to Healthy Cities concepts (drawing on WHO frameworks and related models) and give an alignment score (0–10). We then summarize alignments in a matrix against the five WHO dimensions: Environmental Quality; Health & Well-being; Social Determinants; Built Environment; Governance & Participation.

1. Spatial Resilience

Flexibility and Adaptability (Spatial Resilience): Flexible, adaptive design enables cities to respond to changing environmental and social conditions, a cornerstone of urban resilience. For example, modular infrastructure or mixed-use zoning allow rapid reconfiguration (e.g. converting streets or buildings for new uses) as community needs evolve. This aligns with WHO’s definition of a healthy city that “continually creates and improves its physical and social environments”. Flexible design thus supports environmental quality (e.g. climate adaptation), a robust built environment, and ultimately protects health by preserving services during shocks.

Alignment Score: 8/10

Multifunctionality (Spatial Resilience): Creating spaces and buildings that serve multiple functions maximizes urban efficiency and health benefits. Mixed-use developments integrate residential, commercial and recreational uses, reducing car dependence and making cities more walkable. In green infrastructure, multifunctionality (combining recreation, habitat, stormwater management, etc.) “maximizes the potential health benefits for the greatest number of individuals,” by catering to physical activity, social interaction and nature exposure simultaneously. This reflects WHO and SDG11 goals of integrated environments for well-being. Multifunctional design thus advances environmental quality and social determinants (by serving diverse needs) while enhancing the built environment’s flexibility.

Alignment Score: 8/10

2. Social Equity and Inclusion

Diverse Space Provision (Social Equity): Providing a mix of public spaces (parks, plazas, community centres, etc.) fosters social inclusion and equity. As one URBACT analysis notes, well-designed public spaces “have the transformative potential to foster social cohesion, enhance quality of life, and support sustainable urban living,” contributing to “healthier, more equitable cities”. WHO echoes this by calling for “an accessible social, physical and cultural environment” that enables health. Diversity in space (catering to different ages, cultures and activities) addresses social determinants by ensuring all groups have amenities, and supports mental and physical health through recreation and social interaction. The EU’s New European Bauhaus also emphasizes that built environments must be “not only sustainable, but also inclusive”.

Alignment Score: 9/10

Accessibility and Inclusivity (Social Equity)

Ensuring that everyone—regardless of age, ability or income—can access housing, transportation, parks and services is central to WHO’s vision. Healthy Cities promote “inclusion, integration and non-discrimination” with “access for all to common goods and

services”. Universal design (ramps, multilingual signage, affordable transit, etc.) and inclusive policies remove barriers in the built environment. This directly improves social determinants (equitable access to jobs, education, care) and health outcomes (everyone can use healthcare, recreation, etc.). For example, URBACT stresses that public spaces should be “accessible to all citizens and not create discrimination”.

Alignment Score: 10/10

3. Circular Urbanism

Circularity in Construction (Circular Urbanism): Designing buildings and infrastructure for reuse, recycling and minimal waste addresses environmental sustainability. This aligns with WHO Healthy Cities’ emphasis on sustainability: European Healthy Cities call for “investment in the circular economy” as part of urban prosperity, and WHO Europe links green transition with “circular economies”. Circular construction (e.g., using recycled materials, designing for disassembly) reduces pollution and resource use, improving air and soil quality. It also promotes safer building materials and resilient supply chains, benefiting health and built environment quality

Alignment Score: 7/10

4. Governance and Participation

Community Involvement (Governance & Participation): Engaging residents in planning and decision-making is a hallmark of healthy cities. WHO emphasizes participatory governance: healthy cities “lead by example” with community involvement in decisions about local environments and services. This empowers populations, builds social capital, and ensures policies meet real needs. For instance, community-led design of a park or participatory budgeting for transit increases trust and well-being. Participation also ties to health: WHO notes that participatory governance can be “transformational for health and health equity”.

Alignment Score: 9/10

KPI 10.6 Replication of solutions

Expected Impact: High replication potential of Visionary Solutions (Direct Impact)

VS(s): 1-3

Evaluation Method: Co-evaluation

The graphs below present the number of responses regarding the replicability of various solutions.

- The urban living room intervention (mobile) and data collection (VS1) is perceived as moderately replicable, with 34 responses in this category, followed by high replicability (17), indicating some adaptability depending on the context.
- On the other hand, the IoT infrastructure for smart lighting and noise measurements (VS2) shows a high potential for replicability, with 32 responses rating it as highly replicable and an additional 16 as very highly replicable, suggesting that this solution is widely seen as scalable and suitable for implementation in other contexts.

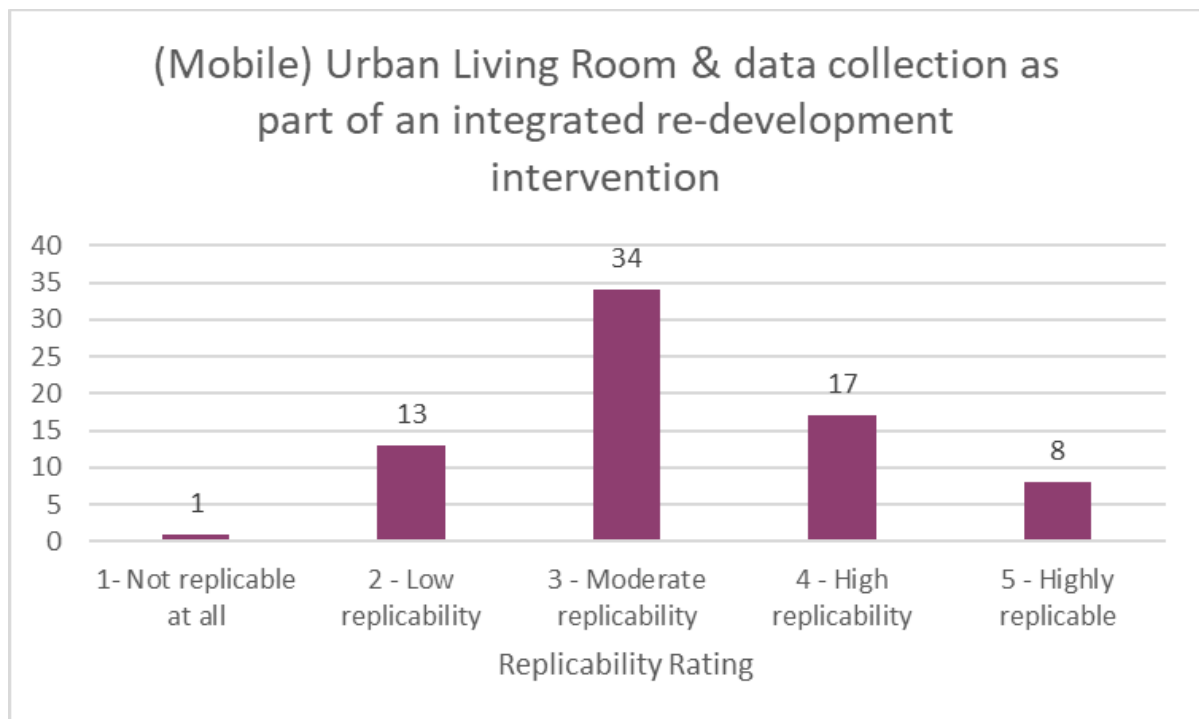


Figure 305: Leuven VS Group 1 replication potential

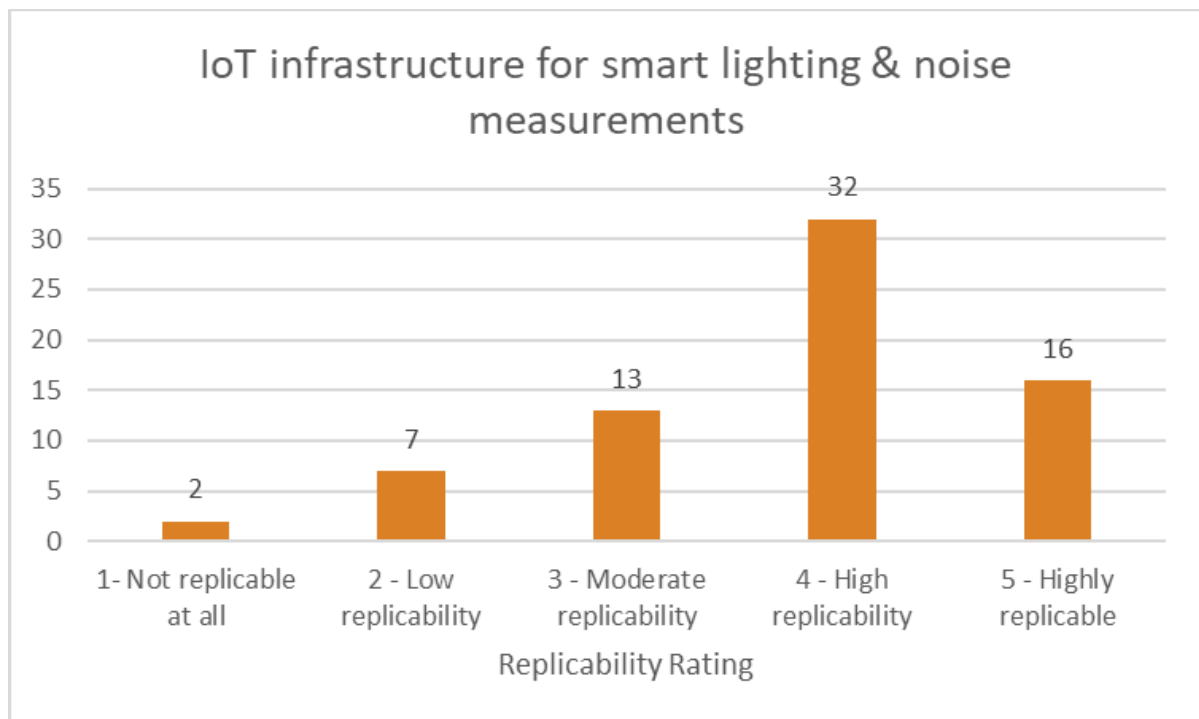


Figure 306: Leuven VS Group 2 replication potential

KPI 10.8 Saved healthcare spending

Expected Impact: Savings in healthcare spending (Direct Impact)

VS(s): 1-3

Evaluation Method: Pre & Post

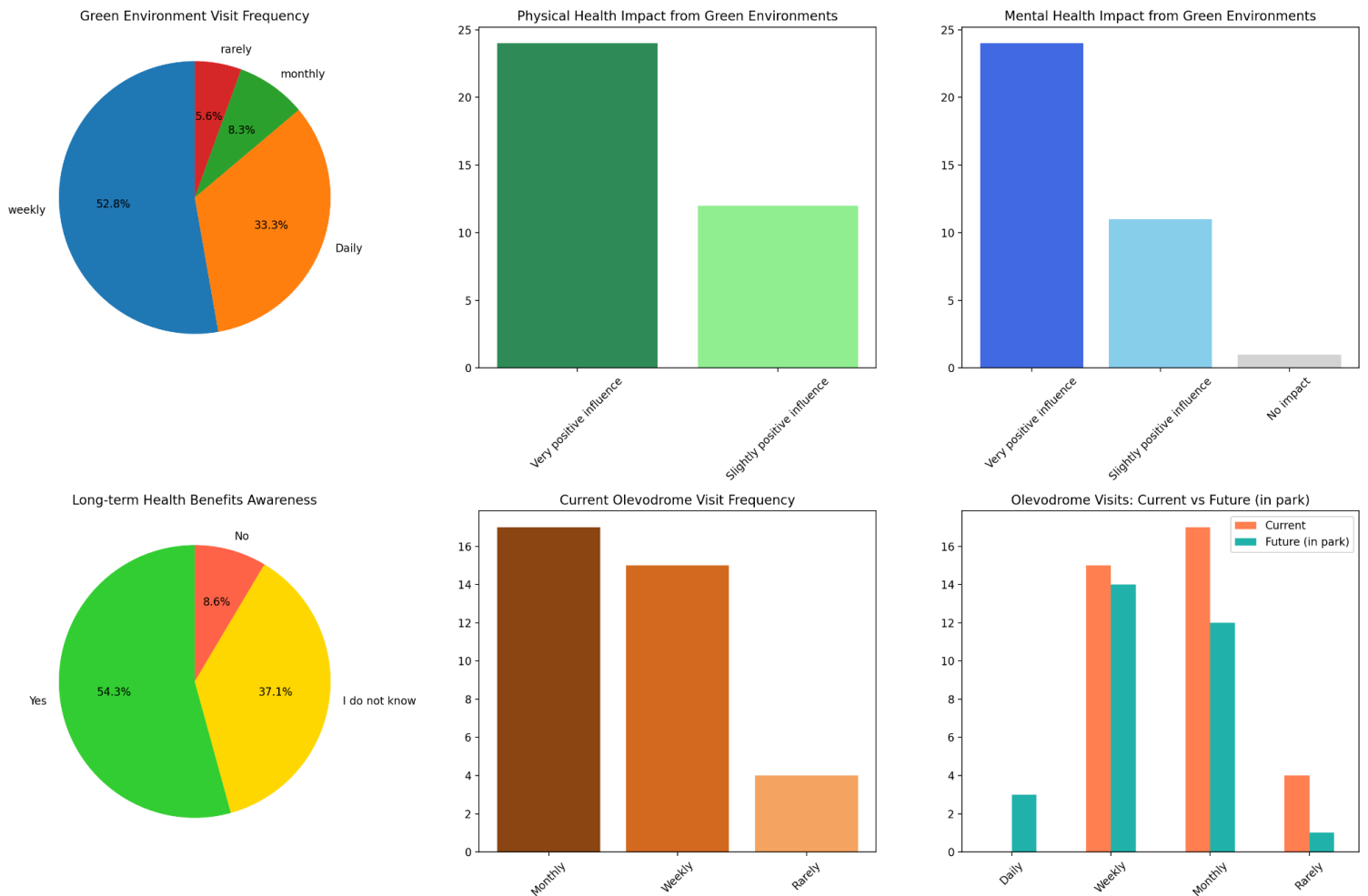


Figure 307: Health benefits and visitor frequency in Leuven

This survey examined the relationship between green environment access and health outcomes among 36 residents of Leuven, Belgium. The study focused on general green space usage patterns, health impacts, and specific experiences with the Olevodrome facility, both in its current location and projected future park setting.

Green Environment Usage Patterns

The survey revealed high engagement with green spaces among Leuven residents. The majority (86%) visit green environments at least weekly, with one-third visiting daily. This demonstrates strong community connection to natural spaces and suggests green environments are integral to residents' daily routines.

Health Impact Assessment

Participants reported overwhelmingly positive health outcomes from green environment visits:

Physical Health: 100% of respondents experienced positive impacts (67% very positive, 33% slightly positive)

Mental Health: 97% reported positive mental health effects (67% very positive, 31% slightly positive)

Long-term Benefits: Over half (53%) confirmed experiencing lasting health benefits, with common themes including stress reduction, mental tranquillity, physical activity, and overall wellbeing enhancement.

Olevodrome Facility

The Olevodrome, currently situated on a vacant lot, shows strong community engagement with 89% visiting monthly or weekly. Current health impacts are notably positive for mental health (47% very positive impact) and moderately positive for physical health (19% very positive, 42% slightly positive). When asked about the Olevodrome's planned relocation to a park setting, respondents indicated similar visit frequency expectations. Interestingly, the projected health impacts show mixed results - while physical health benefits may slightly improve, mental health benefits might not see substantial enhancement, suggesting the current location already provides significant therapeutic value.

KPI 10.9 Public & private investments during/after the project

Expected Impact: Increased public/private investments (Direct Impact)

VS(s): 1-3

Evaluation Method: Pre & Post

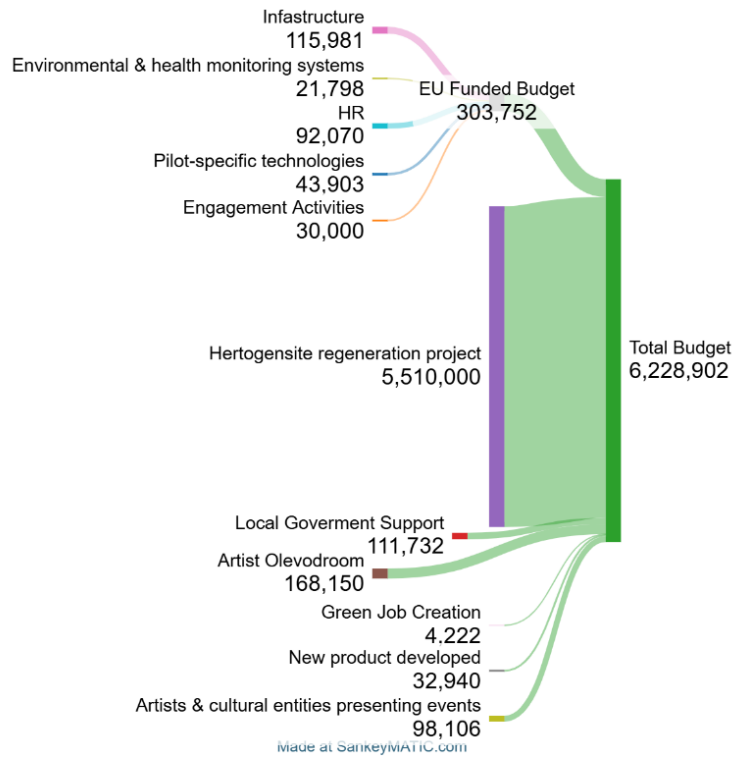


Figure 308: Current public & private investment in Leuven

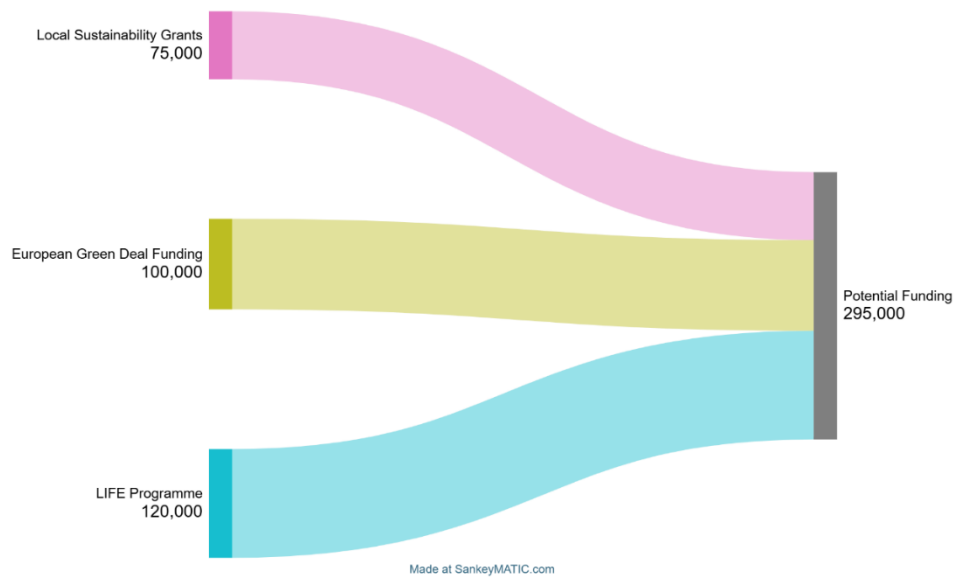


Figure 309: Future public & private investment in Leuven

A2.6 Novo Mesto

Challenge 1

KPI 1.1 C removed/stored by vegetation

Expected Impact: Increased (data on) carbon storage in and sequestration by vegetation (Added value)

VS(s): 1

Evaluation Method: Pre & Post

The graph below shows the amount of carbon sequestered per year in the Novo Mesto pilot site. The pre-implementation phase corresponds to the years 2022 and 2023, with 112 and 113 tonnes respectively. After the intervention, in 2024, the previous years' values of sequestered carbon were maintained, with values close to 113.8. The exact calculations related to the amount of carbon sequestered per tree per year have been described in the methodological report for KPI 1.1 (Section 6).

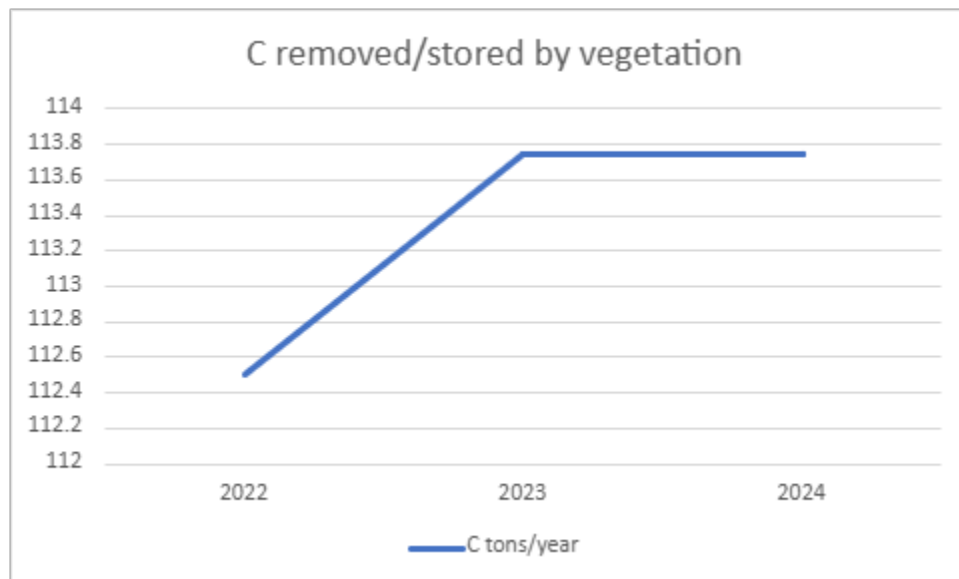


Figure 310: Carbon sequestration in Novo Mesto

KPI 1.3 Measures of human comfort

Expected Impact: Increased temperature data on human comfort (Added value)

VS(s): 2,5

Evaluation Method: Benchmarking

Similarly, to the Castelfranco calculations, PET in Novo Mesto is being measured using the following constants: body weight/height of 75 kg/1.75 m for male body, clothing level of 0.9, standing position. The outdoor thermal comfort range for Novo Mesto is also being considered for temperatures between 24°C – 29°C, and other central European cities in general.

The graph below shows PET calculations during 31/1/2023 - 31/12/2023. The readings were taken every day during this period.

The blue line represents the daily PET values, while the orange lines indicate the outdoor thermal comfort range defined between 24 °C and 29 °C. Throughout the measurement period, the upper limit is frequently exceeded, coinciding with the warm months, while in the cold months the values fall significantly below the range, even reaching negative values.

Only in a short period PET values remain within the comfortable range, which is evidence that most of the year the inhabitants of Novo Mesto are exposed to thermally uncomfortable conditions.

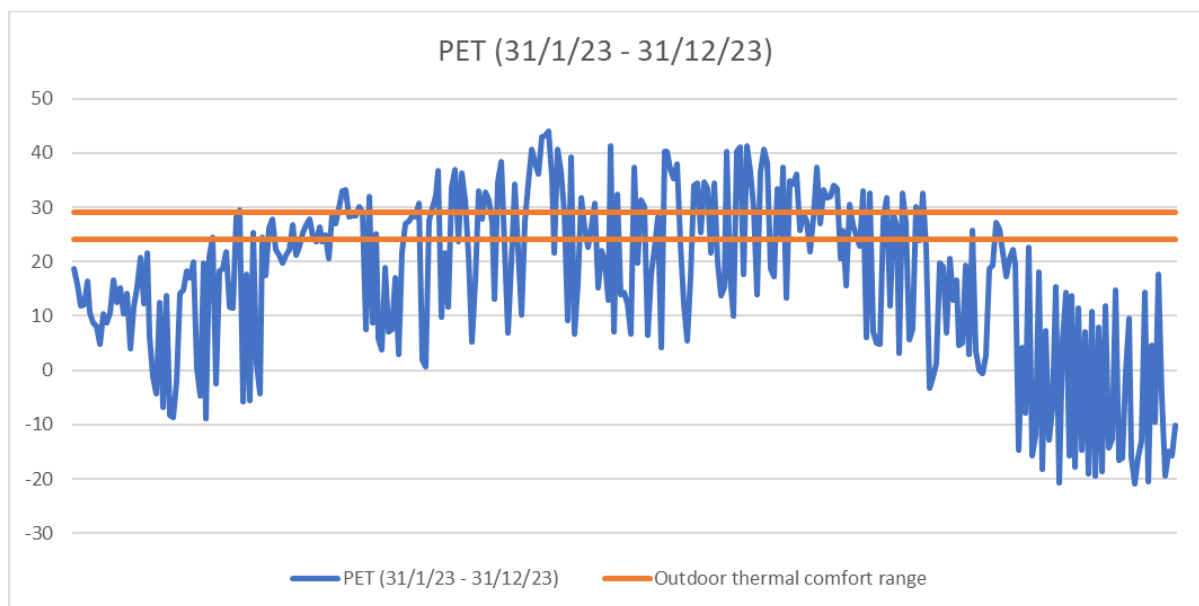


Figure 311: Thermal Comfort in Novo Mesto

Challenge 4

KPI 4.2 Accessibility of urban green spaces for population

Expected Impact: Increased accessibility of urban green spaces (Direct Impact)

VS(s): 2

Evaluation Method: Pre & Post

The table below outlines the pre-implementation and post-implementation results in the Novo Mesto pilot site, showing the difference in distance and travel time from the old town main square in Novo Mesto to the site on foot and by bus. The difference in distance is of 876 Kilometres, situating the implementation site nearer to the population centre. When comparing, the travelling time by bus is still 30 minutes, however the walking distance has decreased by 9.18 minutes. The percentage calculation for the decrease in walking time is that of 16.9% for citizens, making the pilot site more accessible on foot.

Pre & Post Implementation	Km	Min. on foot	Min. by bus
Before	5.168	54.17	30
After	4.292	44.99	30

Table 187: Distance & travel time to green space in Novo Mesto

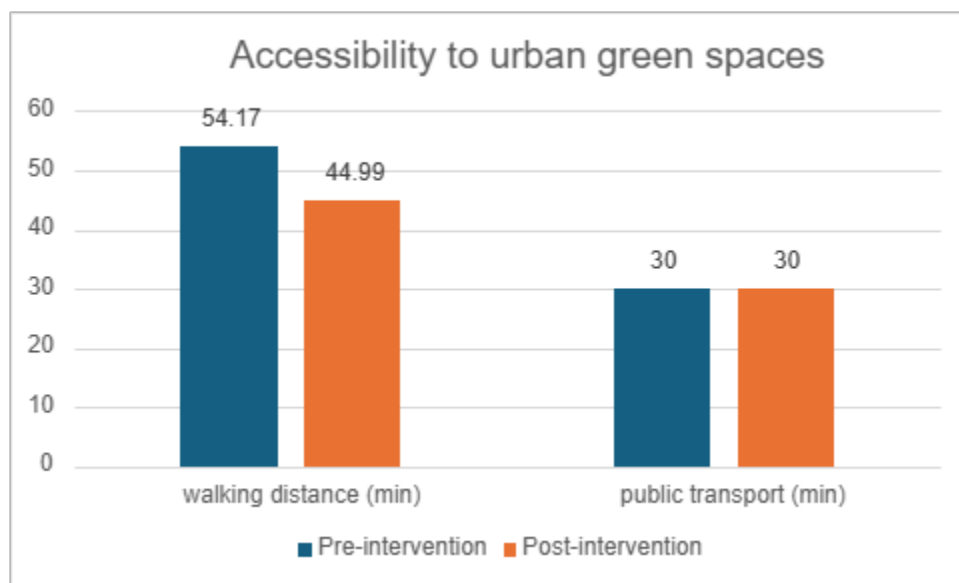


Figure 312: Accessibility to urban green spaces

The maps below illustrate the distance being reduced by 1 meter following the opening of a new pedestrian bridge.



Figure 313: Green space accessibility map 1 (Novo Mesto)



Figure 314: Green space accessibility map 2 (Novo Mesto)

KPI 4.3a Recreational or cultural value of green spaces (number of visitors)

Expected Impact: Increased recreational and cultural value of green spaces (Direct Impact)

VS(s): 2

Evaluation Method: Pre & Post

The bar chart below shows the number of visitors recorded at the facilities in 2023 and 2024 with a significant increase of 64,867 in 2024. Visitor tracking sensors were used to measure the number of people who frequented the pilot site in general, and therefore not only for attending events. The measurements are being taken at various points as indicated in the methodology description for KPI 4.3b.

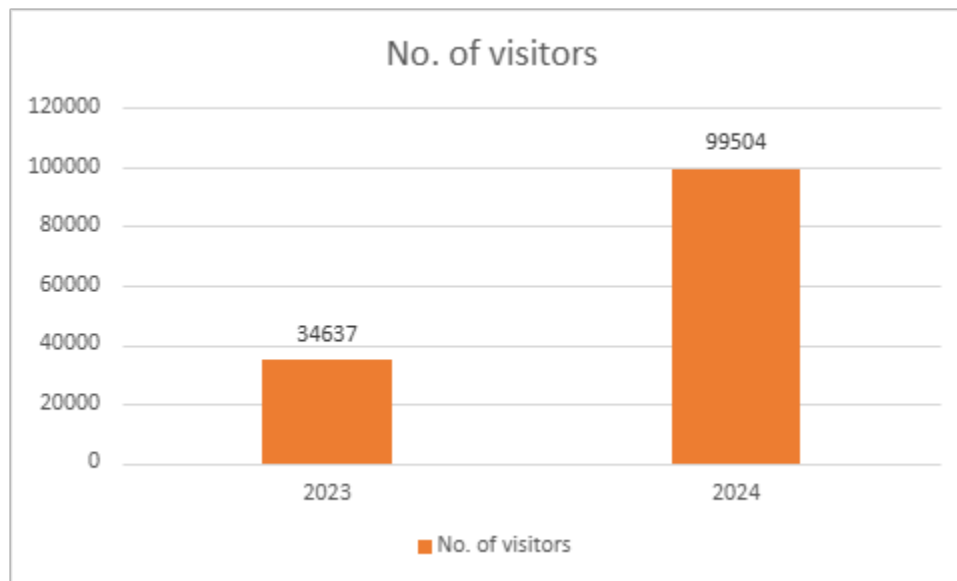


Figure 315: No. of visitors in green spaces in Novo Mesto

KPI 4.3b Recreational or cultural value of green spaces (activities in green spaces)

Expected Impact: Increased recreational and cultural value of green spaces (Direct Impact)

VS(s): 2

Evaluation Method: Pre & Post

The bar chart below shows the number of activities organised in green spaces by the Equestrian Centre and the Institute for Sports, Culture, Tourism, and Youth of Novo Mesto. Some of the events organised were Youth Friendship games, cycling championships, swimming courses, senior-specific exercises, competitions and much more. The number of activities increased with the opening of the forest trail.

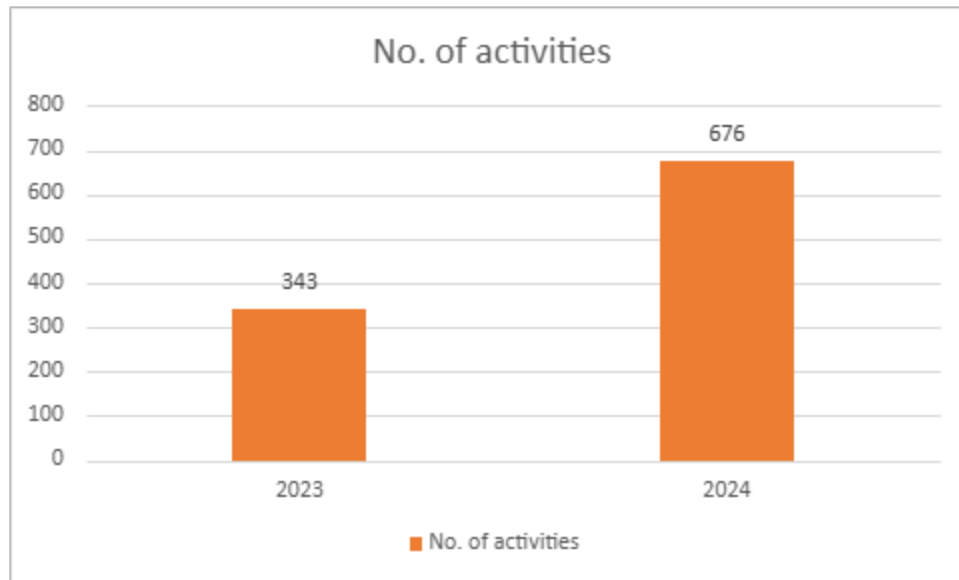


Figure 316: No. of activities in green spaces in Novo Mesto

KPI 4.4 Weighted recreation opportunities provided by Urban Green Infrastructure

Expected Impact: Increased weighted recreation opportunities provided by Urban Green Infrastructure (Direct Impact)

VS(s): 2

Evaluation Method: Pre & Post

KPI 4.4 is taking into consideration the share of activities organised at the pilot site to determine any increase in recreational opportunities created by green spaces. The percentage of recreation opportunities provided by Urban Green Infrastructure in Novo Mesto is 47.37%.

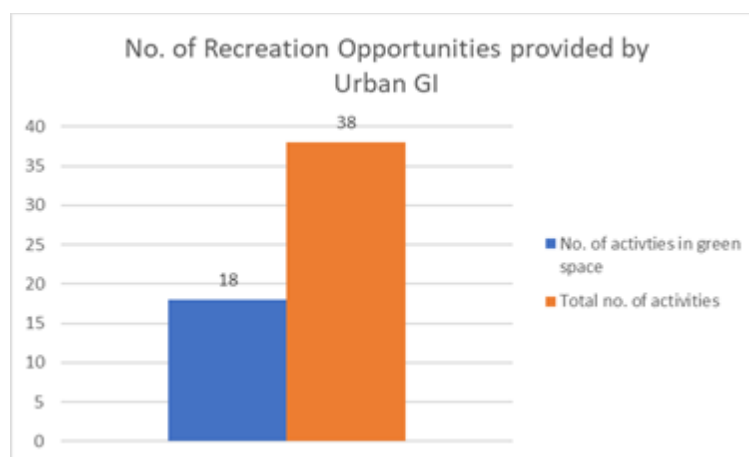


Figure 317: No. of recreation opportunities provided by urban GI in Novo Mesto

KPI 4.5 Nature based recreation opportunities

Expected Impact: Increased Nature Based recreation opportunities (Direct Impact)

VS(s): 2

Evaluation Method: Pre & Post

A list of different Nature-based recreation activities was developed to show the various opportunities offered by the pilot site to the general public.

List of Nature-based recreation opportunities provided in the pilot site
Cycling on Velodrome
Outdoor Motoric Park
Horseback riding
Outdoor Sensoric park
Swimming in pool
Forest Path

Table 188: Nature-based recreation opportunities in Novo Mesto

KPI 4.7 Green related social service provided to the population

Expected Impact: Increased Green-related social service provided to population (Direct Impact)

VS(s): 3

Evaluation Method: Pre & Post

The data shows a detailed distribution of green spaces in a pilot area, with a focus on usable and improved areas:

Usable areas for residents include 6,800 m² comprising lawns, footpaths and playgrounds, and 3,000 m² of forest trails. Unimproved areas cover 37,700 m², which are natural spaces without infrastructure. On the other hand, the improved areas include 6,300 m² of parking, 22,600 m² dedicated to an equestrian centre and 4,000 m² of swimming pool.

There is a noticeable improvement in the value-added factors, which are evaluated before and after the intervention on a scale of 1 to 5, with 1 being the worst condition and 5 the best condition.

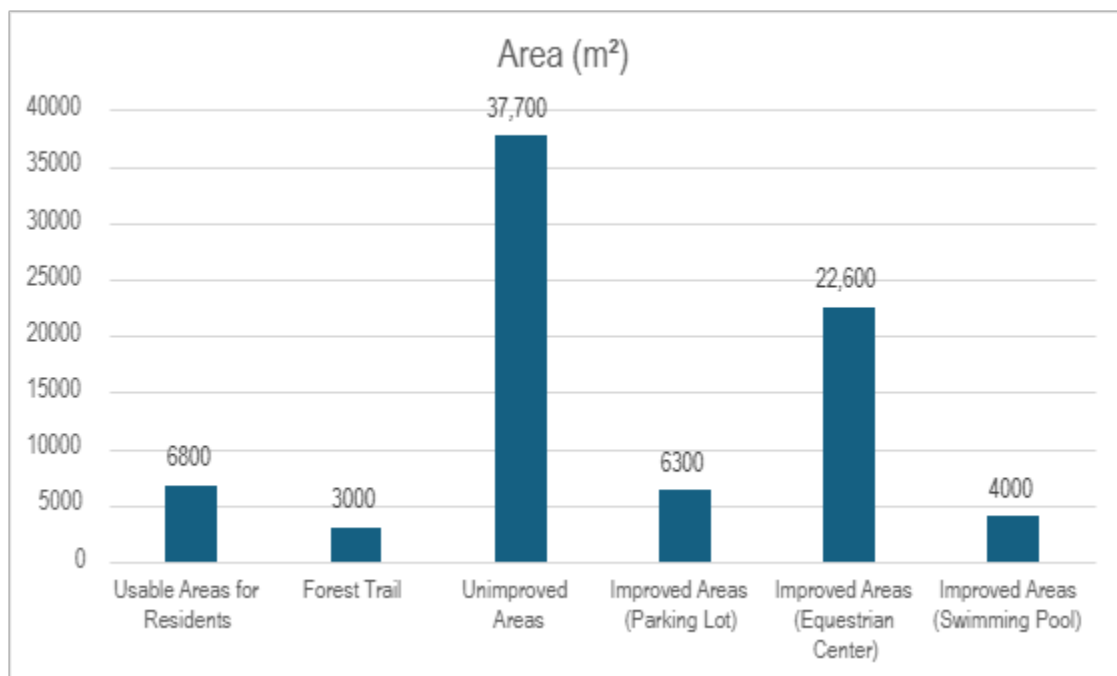


Figure 318: Green related social service provided in Novo Mesto (area)

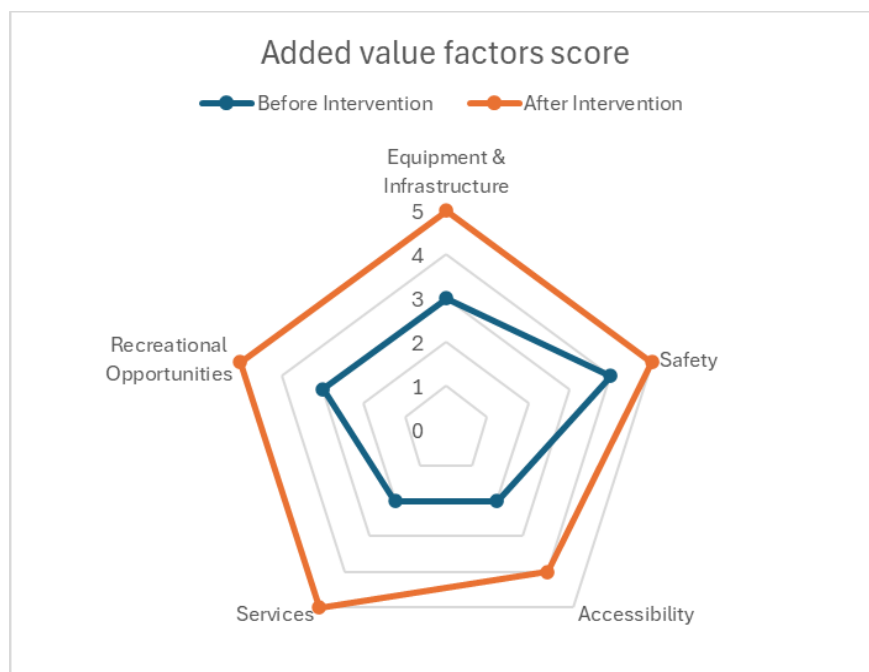


Figure 319: Green related social service provided in Novo Mesto (factors score)

KPI 4.14b Increased connectivity to sports facilities

Expected Impact: Increased connectivity to sports facilities (Direct Impact)

VS(s): 2, 3

Evaluation Method: Pre & Post

The connection between the swimming pool and the equestrian centre has been significantly improved with the opening of a sustainable forest path, reducing the distance from 1,002 metres to 355.67 metres—a 64.6% increase in accessibility.

Challenge 5

KPI 5.5 Physical air quality indicators

Expected Impact: Increased (physical) air quality data (Added value)

VS(s): 1,5

Evaluation Method: Benchmark

The graphs show the monthly mean air temperature (°C) and relative humidity (%) recorded by four sensors (001, 003, 005 and 006) during a period from 2 August 2023 to

17 December 2024. A total of 30,899 (sensor 001), 32,663 (sensor 003), 31,323 (sensor 005) and 33,082 (sensor 006) data entries were collected.

The temperature distribution follows a seasonal pattern, with lower averages during the winter months and peaks in mid-summer. Relative humidity remained high throughout the year, generally ranging between 70% and 100%, with slightly lower values observed during the warmer months.

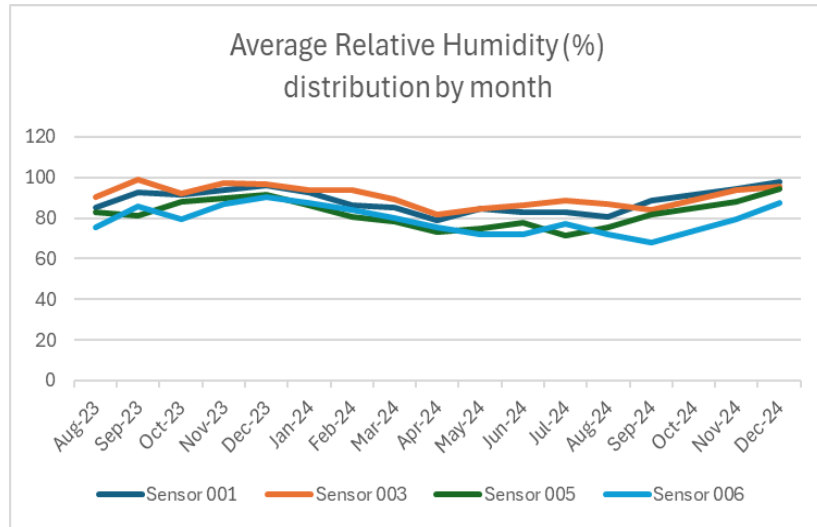


Figure 320: Average humidity in Novo Mesto (%)

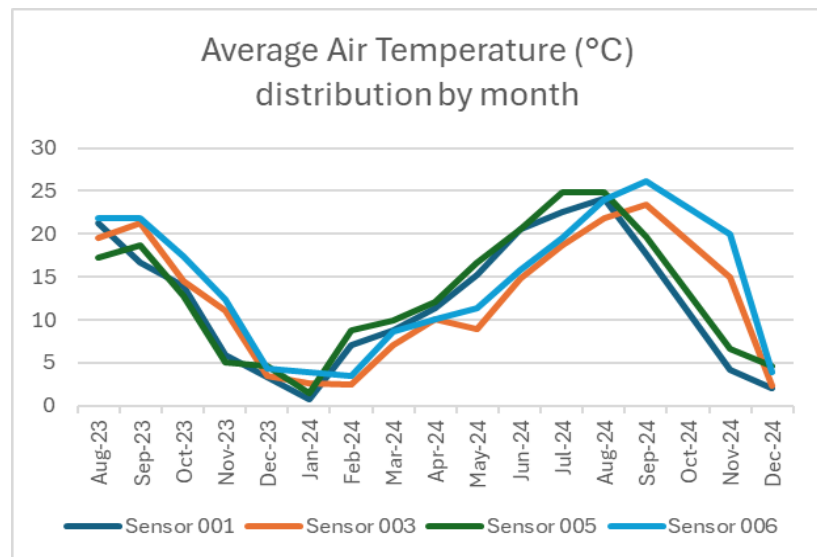


Figure 321: Average air temperature in Novo Mesto (°C)

KPI 5.6 Chemical air quality indicators

Expected Impact: Increased (chemical) air quality data (Added value)

VS(s): 1,5

Evaluation Method: Benchmark

The graph shows the daily average concentrations of PM2.5 (in purple) and PM10 (in green) measured in micrograms per cubic metre ($\mu\text{g}/\text{m}^3$) in two sensors, over a period from 20 December 2023 to 11 January 2025, during which 9272 (sensor 851) and 9261 (sensor 938) entries of data were collected. Peaks occurred during the cold months of the year.

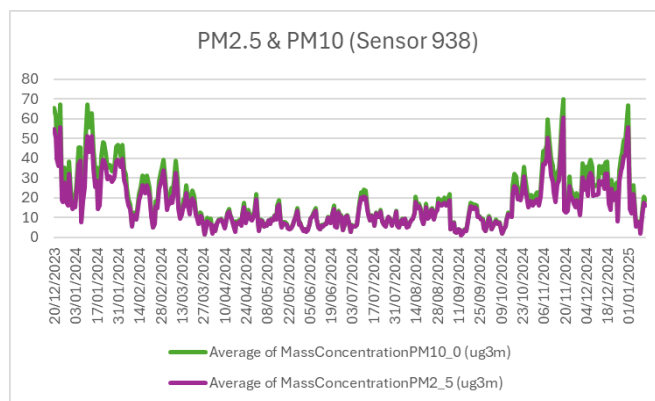


Figure 322: PM2.5 & PM10 (sensor 938) in Novo Mesto

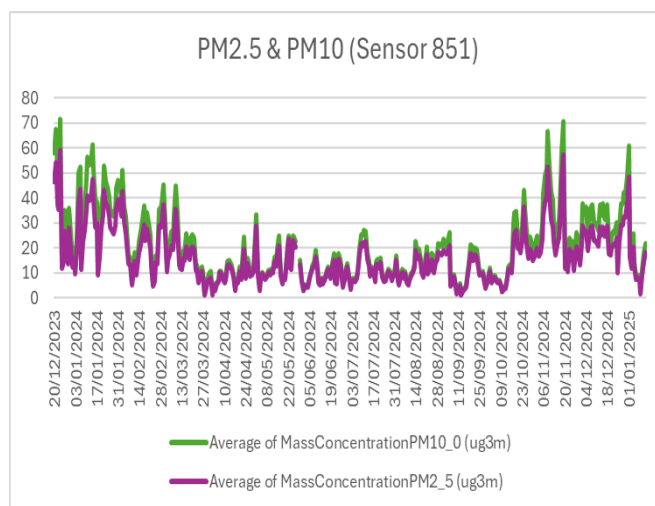


Figure 323: PM2.5 & PM10 (sensor851) in Novo Mesto

Challenge 6

KPI 6.4 Reclamation of contaminated land

Expected Impact: Increased reclamation of contaminated land (Direct Impact)

VS(s): 1

Evaluation Method: Pre & Post

Reclamation of contaminated land in the Novo Mesto pilot site has been fully successful. The VS implementation led to 100% of the area reclaimed, reaching the expected impact of KPI 6.4.

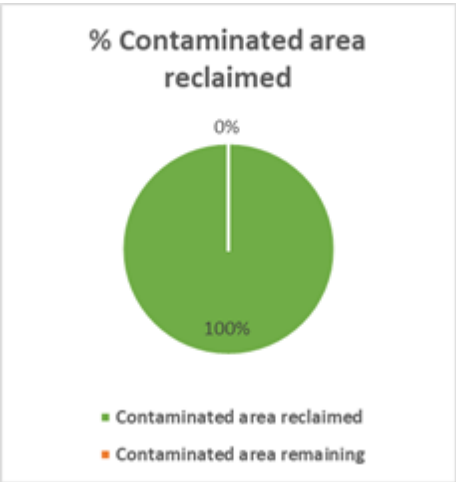


Figure 324: Contaminated Area Reclaimed in Novo Mesto

Area (m2)	
Contaminated area reclaimed	6,660m2
Total contaminated area	6,660m2

Figure 325: Contaminated area reclaimed in Novo Mesto

Challenge 7

KPI 7.4 Perceptions of citizens on urban nature

Expected Impact: Increased awareness of urban ecosystems (Direct Impact)

VS(s): 3,4

Evaluation Method: Co-evaluation

In questionnaires circulated in 2023 and 2024, respondents were asked, “What do you think about the Visionary Solutions of the VARCITIES project?” and rated their opinion on a scale from 1 to 5 (1 being very bad and 5 being very good). In 2023, out of 36 responses, the average score was 3.9, indicating a neutral to moderately positive perception. By 2024, with 42 respondents, the average score increased to 4.4, reflecting a more favourable view of the project's visionary solutions.

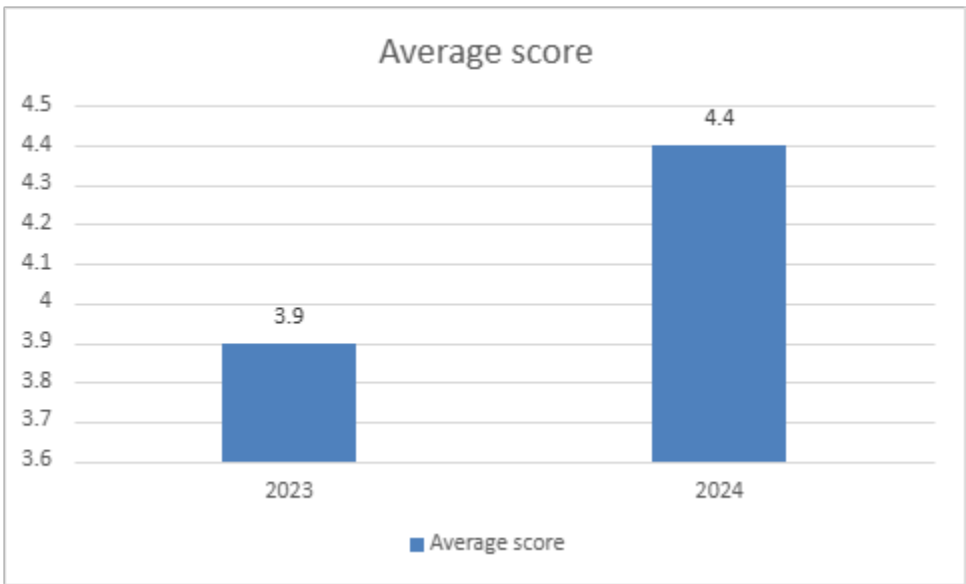


Figure 326: Perceptions of citizens on urban nature in Novo Mesto (average score)

When asked to rate the impact of the visionary solutions in achieving the expected results, 10% of the 29 respondents rated them as extremely effective, 53% as very effective, 27% as moderately effective, and 10% as slightly effective. Additionally, one respondent noted that similar solutions are needed.

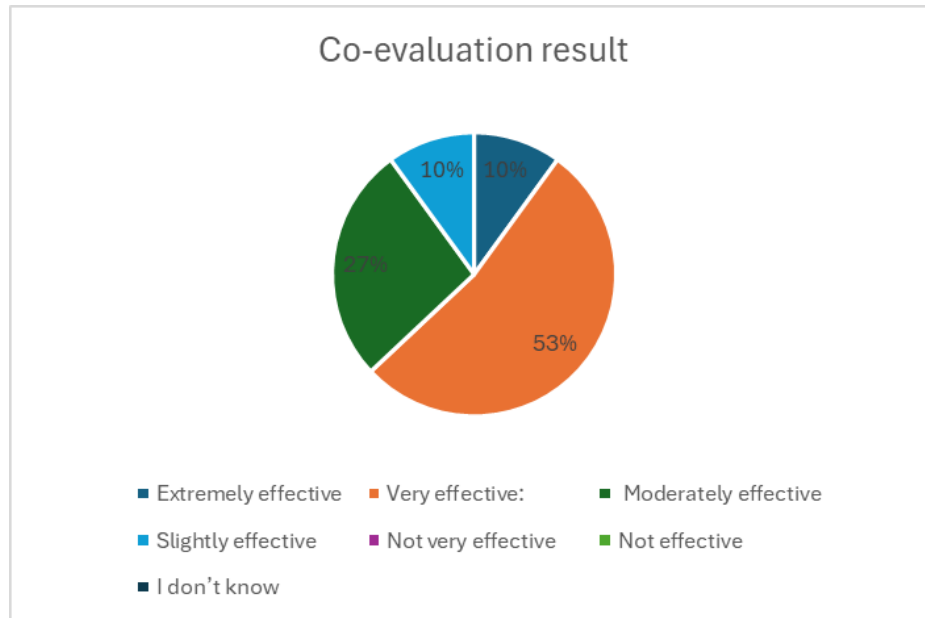


Figure 327: Perceptions of citizens on urban nature in Novo Mesto co-evaluation result

KPI 7.5 Social values for urban ecosystems and biodiversity

Expected Impact: Increased awareness of urban ecosystems (Direct Impact)

VS(s): 3, 4

Evaluation Method: Co-evaluation

This KPI was measured based on visitor participation in the facilities listed in KPI 4.5. In 2023, there were 34,637 visitors while in 2024, participation increased to 65,272, indicating a significant rise in engagement. This growth suggests increased awareness and appreciation of urban ecosystems, aligning with the expected impact of the initiative. Further analysis may consider trends across specific facilities and demographic insights to assess long-term behavioural shifts.

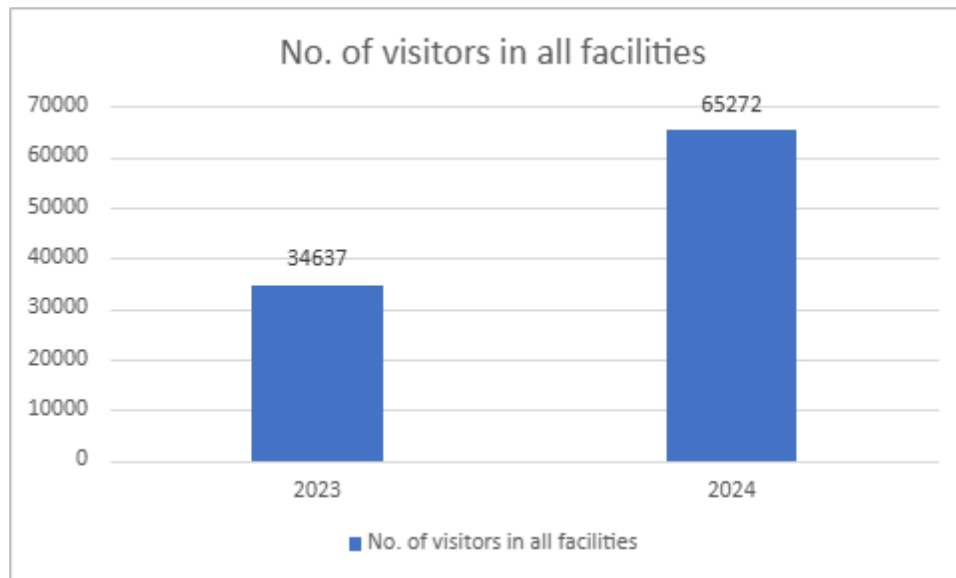


Figure 328: No. of visitors in all facilities in Novo Mesto

When asked to rate the impact of the visionary solutions in achieving the expected results, 25% of the 29 respondents rated them as extremely effective, 55% as very effective, 20% as moderately effective. Additionally, the respondents noted that “It is crucial to sustain these solutions even after the project concludes.” and that “It is crucial to ensure a high number of stakeholders in the future with continuous awareness efforts.

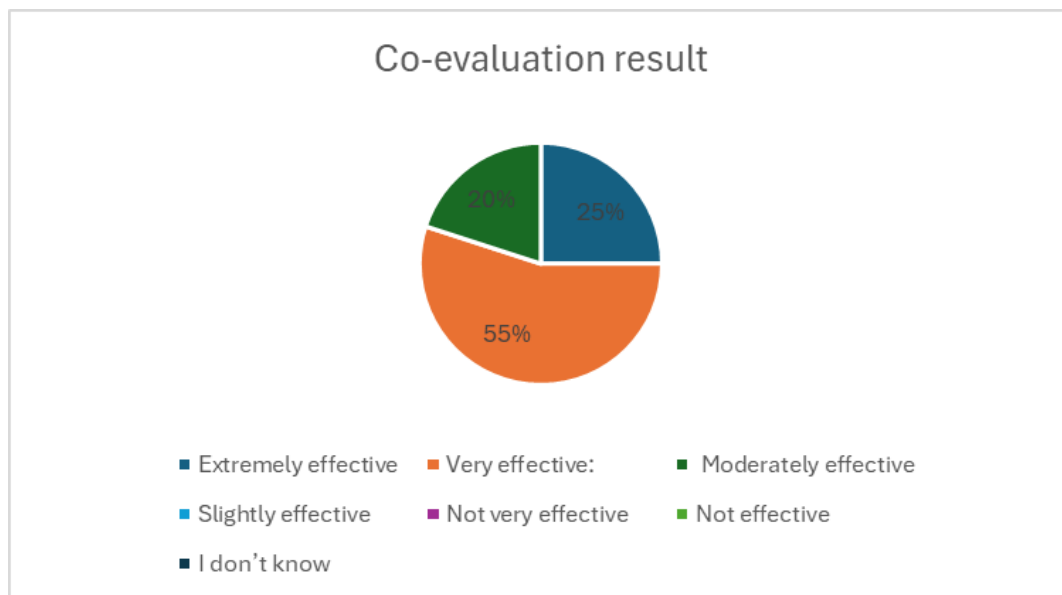


Figure 329: No. of visitors in all facilities in Novo Mesto co-evaluation result

KPI 7.6 Inter-departmental collaboration leading to NBS designs for multi-functionality

Expected Impact: Increased governance coordination for NBS (Direct Impact)

VS(s): 3

Evaluation Method: Co-evaluation

A total of 49 stakeholders participated in co-creation workshops with 12 stakeholders (24.5%) representing governance bodies. This level of participation indicates meaningful collaboration between different governance sectors and other stakeholders, supporting the objective of enhanced governance coordination in NBS planning and implementation.

Number of stakeholders in co-creation workshops	Number of stakeholders from governance	%
49	12	24.5

Table 189: Inter-departmental collaboration for NbS design in Novo Mesto

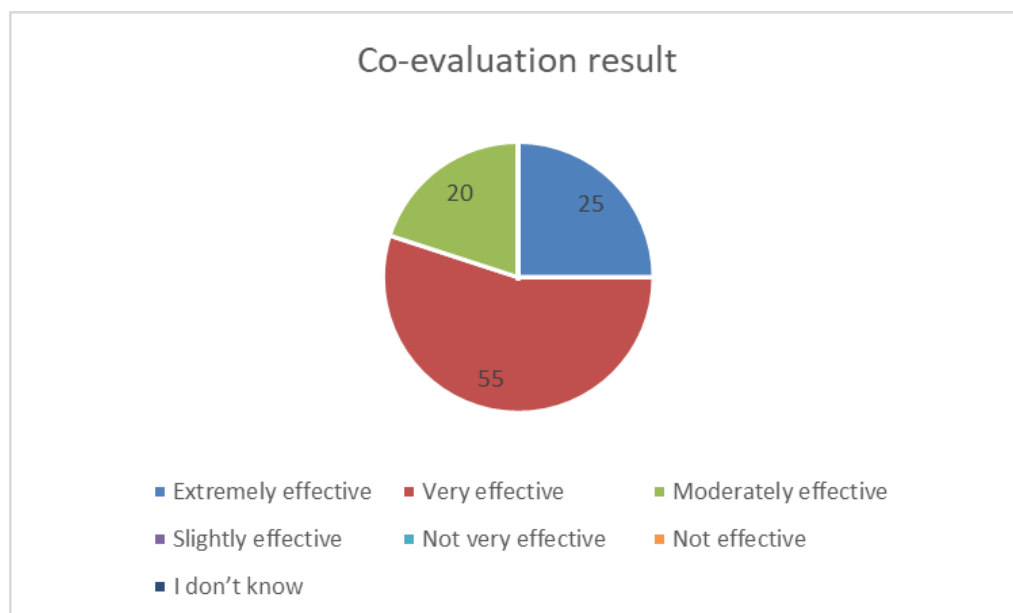


Figure 330: Inter-departmental collaboration leading to NBS designs for multi-functionality co-evaluation result

When asked to rate the impact of the visionary solutions in achieving the expected results, 8% of the 29 respondents rated them as extremely effective, 30% as very effective, 40% as moderately effective and 10% as slightly effective.

KPI 7.7 Improved coordination of NBS strategies within and across levels of governance

Expected Impact: Increased governance coordination for NBS (Direct Impact)

VS(s): 3

Evaluation Method: Pre & Post

To evaluate this KPI, two stakeholder surveys were conducted in 2023 and 2025. Participants were asked the following question: "How do you assess the impact of the NBS project on changes in rules and regulations in your municipality or region?"

Responses were measured on a Likert scale from 1 (no impact) to 5 (very high impact).

- In 2023, the average score was 3.0 based on feedback from 49 participants
- In 2025, the average score increased to 3.7 from 23 participants

KPI 7.8 Citizen participation in and co-creation of the design, implementation and evaluation of project interventions

Expected Impact: Increased and improved participation (Direct Impact)

VS(s): 3.4

Evaluation Method: Co-evaluation

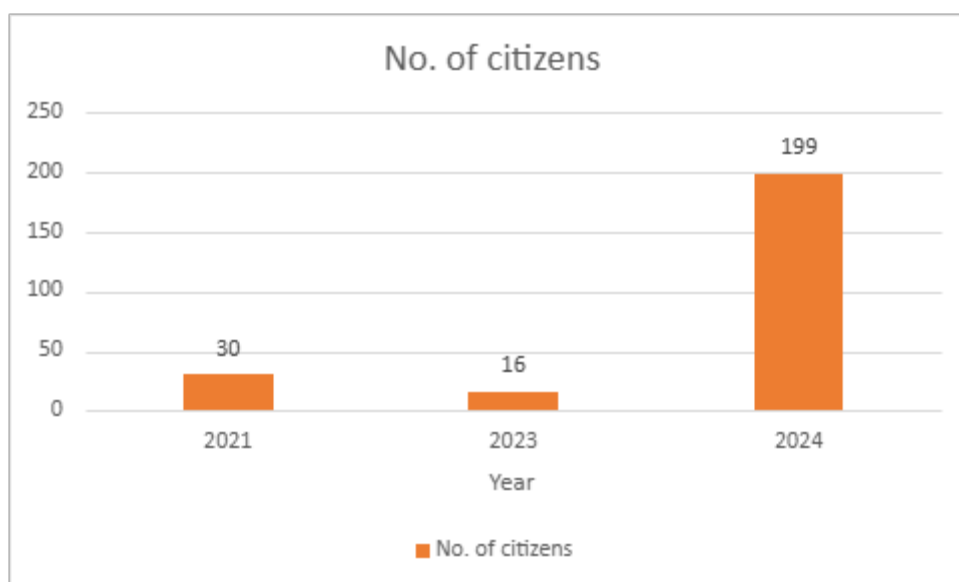


Figure 331: Total no. of citizens in activities in Novo Mesto

The evolution of the total number of citizens who have participated in activities organised in Novo Mesto is shown. In 2021, there was an attendance of 30 citizens, while in 2023 it decreased to 16 participants. However, by 2024 there is a significant increase in participation, with a total of 199 citizens.

When asked to rate how effective the result was in achieving the expected impact, 6% of the 29 respondents rated them as extremely effective, 62% as very effective, 27% as moderately effective, and 3% as slightly effective.

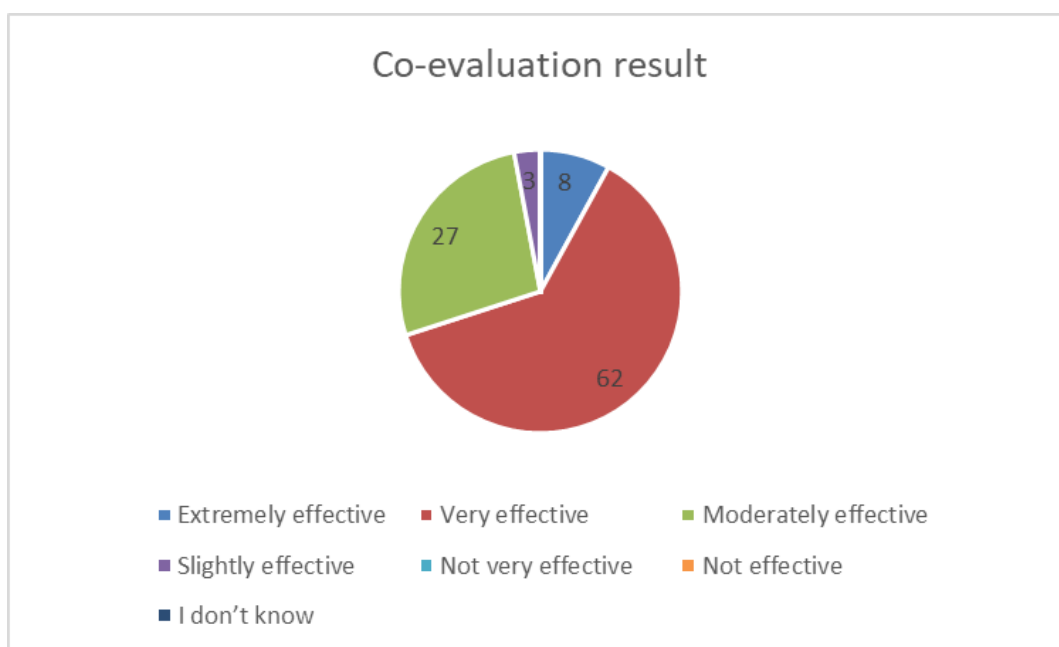


Figure 332: Citizens in activities in Novo Mesto co-evaluation result

KPI 7.9 Institutional learning concerning acquisition of knowledge and understanding

Expected Impact: Increased institutional capacity (Direct Impact)

VS(s): 3

Evaluation Method: Pre & Post

Participants were asked to rate the extent to which they were able to learn and contribute to discussions during stakeholder workshops, using a scale from 1 (not at all) to 5 (to a very great extent).

- In a 2023 workshop, the average score was 4.0, indicating a high level of perceived engagement and value.
- Across two workshops held in 2024, the combined average score was 3.6, suggesting slightly lower but still positive levels of participant learning and contribution.

KPI 7.11 Number of individuals that is aware of the project's objectives, content and processes

Expected Impact: Increased and improved participation (Direct Impact)

VS(s): 3

Evaluation Method: Pre & Post

The bar chart illustrates the total number of people reached through five digital platforms (Facebook profile of the Municipality of Novo mesto, Facebook profile of the Olympic Centre Novo mesto, Instagram profile of the Municipality of Novo mesto, Website of the Municipality of Novo mesto, and Website of the Olympic Centre Novo mesto) in relation to various events held.

The event with the highest reach was the Disabled Pool Lift, which stood out particularly on the Facebook profile of the Municipality of Novo mesto with 11,027 views, followed by the Facebook profile of the Olympic Centre Novo mesto with 1,920 views. This event achieved significant exposure across all platforms.

Regarding the platform with the greatest impact, the Facebook profile of the Municipality of Novo mesto consistently achieved the highest reach. The total of people reached was 46,485

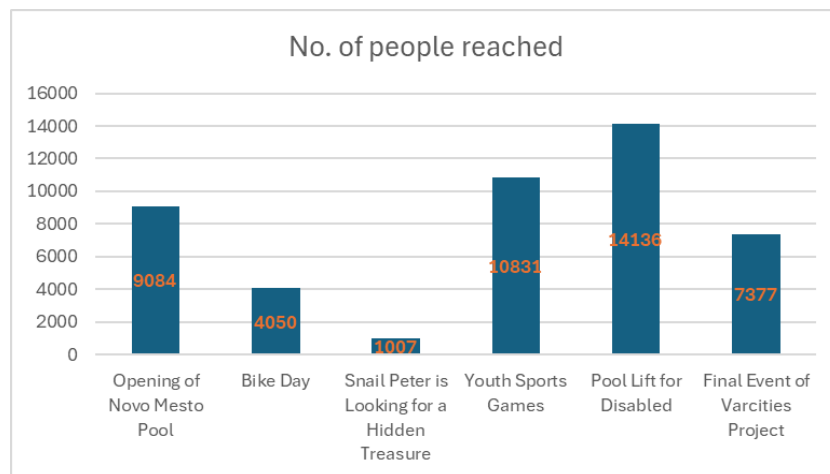


Figure 333: Total no. of People Aware of the Project in Novo Mesto

KPI 7.13 No of new information channels generated between public institutions & citizenship

Expected Impact: Fair participation to project activities (Direct Impact)

VS(s): 3

Evaluation Method: Pre & Post

The Novo Mesto Pilot recorded a total of 4 new information channels including:

- Installation of two public information screens at the Velodrome and the Swimming Pool and launch of a booking system in 2023
- Development and release of a digital platform: www.olimpijskicenter-nm.si in 2024

KPI 7.14 No civil society entities that have participated in the execution of the project in relation to the total of entities with presence in the neighbourhood

Expected Impact: Fair participation to project activities (Direct Impact)

VS(s): 3

Evaluation Method: Pre & Post

The Novo Mesto Pilot reported that 30 entities actively participated in the execution of the project, out of a total of 105 entities in the neighbourhood. This represents a participation rate of approximately 28.6%. This level of involvement indicates a moderate degree of local engagement and reflects the project's reach within the community.

Challenge 8

KPI 8.5 Personal and social background of people who participated in the project's activities

Expected Impact: Fair participation to project activities (Direct Impact)

VS(s): 3

Evaluation Method: Co-evaluation

The data below shows that 47.7% of responses come from the "31-50" age category, while 33.8% are from the "51-65" category. The "18-30" group accounts for 4.6%, and the "65+" group represents 2% of the total responses.

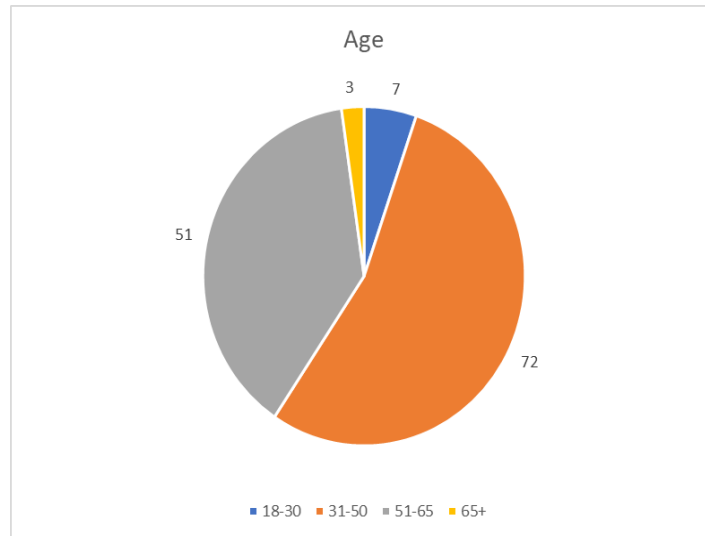


Figure 334: Age groups in Novo Mesto activities

Males in the following chart represent 56% of respondents (75 responses), while females account for 43% (58 responses). Additionally, 7 responses fall under the "Prefer not to say" category. The representation in this chart reflects the participation of stakeholders who accepted invitations or expressed interest in the events in Novo Mesto. Future events may help increase diversity and representation across all categories.

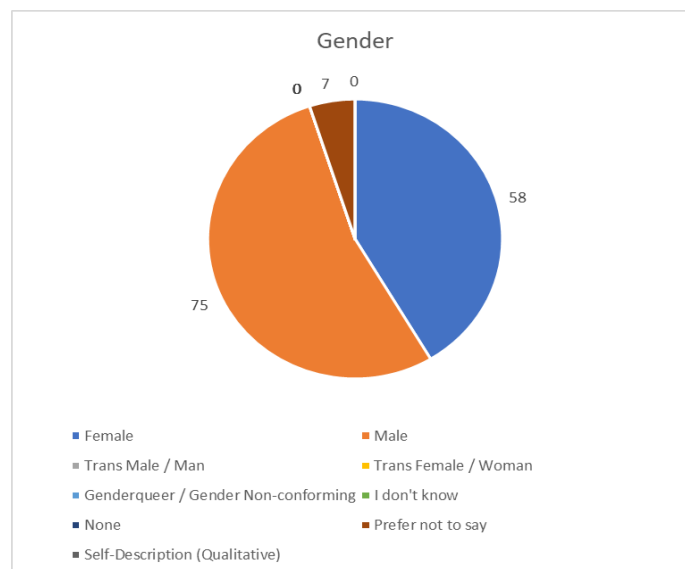


Figure 335: Genders in Novo Mesto activities

Once again, in Novo Mesto activities, the dominant category is 'heterosexual/straight', representing 93.3% (125 responses). Additionally, 4 respondents (3%) selected 'prefer not

to say', indicating potential representation from other categories. The remaining categories have no significant representation in this dataset.

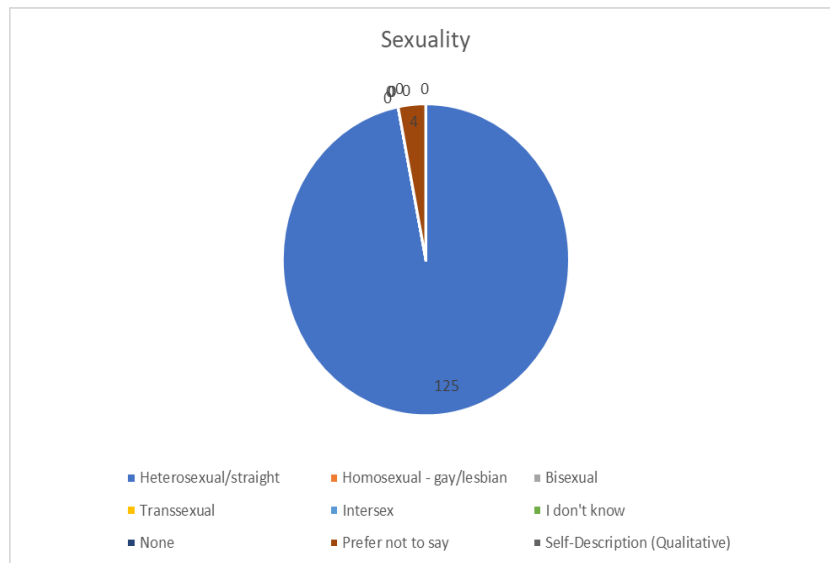


Figure 336: Sexual orientation in Novo Mesto Activities

The majority of responses in the chart fall under the 'privileged' category, accounting for 77.8% (112 responses) of the participants. Additionally, 14% (20 responses) selected 'prefer not to say', while 5.6% (8 responses) identified as privileged, and 2.8% (4 responses) indicated they were unsure. Increasing representation from underprivileged participants could be achieved by targeting specific communities and encouraging broader engagement in future events.

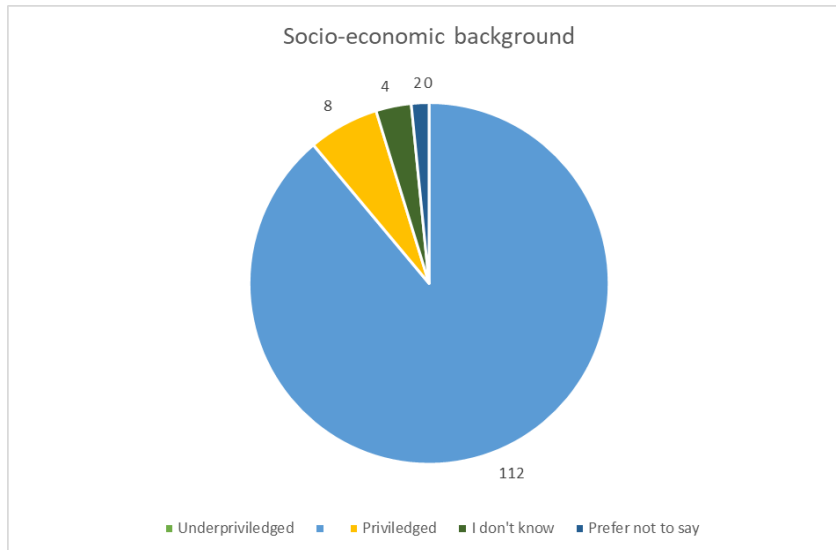


Figure 337: Socio-economic background in Novo Mesto activities

The majority of participants hold a bachelor's degree (47.2%), making it the most represented educational background. Those with a master's degree account for 26.4%, followed by high school graduates at 15.3%. Smaller groups include individuals who have completed parts of high school (2.1%), held a PhD (2.1%), or preferred not to disclose their education level (2.1%)

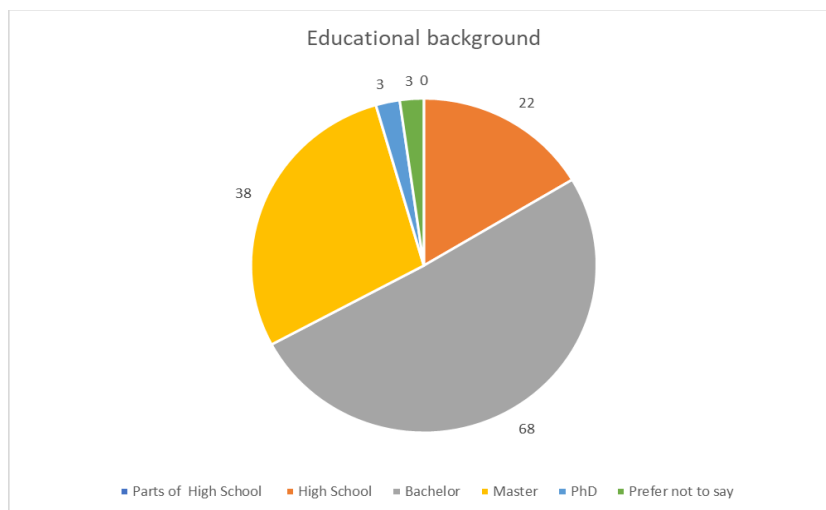


Figure 338: Educational background in Novo Mesto activities

The chart shows that full-time employment is the most common status, representing approximately 72.7% of participants. The remaining 27.3% is distributed among individuals who are part-time employed (10.1%), self-employed (2.2%), students (7.9%),

retired (2.2%), or prefer not to say (2.2%). There are also small groups of unemployed and those unable to work, both making up a minimal percentage.

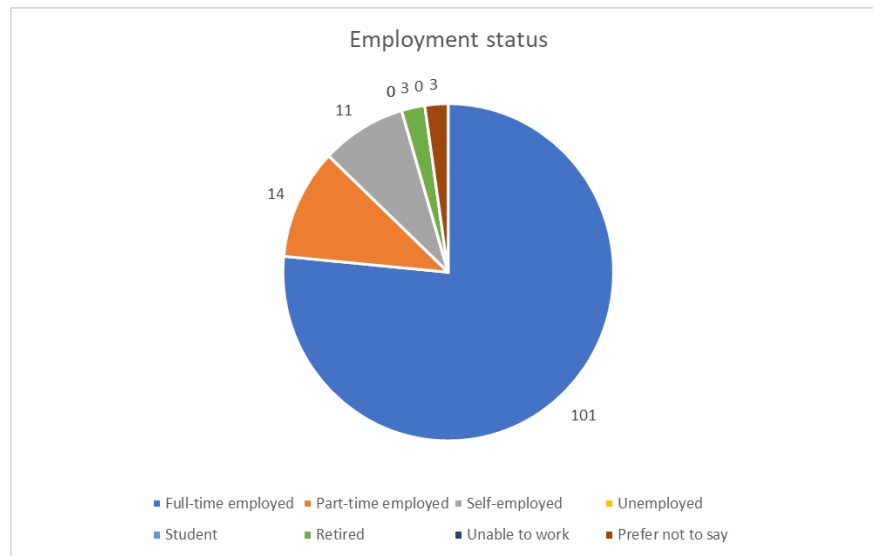


Figure 339: Employment status in Novo Mesto activities

The income data from the pilot representatives differs from other pilots as it focuses on whether participants' income meets their needs rather than specific income brackets. The largest category, making up 76.9% of responses, is 'sufficient for all household needs, including education and free time'. Other responses indicate varying levels of financial sufficiency, with a smaller portion reporting income insufficiency.

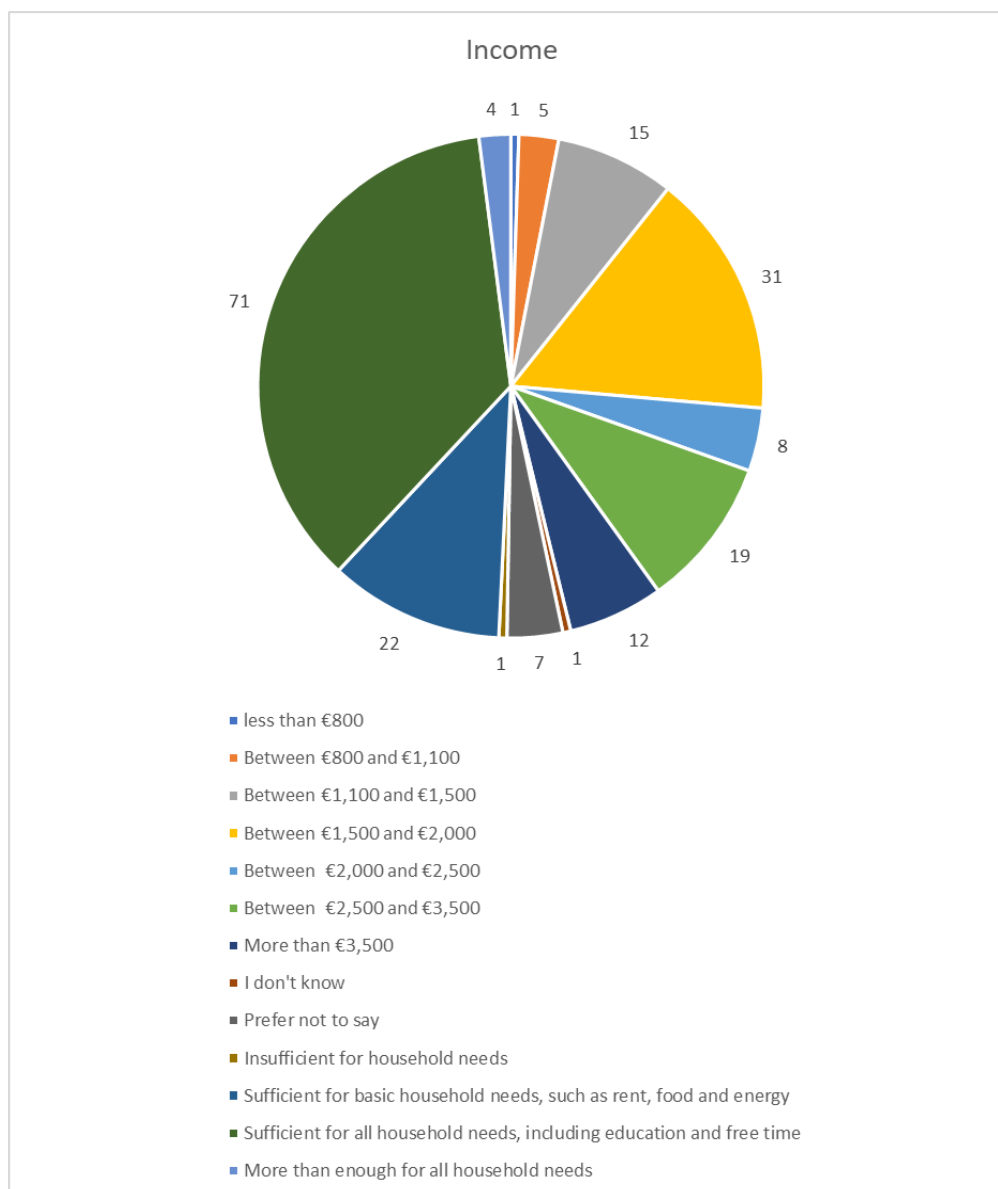


Figure 340: Income of participants in Novo Mesto activities

Slovenian representation in Novo Mesto activities has the highest prevalence among the responses. The total number for this category amounts to 80%. The remaining percentage is allocated to ex-Yugoslavian participants.

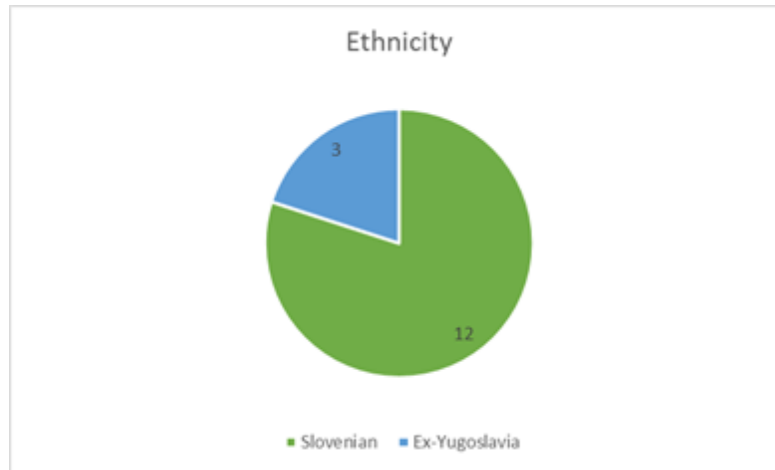


Figure 341: Ethnicity in Novo Mesto activities

The majority of respondents (86.7%) reported that they do not experience any of the listed disabilities. However, a small percentage of participants indicated challenges, including chronic pain/illness (4.9%), difficulties walking or climbing steps (2.9%), and difficulty seeing (2.9%). Additionally, 1.9% of respondents reported difficulty hearing, highlighting valuable insights for inclusive planning at the pilot site.

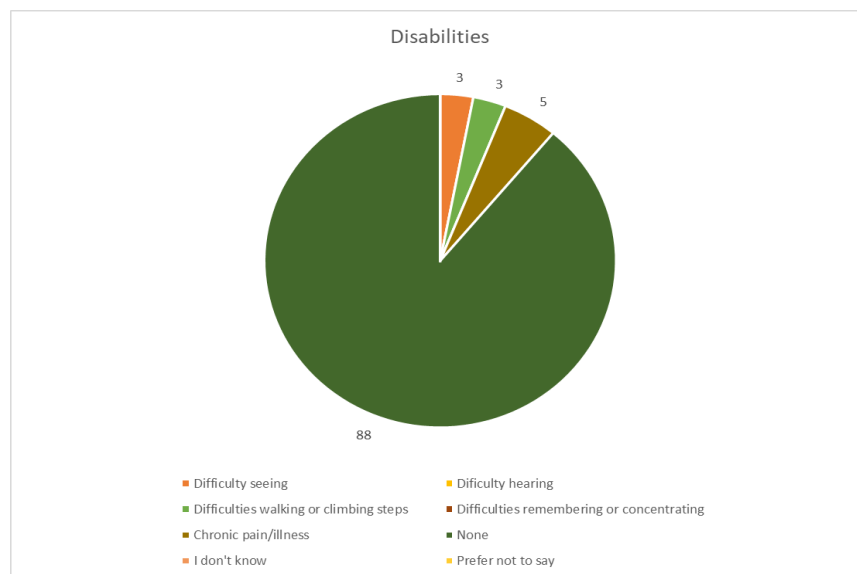


Figure 342: Disabilities in Novo Mesto activities

The majority of respondents (64.3%) identified as Christian Catholic, making it the most represented religious affiliation in the survey. Additionally, 40.2% of participants either reported having no religious affiliation or preferred not to disclose their religious beliefs.

A small percentage of respondents identified with other religious groups, including Hindu, Jewish, and Sikh faiths.

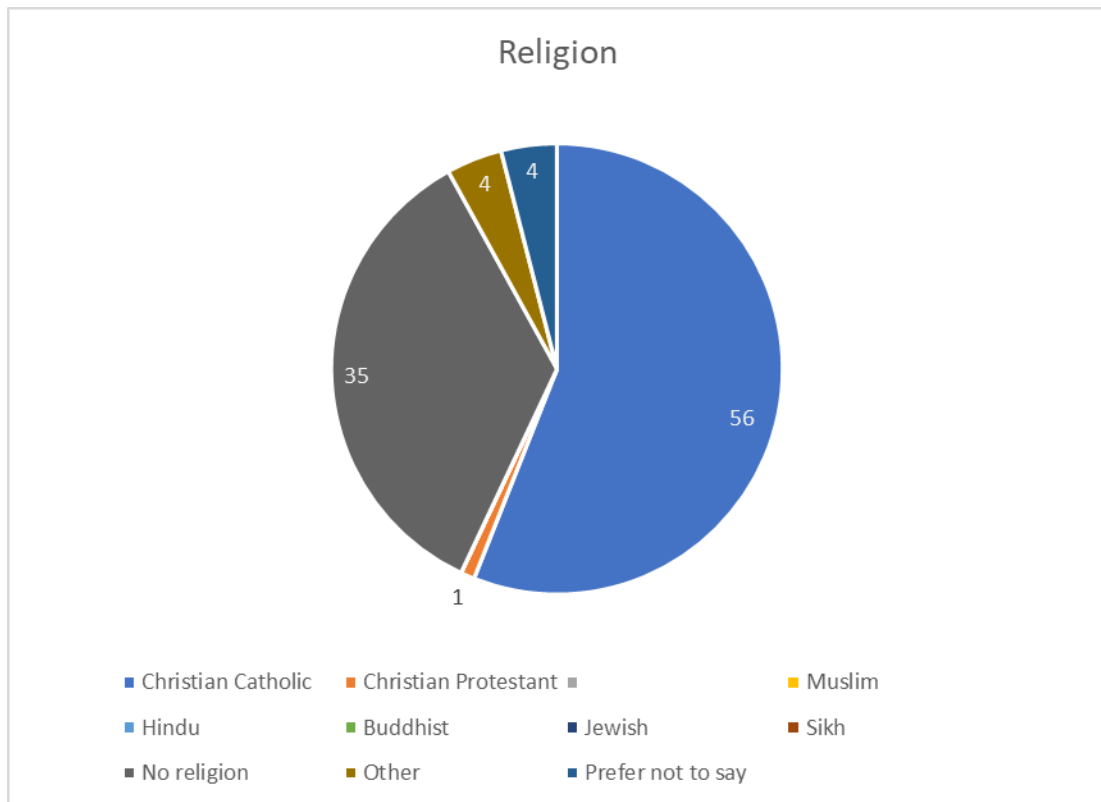


Figure 343: Religions in Novo Mesto activities

The results indicate that most respondents perceive the effectiveness of the solution as moderate or low, with only 15% rating it as 'very effective' and none as 'extremely effective'.

Comments suggest an increase in the inclusion of older, younger and disabled people.

"More elderly individuals."

"Include more young people, elderly individuals, those with disabilities, and different statuses to make the result more realistic."

"Include more diverse individuals with various backgrounds."

"Diversity should be increased—include more elderly and young people."

"Include even more elderly individuals."

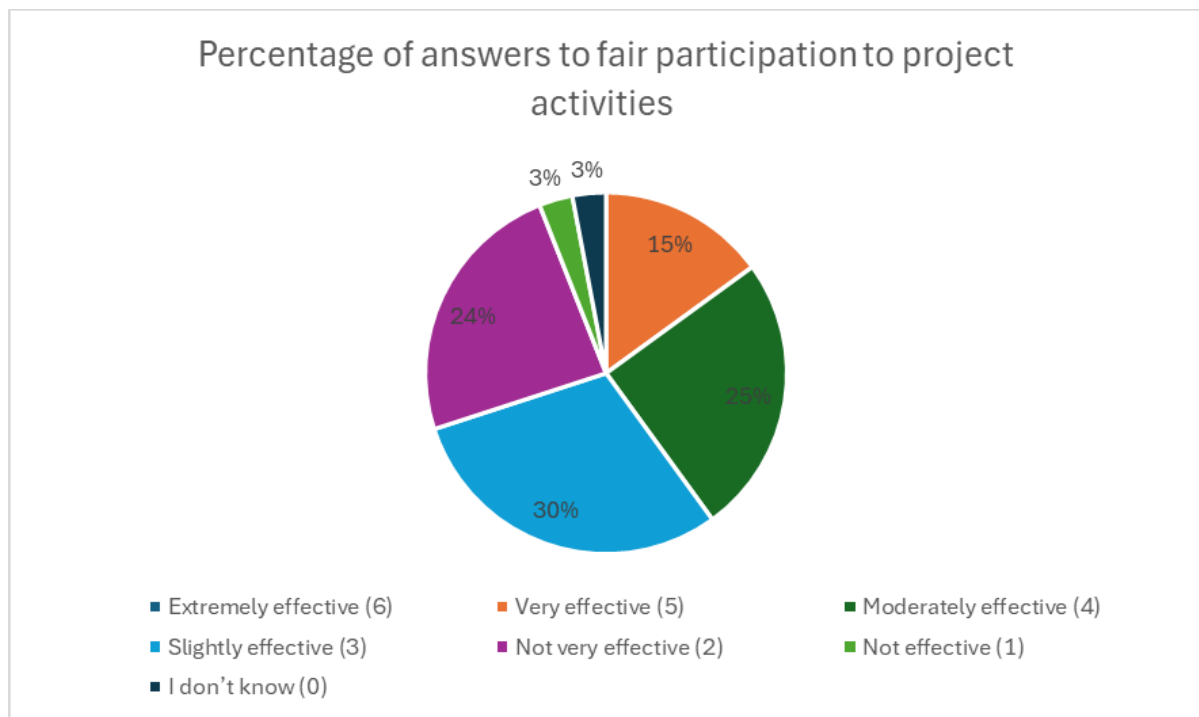


Figure 344: Co-evaluation result of social background participation in Novo Mesto activities

KPI 8.7 Participation of entities representing groups of persons with functional disabilities

Expected Impact: Greater inclusion of people with functional disabilities (Direct Impact)

VS(s): 3

Evaluation Method: Pre & Post

Out of a total of 30 organisations contacted, 20% of them included people with disabilities. The graph shows the specific distribution of the public with disabilities (including elderly people).

Organisation focus of services

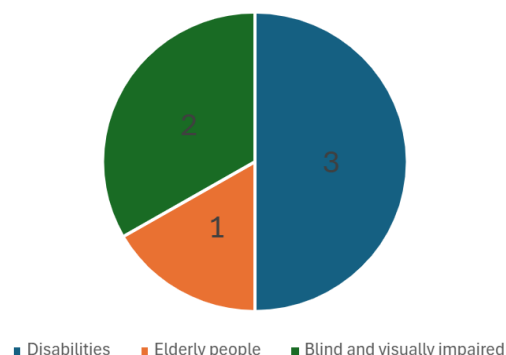


Figure 345: Participation of entities representing groups of persons with functional disabilities in Novo Mesto

KPI 8.8 Participation of individuals with functional disabilities

Expected Impact: Greater inclusion of people with functional disabilities (Direct Impact)

VS(s): 3

Evaluation Method: Pre & Post

From the first monitoring period ((7.47%) to the second one (19.27%), there is a notable increase in the participation of people with disabilities, although in the third one (3.53%) there is a low decrease, in the fourth (38.75%) and fifth measurement (23.61%) the previous values are exceeded.

Nº of people attending to the events

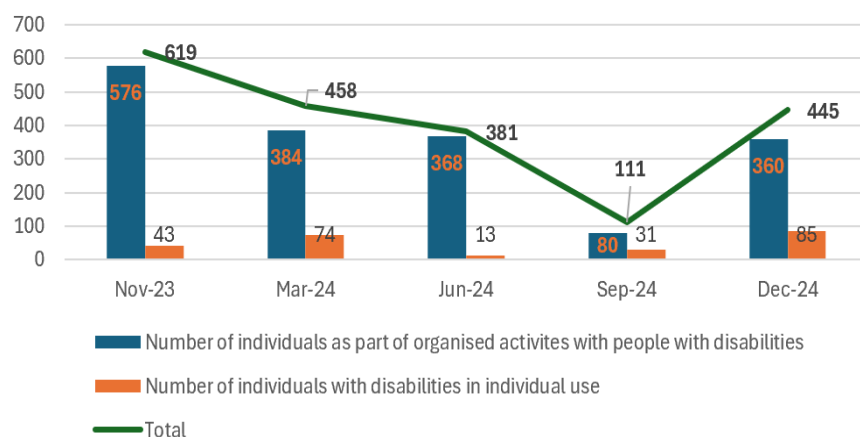


Figure 421: Participation of individuals with functional disabilities in Novo Mesto

KPI 8.10 Accessibility of open public spaces and buildings for families with baby carriages and individuals with restricted mobility

Expected Impact: Greater inclusion of families with babies and individuals with restricted mobility (Direct Impact)

VS(s): 3

Evaluation Method: Pre & Post

This indicator measures the total area (in square metres) of public open spaces and buildings accessible for families with prams and persons with reduced mobility. This includes access points such as entrances, ramps, accessible parking spaces, pedestrian paths and pavements; the distribution of these can be seen in the following sketch.

Before Project Implementation	After Project Implementation
0 m²	4,000 m² swimming pool 11,730 m² – outdoors

Table 190: Accessibility of open public spaces and buildings for families with baby carriages and individuals with restricted mobility in Novo Mesto (pre & post)



Figure 346: Accessibility of open public spaces and buildings for families with baby carriages and individuals with restricted mobility (map)

Challenge 9

KPI 9.8 Feeling of improving the quality of life

Expected Impact: Improved quality of life (Direct Impact)

VS(s): 3, 5

Evaluation Method: Pre & Post

In 2024, three separate surveys were conducted to assess the impact of visionary solutions on respondents' quality of life. Two of the surveys received 42 responses each, while the third had 36 responses. The participants were asked 'How has your quality of life improved with visionary solutions in a pilot project?'. Participants rated their experiences on a scale from 1 to 5, with 1 indicating no improvement and 5 representing significant improvement. The average score across all three surveys was 3.9, suggesting a moderate to substantial improvement.

KPI 9.16 Number / share of people being physically active (min. 30 min 3 times per week)

Expected Impact: Increased outdoor physical activity (increased of data gathering of data of people being physical active) (Direct Impact)

VS(s): 5

Evaluation Method: Pre & Post

The number of people being physically active varied across the four monitoring periods. In Sep–Dec 2023, 5,070 individuals were active. This number increased significantly to 21,706 in Jan–Mar 2024, marking the highest recorded value. In the following period, Apr–Jun 2024, the number decreased to 4,420, before rising again to 7,610 in Jul–Sep 2024.

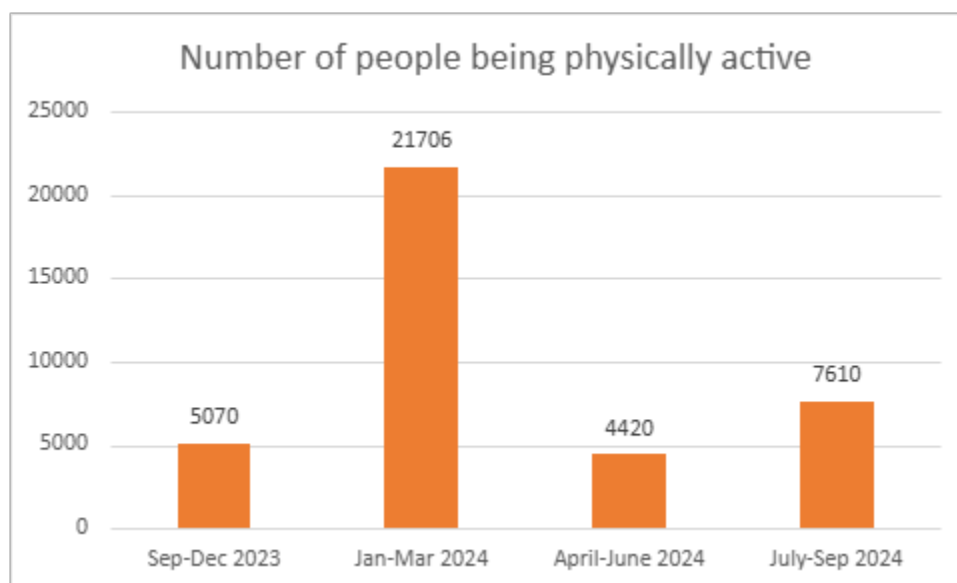


Figure 347: No. of people being physically active in Novo Mesto

KPI 9.19 Increase in walking and cycling in and around areas of interventions

Expected Impact: Increased outdoor physical activity (increased of data gathering of data of people being physical active) (Direct Impact)

VS(s): 5

Evaluation Method: Pre & Post

In two years, the number of people entering and leaving different points of the park, including the Velodrome, the forest, the interior of the forest and the main road, were recorded. During 2023, a total of 50 samples were taken, at one per day, with a total of

5070 people entering through the different points. In comparison, in 2024 a total of 94 samples were taken, at one per day, and 4737 people were counted.

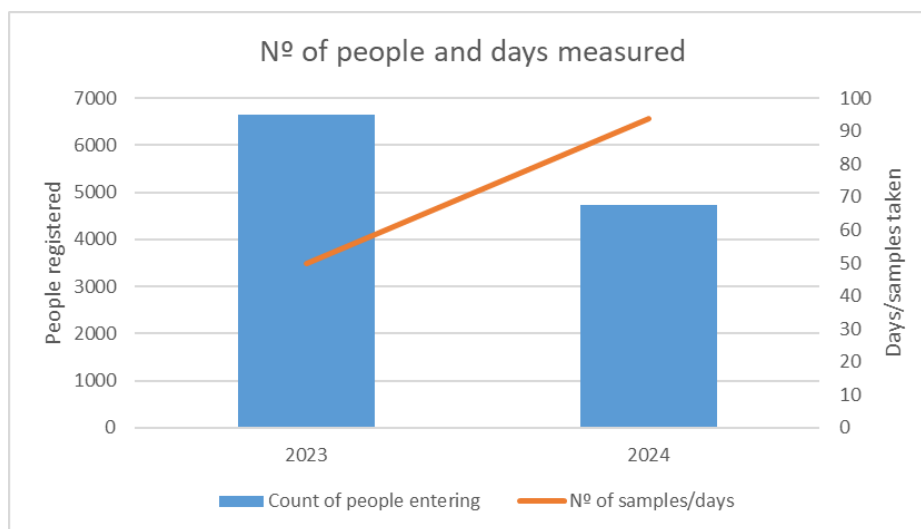


Figure 348: Visitor counting in Novo Mesto intervention areas

KPI 9.22 Improved motor skills among the youth

Expected Impact: Improved motor skills among the youth (Direct Impact)

VS(s): 3

Evaluation Method: Pre & Post

This indicator assesses improvements in motor skills and overall swimming proficiency among youth. The national program "Naučimo se plavati" (Let's Learn to Swim) serves as an example of how structured training enhances motor skills, as in water adaptation, coordination, and swimming ability among youth aged 6-7 years and 9-10 years.

Pre-Intervention Assessment

Before starting the swimming course, each child undergoes an initial evaluation of motor skills and swimming proficiency. The assessment focuses on five key criteria:

- Head submersion
- Gliding

- Swimming movements – arm strokes
- Swimming movements – leg kicks
- Coordination and overall swimming technique

Each criterion is rated on a 1-5 scale, where 1 represents the lowest ability and 5 represents full proficiency.

Post-Intervention Assessment

Following the swimming course, children are reassessed using the same criteria to quantify motor skill improvement. The intervention includes:

- 6-7 years old: A 10-hour swimming course
- 9-10 years old: A 20-hour swimming course

Children who initially lack swimming skills are categorized based on their level of water adaptation and awarded diplomas according to their proficiency:

- "Sea Horse" (Morski konjiček) – Bronze, Silver, Gold
- "Dolphin" (Delfin) – Blue

A participant is classified as a swimmer upon achieving the "Bronze Dolphin" (Bronasti Delfin) level, which requires:

- Swimming 50 meters
- Successfully completing a safety maneuver, transitioning from a horizontal front position → vertical position → horizontal back position, and then returning to the starting position while continuing to swim

On average, the program has an 85% success rate in improving motor skills and swimming abilities. The primary reasons for failure or non-completion include:

- Absences due to illness
- Early withdrawal from the course

The number of children involved in the swimming courses across different monitoring periods is shown in the graph below:

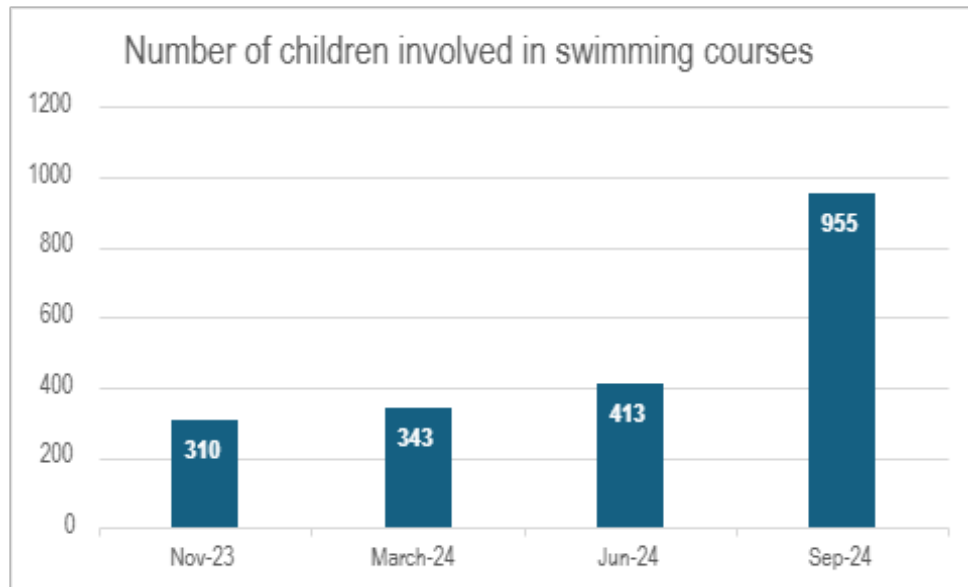


Figure 349: Novo Mesto no. of children involved in swimming courses

Challenge 10

KPI 10.1 No. of jobs created; gross value added

Expected Impact: Increased job opportunities (Direct Impact)

VS(s): 1,2,3

Evaluation Method: Pre & Post

This indicator assesses the impact of the project on improving employment opportunities at the local level. The intervention has led to the creation of new jobs in various areas, with special emphasis on the incorporation of personnel oriented towards training and social dynamization, as is the case of swimming instructors, who represent approximately 47.5% of the total number of new jobs.

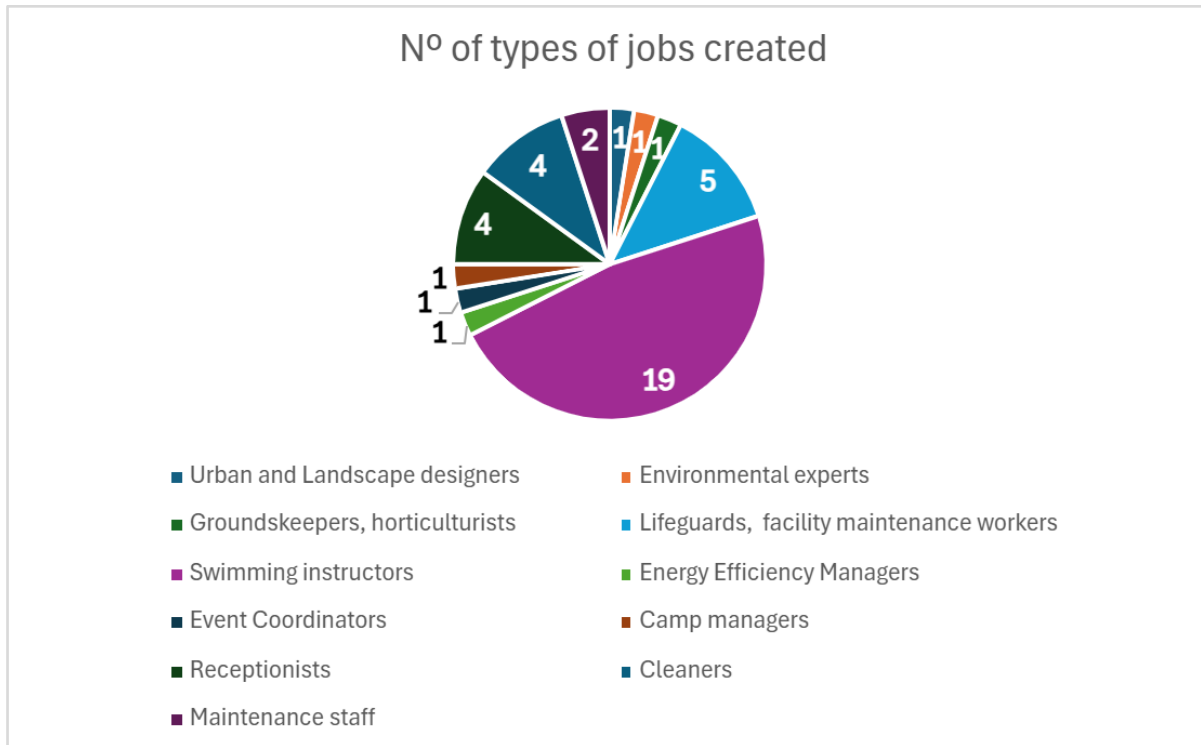


Figure 350: No. of jobs created in Novo Mesto

KPI 10.5 Definition of parameters for (re)designing of green public spaces based on the well-being of users

Expected Impact: Increased parameters for (re)designing green public spaces (Direct Impact)

VS(s): 1,2

Evaluation Method: Benchmark

1 Nature-Based Solutions and Ecosystem Integration

- Emphasizing green infrastructure that enhances biodiversity, ecological connectivity, and urban resilience.
- Implementing green corridors, sustainable mobility routes, and multifunctional green areas to support both recreational and ecological functions.

2 Active and Healthy Lifestyles

- Designing spaces that encourage physical activity for all age groups, such as motor skill parks, running trails, and accessible swimming facilities.
- Ensuring inclusive access to sports and recreational activities, promoting the well-being of different user groups, including people with disabilities.

- Developing infrastructures that support year-round outdoor activities, increasing citizen engagement with green spaces.

3 Accessibility and Inclusion

- Prioritizing universal accessibility to ensure that all individuals, regardless of physical ability, can engage with the space.
- Integrating features that support people with mobility impairments, such as adapted pathways, pool lift and inclusive sports programs.
- Designing for multi-generational use, considering the needs of families, children, and elderly citizens.

4 Flexibility and Adaptability

- Utilizing modular and adaptable design solutions that can evolve with changing community needs.
- Encouraging dynamic use of spaces that accommodate different types of recreational, cultural, and educational activities.

5 Community Engagement and Co-Creation

- Actively involving local residents, organizations, and stakeholders in the design, implementation, and management of public spaces.
- Organizing participatory workshops, co-creation events, and educational activities to strengthen community.
- Encouraging long-term local stewardship to maintain and enhance the spaces beyond the initial implementation phase.

The evaluation method is grounded in the WHO Healthy Cities framework, using five core categories: Environmental Quality, Health & Wellbeing, Social Determinants of Health, Built Environment, and Governance & Participation. These categories were selected to ensure a holistic and balanced assessment of urban interventions, covering both physical infrastructure (e.g. green space, mobility, zoning) and social systems (e.g. equity, inclusion, participation). Each intervention parameter is mapped using a binary alignment matrix, enabling structured visual comparison. To complement this, a qualitative weighted scoring system is applied to thematic groups of parameters (e.g. air quality, accessibility). The score out of 10 reflects performance across four criteria:

- Coverage (30%): how comprehensively the theme addresses its dimension; Alignment with
- WHO Healthy City principles (30%): how closely it reflects international standards and evidence;

- Implementation Potential (20%): how realistic and scalable the measures are in practice; and
- Transformative Impact (20%): the extent to which the measures drive long-term, systemic change. This combined approach enables consistent, transparent comparison across pilot cities while maintaining focus on health, equity, and sustainability outcomes.

Parameter	Environmental Quality	Health & Well-being	Social Determinants of Health	Built Environment	Governance & Participation
Nature-Based Solutions and Ecosystem Integration	✓	✓		✓	
Active and Healthy Lifestyles		✓	✓	✓	
Accessibility and Inclusion			✓	✓	✓
Flexibility and Adaptability		✓		✓	✓
Community Engagement and Co-Creation		✓	✓		✓

Table 191: Novo Mesto parameters

1. Nature-Based Urbanism & Environmental Integration

Aligned with: WHO Healthy Cities, Urban Green Infrastructure Guidelines, and Nature-Based Solutions frameworks

- Nature-Based Solutions and Ecosystem Integration
Description: Incorporates green and blue infrastructure (e.g., native tree planting, expanded green areas, ecosystem-sensitive park design) to improve air quality, mitigate urban heat, and enhance biodiversity. Strengthens Environmental

Quality and supports Health, Built Environment, and Governance through participatory and cross-sector planning.

Alignment Score: 9/10

2. Health Promotion and Active Living

Aligned with: WHO recommendations on Active Cities, Placemaking Principles

- Active and Healthy Lifestyles
Description: Investments in inclusive, accessible sports and fitness infrastructure (e.g., Olympic Centre) encourage physical activity, improve public health, and promote equity. Ties into Built Environment through design, and Governance through co-funded initiatives and policy support.

Alignment Score: 9/10

3. Inclusive and Equitable Urban Design

Aligned with: WHO Healthy Cities, Universal Design Principles, UN-Habitat Equity Frameworks

- Accessibility and Inclusion
Description: Prioritizes universal access (e.g., ramps, sensory paths, adapted playgrounds), reducing disparities for vulnerable groups. Strongly supports Social Determinants, Health, Built Environment, and Governance via co-creation and policy integration.

Alignment Score: 10/10

4. Spatial Resilience and Adaptability

Aligned with: WHO Urban Resilience, Climate-Adaptive Planning, Smart City Strategies

- Flexibility and Adaptability
Description: Incorporates multi-functional, reconfigurable spaces (e.g., floodable parks, smart infrastructure) to respond to climate, demographic, or social changes. Enhances resilience across health, built form, and equity dimensions.

Alignment Score: 8/10

5. Participatory Governance and Social Capital

Aligned with: WHO Healthy Cities, Placemaking Europe, UN-Habitat Governance Guidelines

- Community Engagement and Co-Creation
Description: Emphasizes participatory decision-making and user-driven design. From co-creating accessible infrastructure to ongoing stewardship of public space, this builds trust, equity, and relevance.

Alignment Score: 9/10

Each score reflects the parameter's overall contribution across all five dimensions – higher scores indicate broader, deeper alignment with the WHO Healthy City framework. The explanations above highlight the multiple pathways (citing WHO and Novo Mesto examples) through which each parameter fosters a healthier, more equitable and sustainable urban environment

KPI 10.6 Replication of solutions

Expected Impact: High replication potential of Visionary Solutions (Direct Impact)

VS(s): 1,2

Evaluation Method: co-evaluation

The graphs below present the number of responses regarding the replicability of various solutions.

- Brownfield Remediation and Greening

The majority of respondents rated this solution as having high replicability (19 responses), followed by very high replicability (16 responses), indicating strong confidence in its scalability.

- Inclusive Design of Recreational & Therapeutic Facilities

This solution received a majority of responses indicating moderate replicability (16 responses), closely followed by high replicability (17 responses), reflecting a generally positive perception with some variation.

- Integrated Management of Facilities

Responses were concentrated around high replicability (17 responses) and moderate replicability (15 responses), suggesting a balanced yet favorable view of the solution's potential for replication.

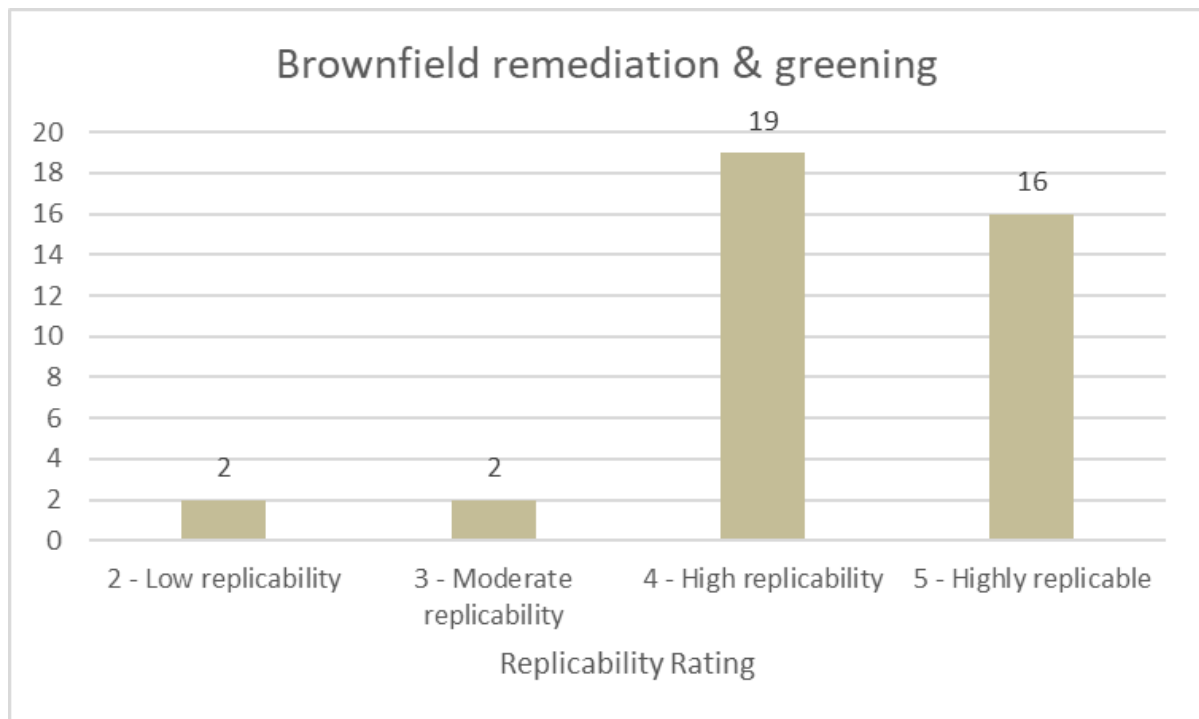


Figure 351: Novo Mesto VS Group 1 replication potential

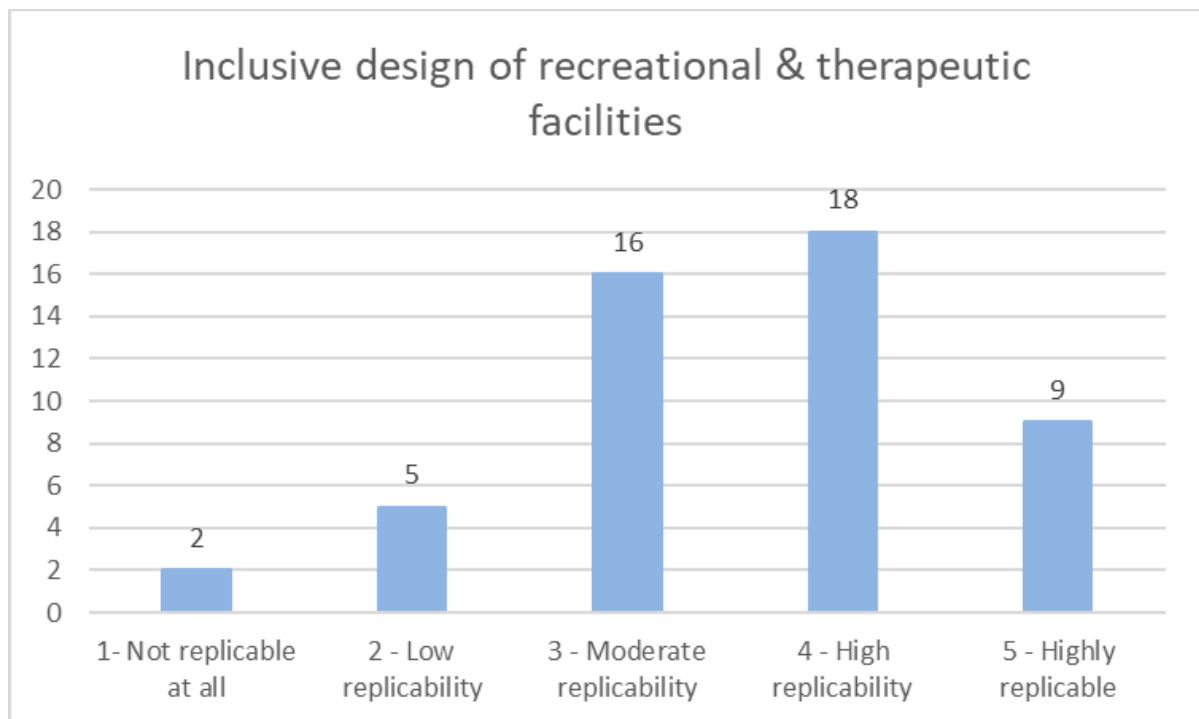


Figure 352: Novo Mesto VS Group 2 replication potential

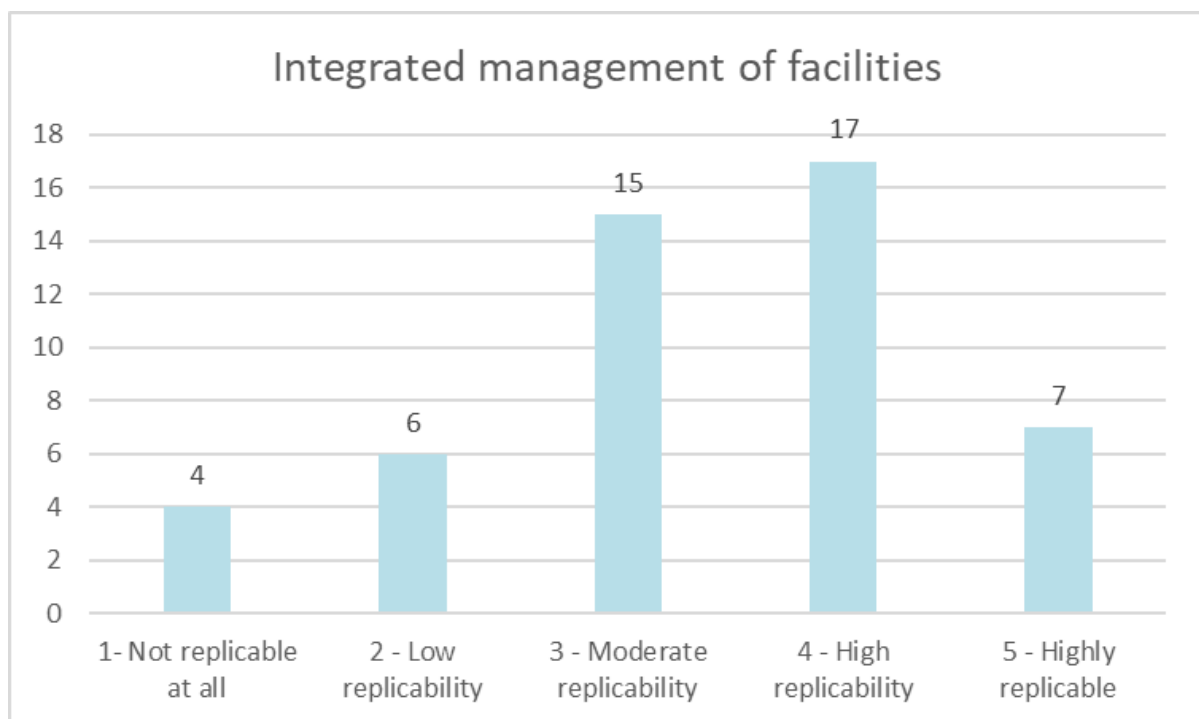


Figure 353: Novo Mesto VS Group 3 replication potential

KPI 10.9 Public & private investments during/after the project

Expected Impact: Increased public & private investments (Direct Impact)

VS(s): 1,2,3,4

Evaluation Method: Pre & Post

Novo Mesto secured the highest total investment of €12,033,420.00, with €862,420.00 from EU funding allocated to infrastructure (€136,000.00), environmental monitoring (€130,050.00), human resources (€538,870.00), and community engagement (€57,500.00). In-kind contributions from local funding and private sponsorships reached €11,171,000.00, supporting large-scale infrastructure projects. Future funding opportunities for Novo Mesto are diverse, focusing on green infrastructure development, sustainable urban mobility, and technology integration. Local Sustainability Grants present multiple avenues for support, including the expansion of green infrastructure to meet surface development needs and replace non-native species. These grants can also fund the rental of camping spaces, as well as support activities related to the sales, rental, or use of resources developed during the project.

Additionally, funding can be directed toward improving access paths to the Equestrian Center and playgrounds, aiming to preserve natural areas by preventing motor traffic and enhancing accessibility for all target groups. Private funding is planned for the establishment of a camp with mobile homes, projected for 2025, supporting tourism and sustainable recreation. European Green Deal Funding offers opportunities to enhance health monitoring technologies, facilitating pilot expansion through the integration of additional tech solutions. The CLLD (Community-Led Local Development) program is set to fund hiking trails in the Natura 2000 area, with an estimated budget of €160,000, planned for 2025. Lastly, Smart Cities and Communities funding will support projects that integrate technology and sustainability within urban areas, focusing on expanding ICT and IoT solutions in city infrastructure to promote smart, sustainable urban development.

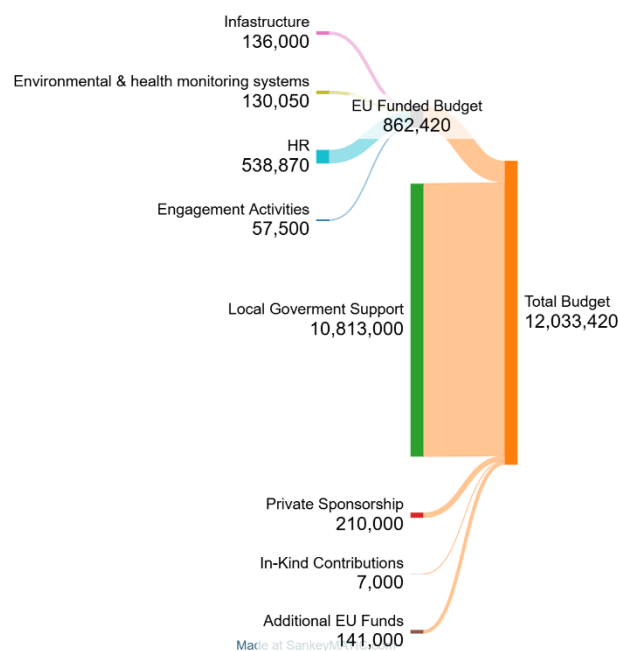


Figure 354: Current public & private investment in Novo Mesto

Novo Mesto's VARCITIES pilot location has an estimated future funding potential of €565,000 from Local Sustainability Grants, Private Funding, European Green Deal Funding, CLLD, and Smart Cities and Communities programs, supporting green infrastructure development, sustainable tourism, ICT integration, and smart urban solutions.

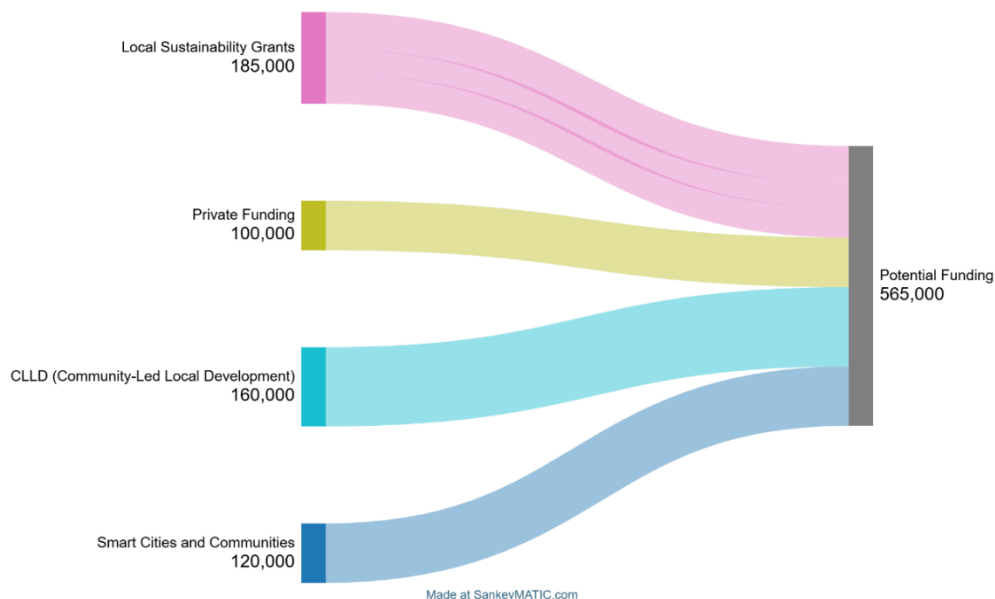


Figure 355: Future public & private investment in Novo Mesto

A2.7 Skellefteå

Challenge 1

KPI 1.4 Energy

Expected Impact: Energy savings from lighting upgrades and improvements (Direct Impact)

VS(s): 3

Evaluation Method: Pre & Post

Number of luminaires replaced	Energy savings per luminaire	Total energy saved
7	22Wh	154Wh

Table 192: Energy savings from luminaire replacement in Skellefteå

Challenge 2

KPI 2.2 Water retention capacity by vegetation and soil

Expected Impact: Increased water retention capacity by vegetation and soil (Direct Impact)

VS(s): 1,2

Evaluation Method: Pre & Post

The water retention capacity of vegetation and soil increased from 3,600 m³ before implementation to 4,000 m³ after implementation.

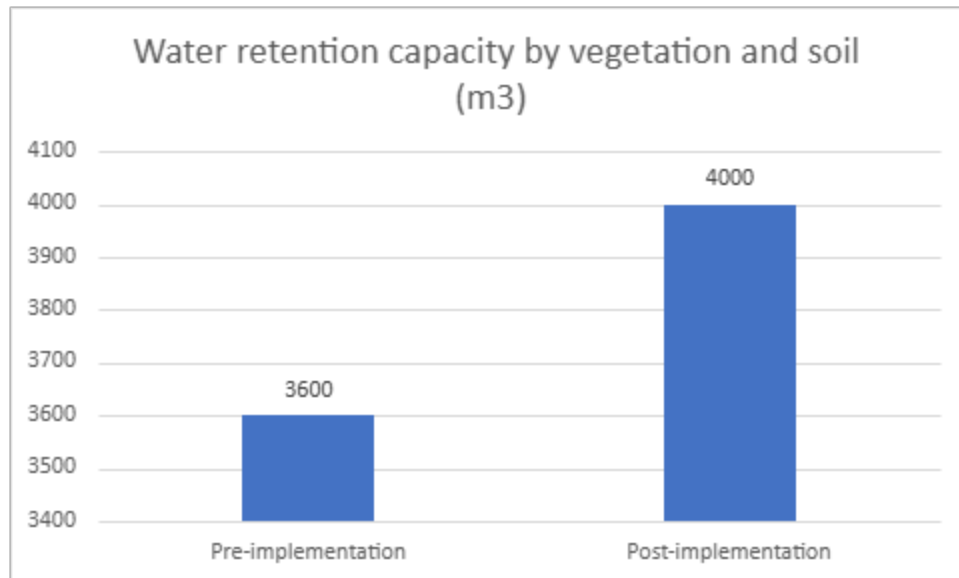


Figure 356: Water retention capacity by vegetation and soil in Skellefteå

KPI 2.6 Water quality indicators

Expected Impact: Increased data on water quality physical parameters (Added value)

VS(s): 1

Evaluation Method: Pre & Post

In Skellefteå, three main measures have been taken so far to assess the surface water quality (in terms of chemical parameters).

These measures were taken at four different sampling locations in Skellefteå, a river which runs through the centre of the city. Samples were analysed for the concentration of Copper (Cu) (mikrogram/L) and the E. coli and Coliform Indexes (as colony forming units per 100 ml) were taken.

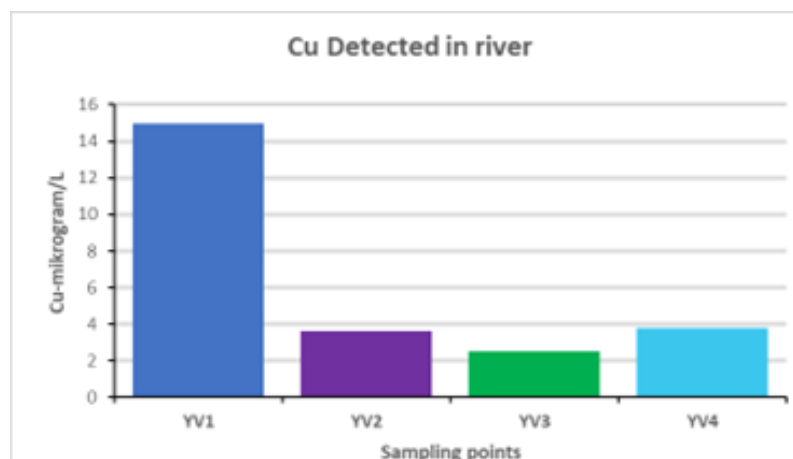


Figure 357: CU Detected in River in Skellefteå

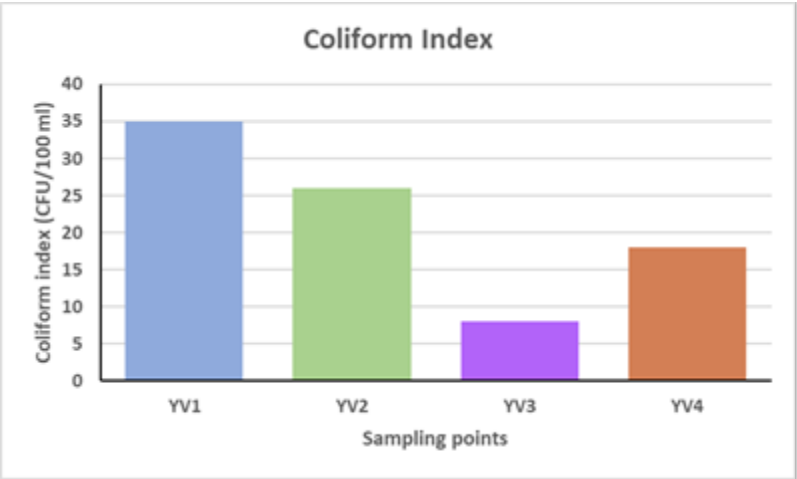


Figure 358: Coliform Index in Skellefteå

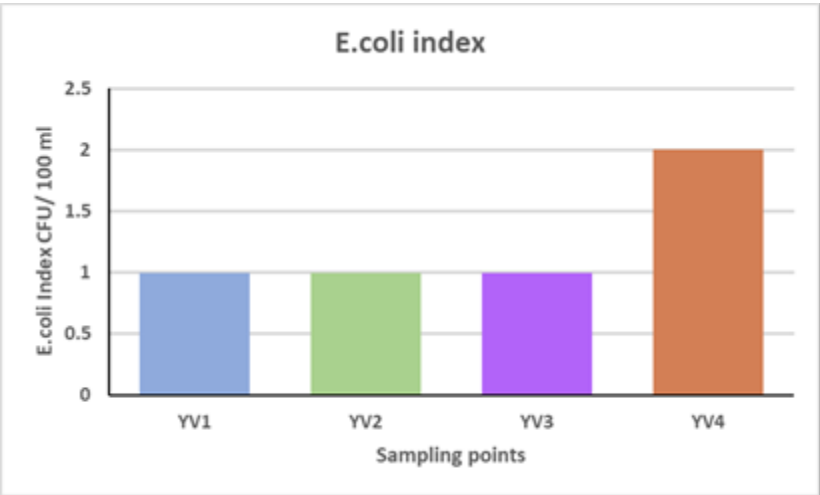


Figure 359: E.Coli Index in Skellefteå

KPI 2.7 Economic benefit of reduced stormwater to be treated in public sewerage system

Expected Impact: Reduction in water routed to drainage network / Reduced costs for sewerage treatment (Direct Impact)

VS(s): 1,2

Evaluation Method: Pre & Post

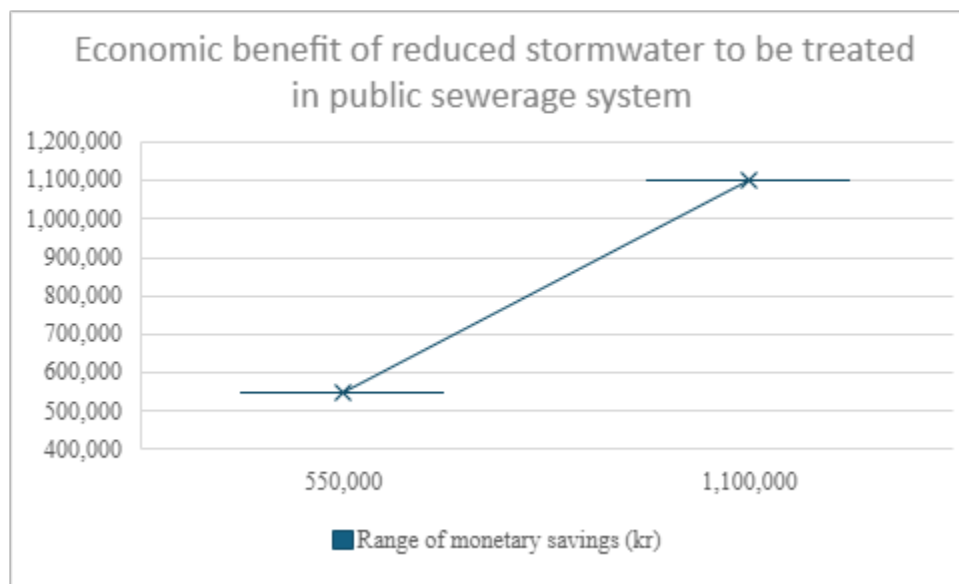


Figure 360: Economic benefit of reduced stormwater in Skellefteå

The economic benefit of reduced stormwater to be treated in the public sewerage system was calculated to be between 550,000 kr (€47,103) to 1,100,000 kr (€94,207).

Challenge 4

KPI 4.3a Recreational or cultural value of green spaces (number of visitors)

Expected Impact: Increased recreational and cultural value of green spaces (Direct Impact)

VS(s): 1,2,3,4

Evaluation Method: Pre & Post

KPI not measured. Installation of the planned visitor number sensor was denied for GDPR reasons. The visitor sensor used only covers one pathway and is not giving conclusive data.

With regards to attendees of events related to green spaces see KPI4.3b:

KPI 4.3b Recreational or cultural value of green spaces (activities in green spaces)

Expected Impact: Increased recreational and cultural value of green spaces (Direct Impact)

VS(s): 1,2,3,4

Evaluation Method: Pre & Post

The pilot organised two green events connected with VARCITIES:

Town hall event with school children - Together with Exploratoriet Science Centre an activity day and workshop were organised for around 80 school students (ages 3-5 and 6-8 years). The students attended several experiment stations in the town hall, connected to the VARCITIES interventions.

Inauguration event for Skellefteå pilot - A number of schools were invited to the park and the outdoor classroom. Over 100 children aged 6-15 participated, several groups including children with special needs and disabilities. The cooperation partner Exploratoriet provided experiment stations to work with biodiversity, insect hotels and other activities.

KPI 4.11 Species richness and composition with respect to indigenous vegetation and local/national biodiversity targets

Expected Impact: Increased urban biodiversity (Direct Impact)

VS(s): 2

Evaluation Method: Pre & Post

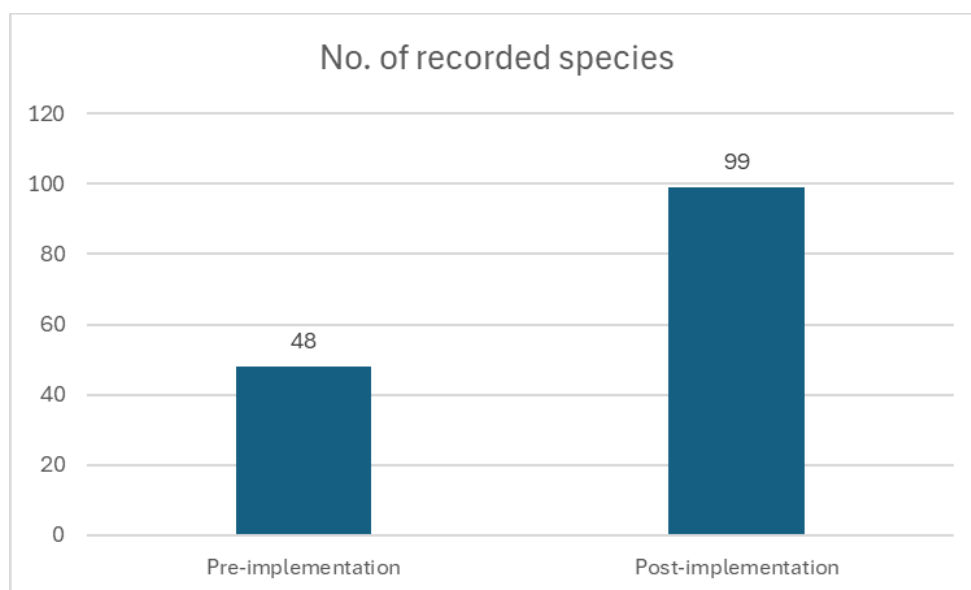


Figure 361: No. of species in Skellefteå

The total number of species recorded increased from 48 pre-implementation to 99 post-implementation.

KPI 4.12 Total area of designated sites of local biodiversity importance within the city (habitat/species management areas)

Expected Impact: Increased urban biodiversity

VS(s): 2

Evaluation Method: Pre & Post

The pilot reports 1372 acres of important value for biodiversity in the city of Skellefteå (5,55km²) at post implementation stage, although the value at pre-implementation stage is not available.

KPI 4.13 Sustainability of green areas

Expected Impact: Savings in operational cost (Direct Impact)

VS(s): 1,2

Evaluation Method: Pre & Post

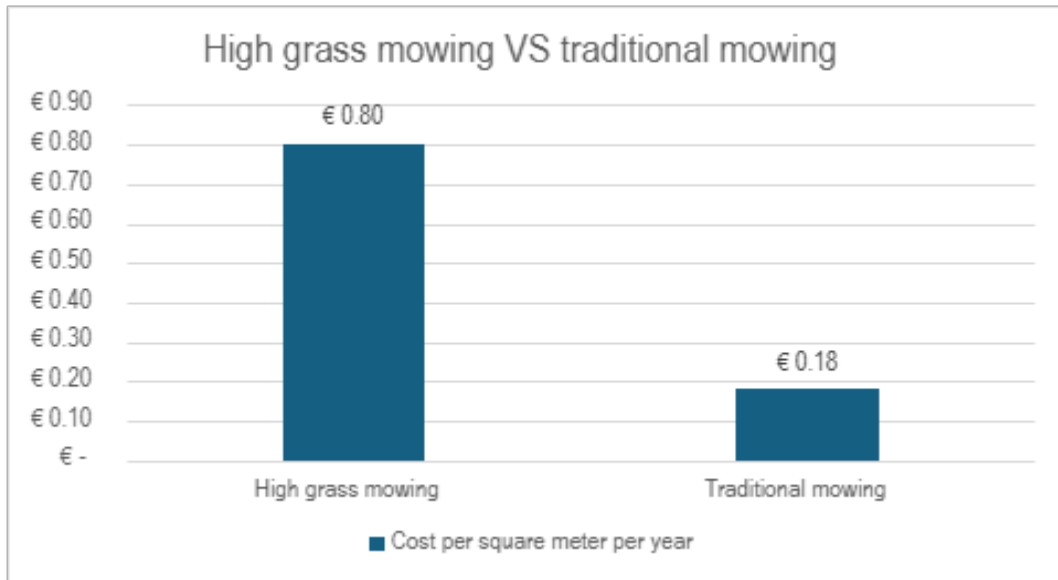


Figure 362: Mowing costs in Skelleftea

The cost for high grass management is €0.80 per square meter per year, while traditional management costs €0.18 per square meter per year. The higher cost for high grass management is partly due to it being a new procedure, where equipment costs are not yet spread across as many areas as in traditional methods.

KPI 4.15 Pollinator species increase

Expected Impact: Increased urban biodiversity / Increased pollinator species (Direct Impact)

VS(s): 5

Evaluation Method: Pre & Post

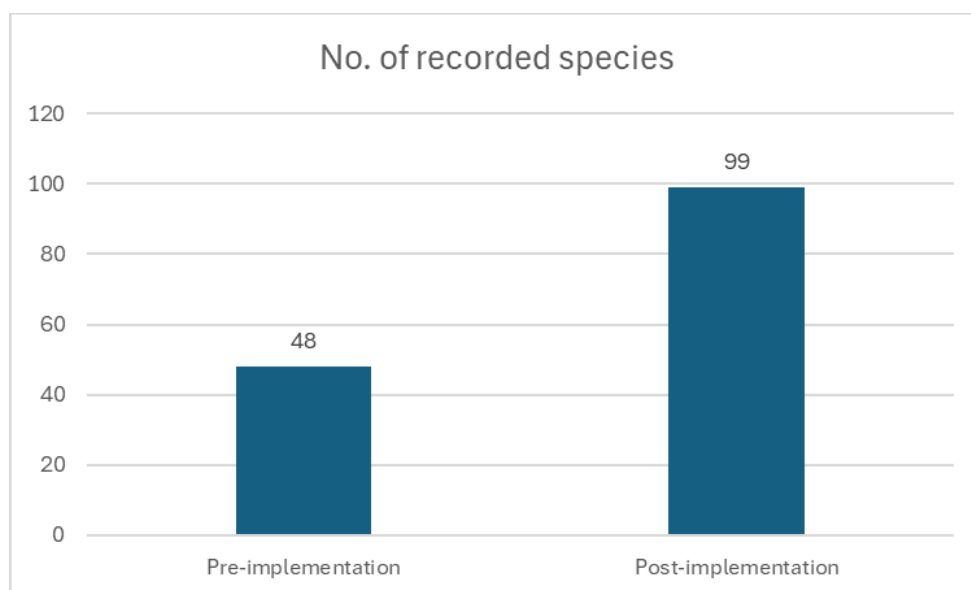


Figure 363: Pollinator species in Skellefteå

The total number of species recorded increased from 48 pre-implementation to 99 post-implementation.

KPI 4.21 Number of sensory elements

Expected Impact: Increased data from sensors (Direct Impact)

VS(s):

Evaluation Method: Pre & Post

Initially, there were no sensors installed at the pilot site in Skellefteå. After implementation, a total of 4 IoT sensors were installed.

Challenge 6

KPI 6.4 Reclamation of contaminated land

Expected Impact: Increased reclamation of contaminated land (Direct Impact)

VS(s): 1

Evaluation Method: Pre & Post

As at the end of November 2023, reclamation of contaminated land in Skellefteå is 75% from the implementation of VSs as shown in the figure below. The following table

indicates the exact number of land reclaimed in m2; 12,225m2 was reclaimed from a total of 16,300m2.

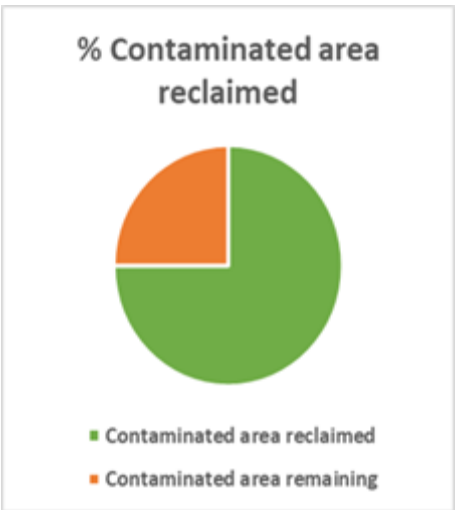


Figure 364: Contaminated Area Reclaimed in Skellefteå

Area (m2)	
Contaminated area reclaimed	12,225m2
Total contaminated area	16,300m2

Figure 365: Contaminated Area Reclaimed in Skellefteå

Challenge 7

KPI 7.3 Social learning concerning urban ecosystems and their functions/services

Expected Impact: Increased awareness of urban ecosystems

VS(s): 4,5

Evaluation Method: N/A

The KPI was not measured. While various learning activities related to urban ecosystems were conducted through schools and science centres, these activities were not evaluated or measured to quantify the level of social learning or awareness achieved.

KPI 7.4 Perceptions of citizens on urban nature

Expected Impact: Increased awareness of urban ecosystems

VS(s): 4

Evaluation Method: N/A

The KPI was not measured. The Park is an open-access area, making it difficult to engage visitors for feedback. Attempts to collect survey responses to understand perceptions were largely unsuccessful, which limited the ability to gather measurable data.

KPI 7.5 Social values for urban ecosystems and biodiversity

Expected Impact: Increased awareness of urban ecosystems (Direct Impact)

VS(s): 4,5

Evaluation Method: Co-evaluation

Results and Outcomes for KPI 7.5 will be reported in D7.5 - SROI Evaluation for the Skellefteå pilot site.

KPI 7.8 Citizen participation in and co-creation of the design, implementation and evaluation of project interventions

Expected Impact: Increased and improved participation (Direct Impact)

VS(s): 4

Evaluation Method: Co-evaluation

The chart below shows the number of citizens recruited for co-creation workshops in the Skellefteå pilot site. The numbers are showing a steady increase since the first WS in 2021. The total number of stakeholders falling under the local citizens/end-user's category is that of 23. The number is expected to increase from the start of 2024 with other co-creation activities planned for this target group.

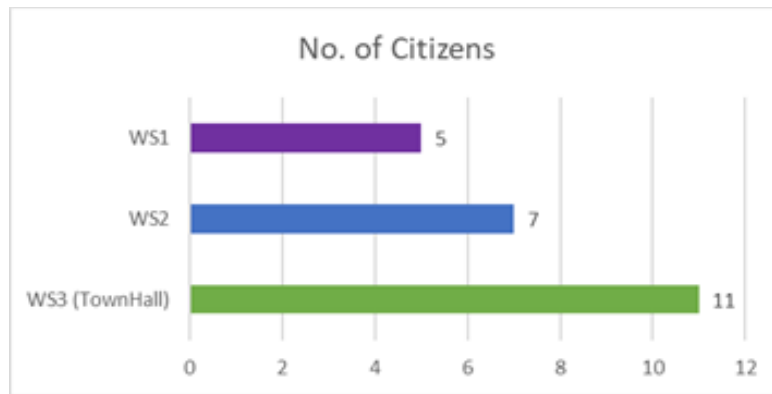


Figure 366: Total no. of Citizens in Activities in Skellefteå

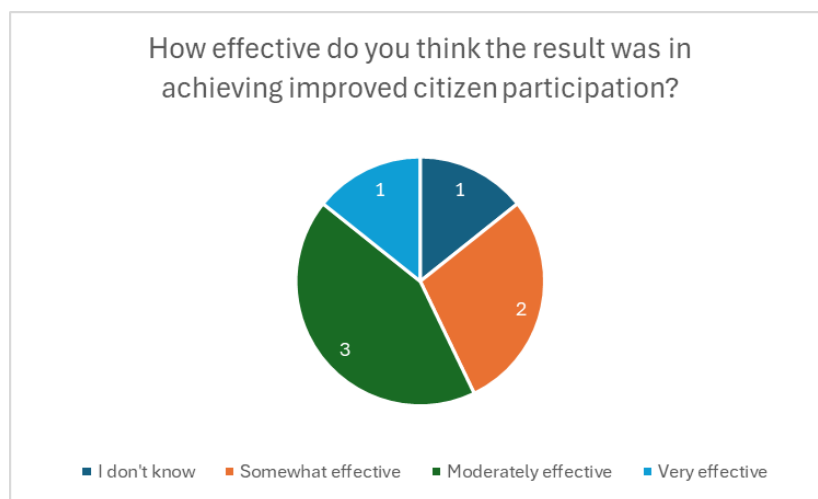


Figure 367: Co-evaluation result

At the final stakeholder event, participants were asked to evaluate how effective the project had been in increasing local citizen participation. The majority of respondents (3) rated the results as moderately effective.

KPI 7.11 Number of individuals that is aware of the project's objectives, content and processes

Expected Impact: Increased and improved participation (Direct Impact)

VS(s): 4,5

Evaluation Method: Co-evaluation

In Skellefteå city, the highest ranked channel in which people were made aware of the project is in a local newspaper, which reaches 19,000 people. Additionally other events and workshops reached a total number of 306 people.

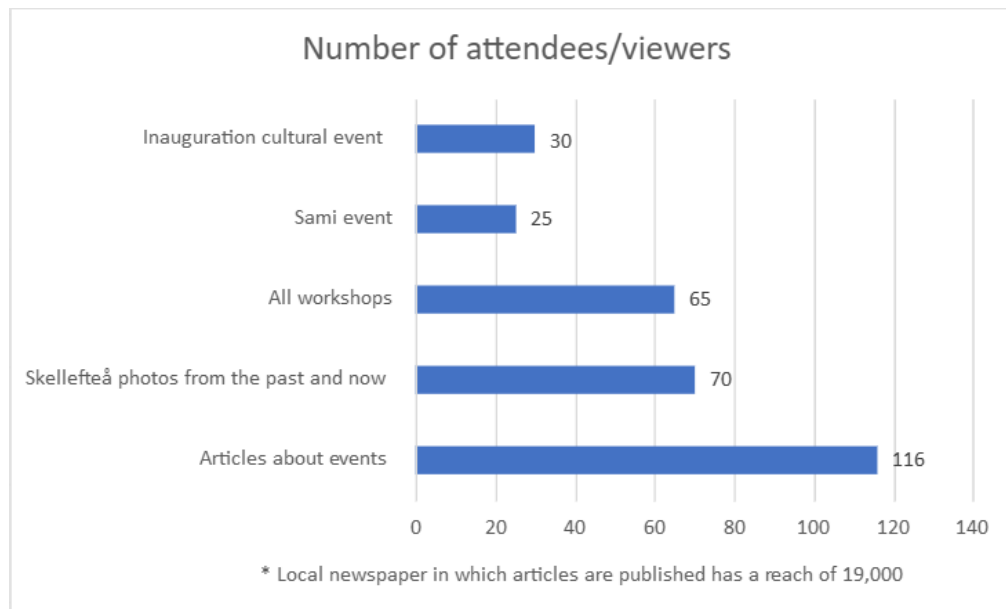


Figure 368: Total no. of People Aware of the Project in Skellefteå

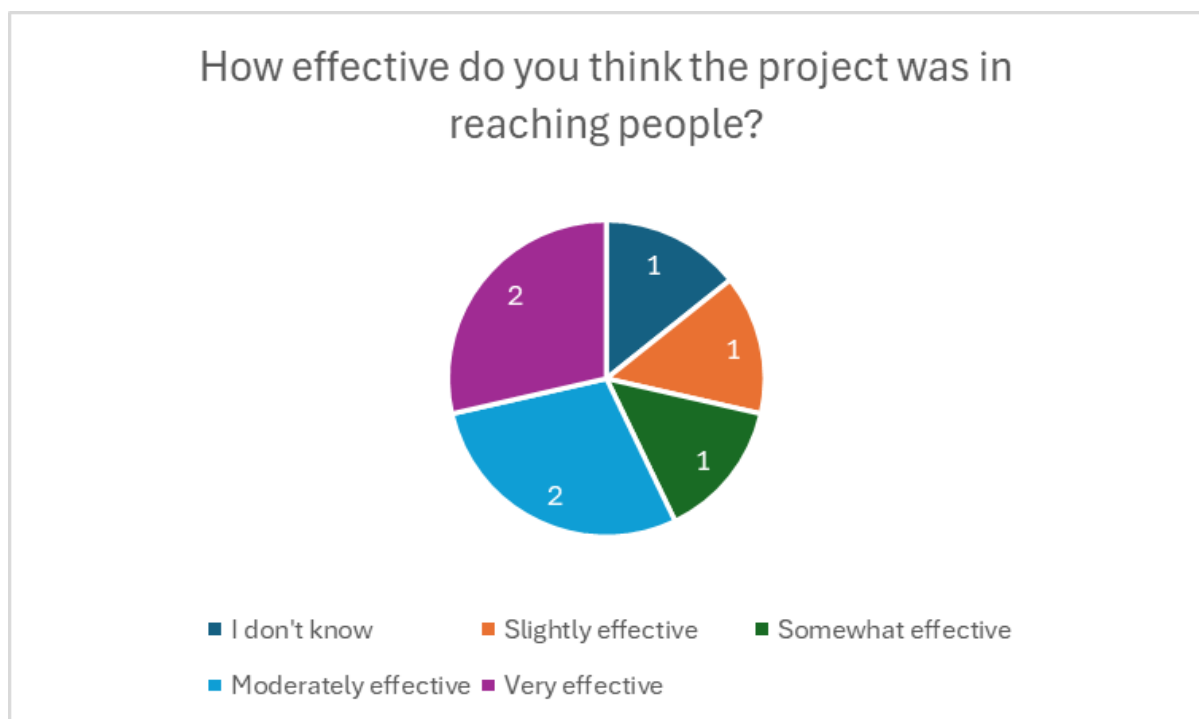


Figure 369: Skelleftea 7.11 Co-evaluation result

At the final stakeholder event, participants were asked to evaluate how effective the project had been in reaching people. An equal number of respondents (2) rated the results as very effective and moderately effective.

Challenge 8

KPI 8.5 Personal and social background of people who participated in the project's activities

Expected Impact: Fair participation to project activities (Direct Impact)

VS(s): 5

Evaluation Method: Co-evaluation

From the evaluation form results submitted by participants in activities organised by the Skellefteå pilot representatives until the end of 2023, it is established that the highest bracket in the below age category among the participants was '31-50'. Other forms of engagement to be organised within the pilot site will attract participation from diverse age groups, with the possibility of increasing engagement from the younger generations. The percentage rate of participation from the higher category is 50%.

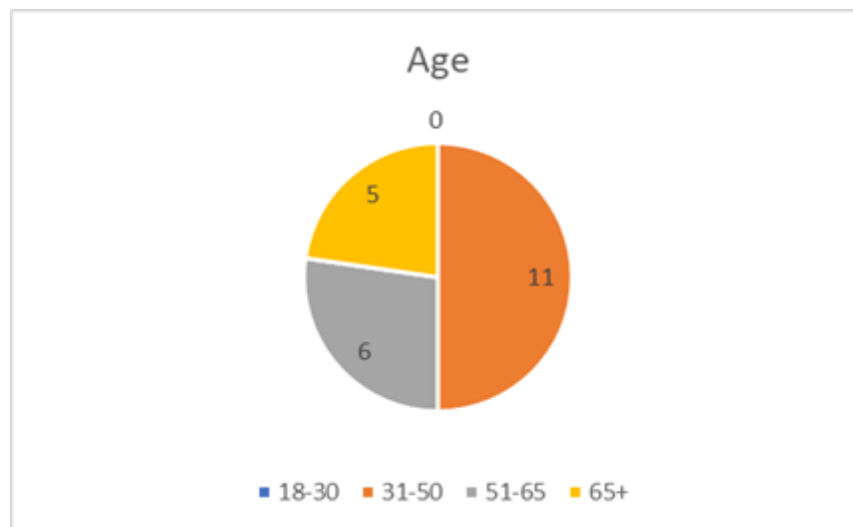


Figure 370: Age groups in Skellefteå activities

From a diverse range of categories related to gender participation in Skellefteå, the data below shows that it was males and females who participated in the pilot site's events - from the submitted evaluation forms. The female gender category is dominant when compared, with 77.2% of participants.

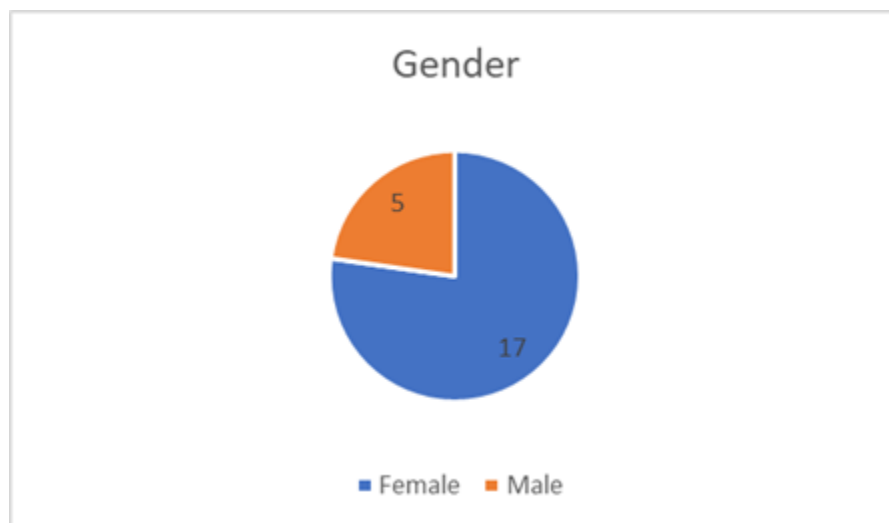


Figure 371: Genders in Skellefteå activities

The pie chart below indicates that participation from the 'Heterosexual/straight' category is the only one which was represented among the participants in the Skellefteå pilot's activities. Other categories might improve in terms of attendance given that other engagement activities are planned for the remaining months of the VARCITIES project.

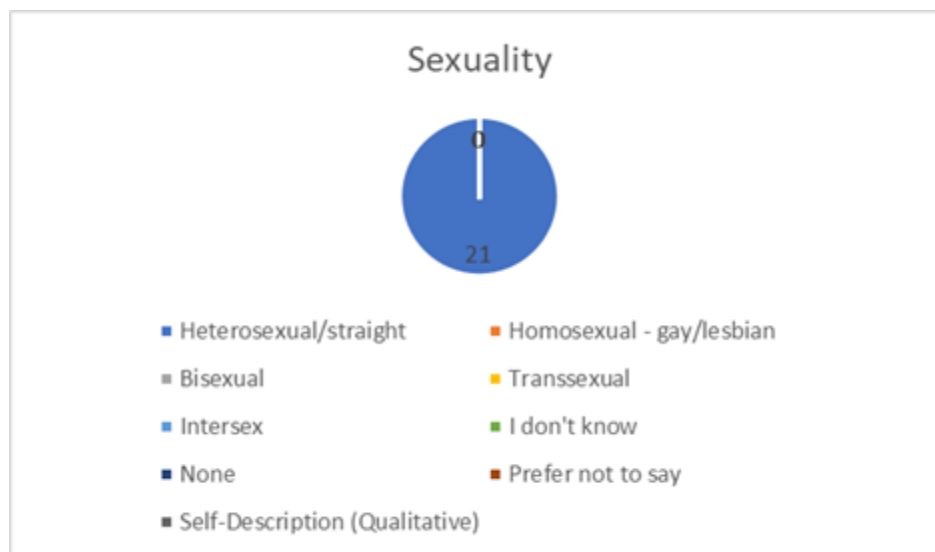


Figure 372: Sexual orientation in Skellefteå activities

In the socio-economic section of the evaluation form, most of the participants are coming from a 'privileged' socio-economic background, however a significant portion of the results show a high participation rate from attendees belonging to the 'underprivileged' category. When the percentages are calculated the following values are obtained; the privileged category is equivalent to 52.4% while the underprivileged category results in 38% of the submitted forms.

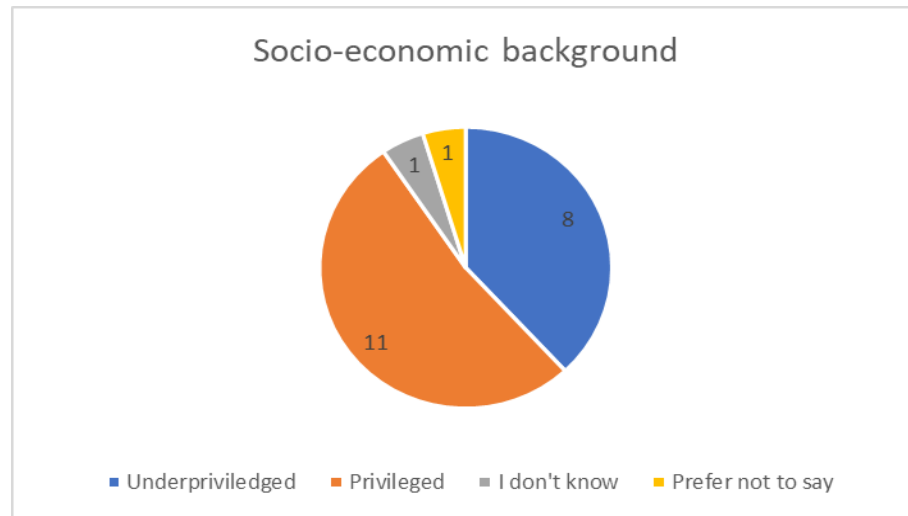


Figure 373: socio-economic background of co-creation participants in Skelleftea

Within the results collected in relation to the educational background of attendees, those with a High School and master's degree is on par and above the rest. Both categories result in 30% of the responses.

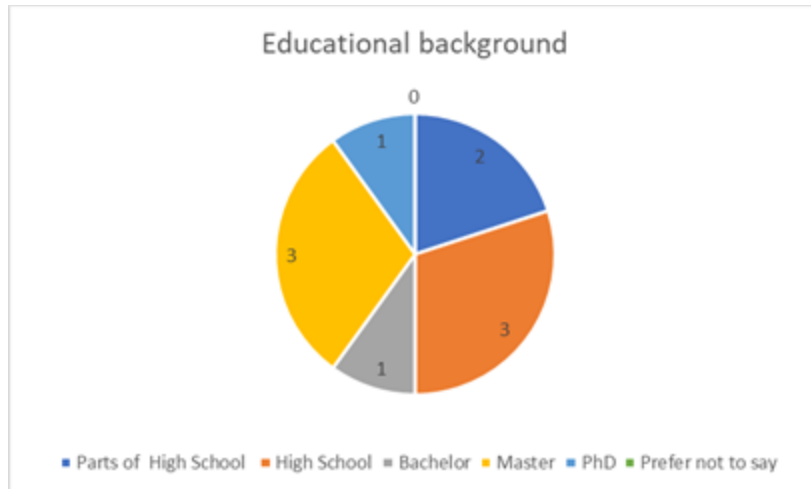


Figure 374: Educational background in Skellefteå activities

As the figure below shows, participants belonging to the ‘full-time employed’ category are the most represented, with 70% representation within the responses. A diverse range of engagement activities targeted at different groups is expected to increase participation of people with a different employment status.



Figure 375: Employment status in Skellefteå activities

Disabilities among the people who participated in Skellefteå activities result in only one incidence of a person suffering from mobility issues so far. The calculated percentage for this category is 5.9%.

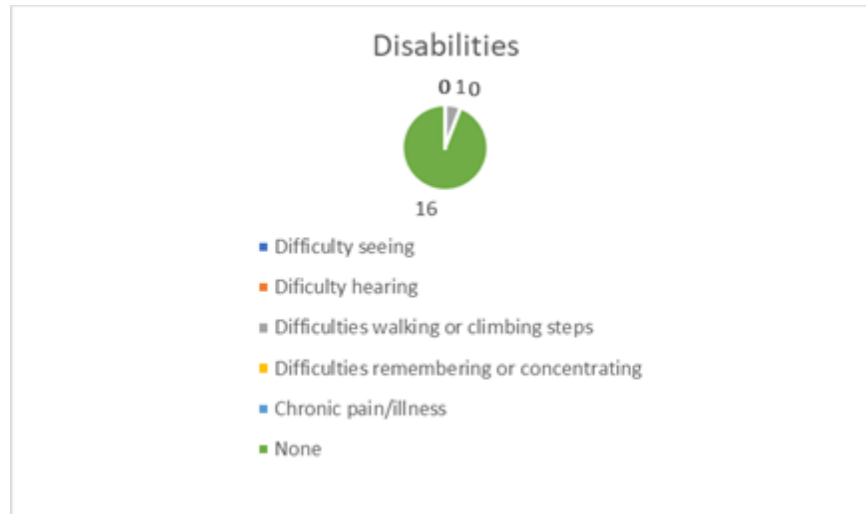


Figure 376: Disabilities in Skellefteå activities

The highest category among the responses below is that of people who have expressed that they belong to the 'no religion' category. However, the highest reported percentage from the categories of various religions, beliefs or faith is 30.8%, representing participation from Christian Protestants.

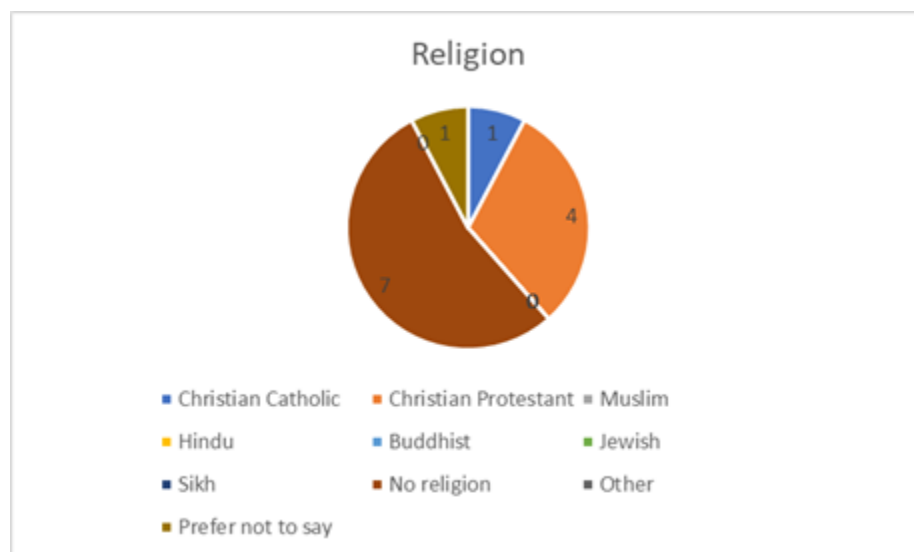


Figure 377: Religions in Skellefteå activities

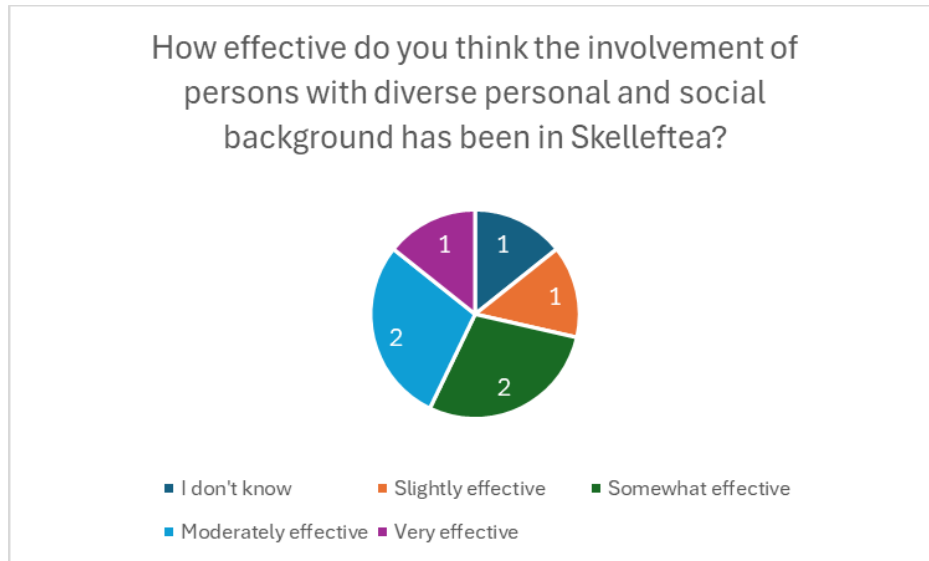


Figure 378: Skellefteå 8.5 Co-evaluation result

At the final stakeholder event, participants were asked to evaluate how effective the involvement of persons with diverse personal and social background has been in Skellefteå. An equal number of respondents (2) considered the outcome to be somewhat and moderately effective.

Challenge 9

KPI 9.19 Increase in walking and cycling in and around areas of interventions

Expected Impact: Increased outdoor physical activity (increased of data gathering of data of people being physical active)

VS(s): 3

Evaluation Method: N/A

The KPI was not measured. The Park is an open-access area, making it difficult to engage visitors for feedback. Attempts to collect survey responses to gather data about physical activity were unsuccessful, which limited the ability to gather measurable data.

KPI 9.27 Anxiety levels

Expected Impact: Reduction in anxiety levels

VS(s): 1,2

Evaluation Method: N/A

The KPI was not measured. The Park is an open-access area, making it difficult to engage visitors for feedback. Attempts to collect survey responses to gather data about anxiety levels were unsuccessful, which limited the ability to gather measurable data.

KPI 9.28 Affective status

Expected Impact: Increased psychological well-being and/or quality of life: improved positive emotions; reduced negative emotions

VS(s): 3

Evaluation Method: N/A

The KPI was not measured. The Park is an open-access area, making it difficult to engage visitors for feedback. Attempts to collect survey responses to gather data about affective levels were unsuccessful, which limited the ability to gather measurable data.

Challenge 10

KPI 10.5 Definition of parameters for (re)designing of green public spaces based on the well-being of users

Expected Impact: Increased parameters for (re)designing green public spaces

VS(s): 1,2,3,4,5

Evaluation Method: N/A

This KPI was not measured.

KPI 10.6 Replication of solutions

Expected Impact: High replication potential of Visionary Solutions (Direct Impact)

VS(s): 1,2

Evaluation Method: Co-Evaluation

The graphs below present the number of responses regarding the replicability of various solutions.

- Natural infrastructure

This solution is most frequently rated as having moderate replicability (approximately 25 responses), followed by a considerable number of responses indicating it is not replicable (around 15).

- Outdoor Educational Infrastructure

The majority of respondents placed this solution in the low replicability category (23 responses), with non-replicable following as the second most frequent response (16).

- Smart Lighting

This solution is predominantly seen as having low replicability (24 responses), followed by moderate replicability (18 responses), reflecting a cautious view of its scalability.

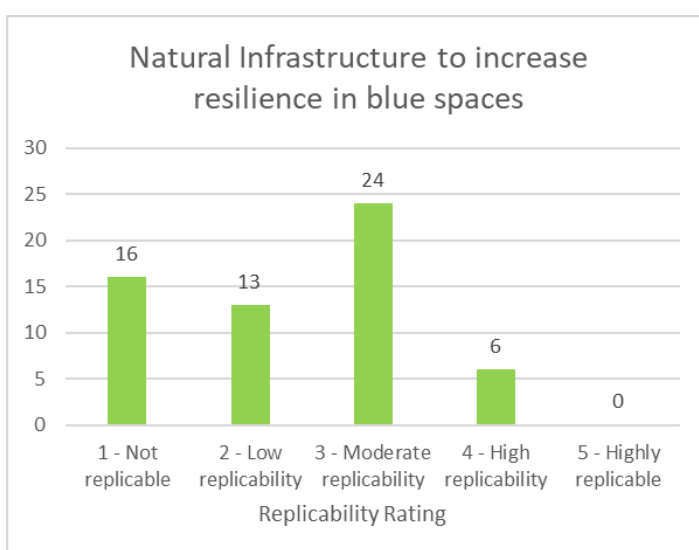


Figure 379: Skellefteå VS Group 1 replication potential

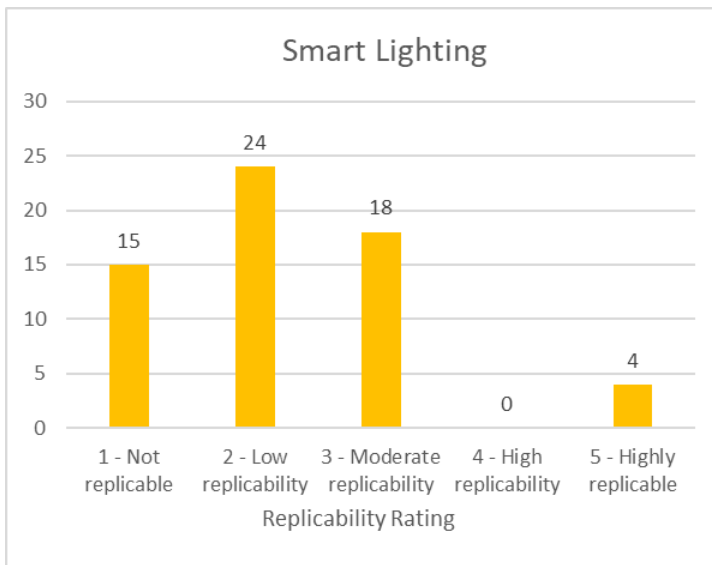


Figure 380: Skellefteå VS Group 2 replication potential

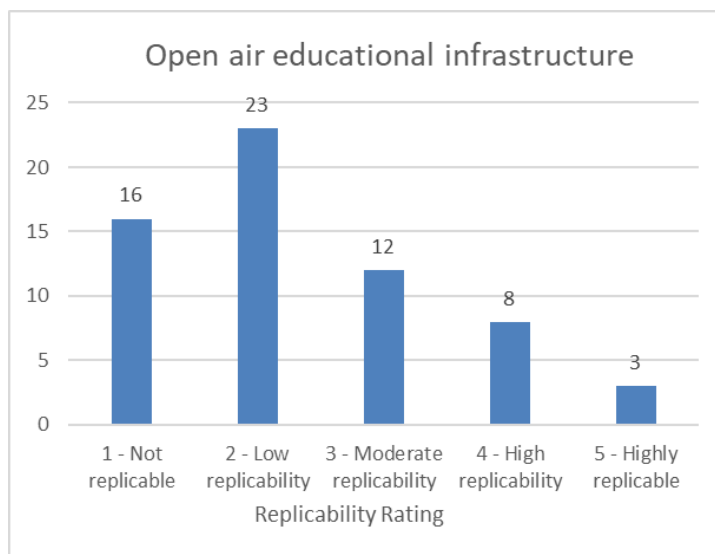


Figure 381: Skellefteå VS Group 3 replication potential

KPI 10.8 Savings in healthcare spending

Expected Impact: Savings in healthcare spending

VS(s): 1,2

Evaluation Method: Pre & Post

This KPI could not be measured as it falls outside the scope of the municipality's authority. The responsibility and competencies related to this KPI lie with a higher level of government—specifically, the regional government.

KPI 10.9 Public & private investments during/after the project

Expected Impact: Increased public & private investments (Direct Impact)

VS(s): 1,2

Evaluation Method: Pre & Post

In Skellefteå, the total investment for the VARCITIES pilot project amounts to €417,318.00, with €395,581.00 sourced from EU-funded allocations. These funds were primarily directed towards infrastructure development (€92,106.00), environmental and health monitoring systems (€31,496.00), human resources (€176,981.00), pilot-specific technologies (€93,486.00), and community engagement activities (€1,512.00). Additional in-kind support was provided by local government contributions (€20,237.00) and volunteer efforts (€1,500.00). Looking ahead, future funding opportunities are focused on securing local sustainability grants to support the expansion of green infrastructure and the creation of additional shaded areas to enhance public spaces.

Skellefteå's VARCITIES pilot location has an estimated future funding potential of €75,000 from Local Sustainability Grants, aimed at expanding green infrastructure and creating shaded areas, contributing to the city's ongoing sustainability and urban development efforts.

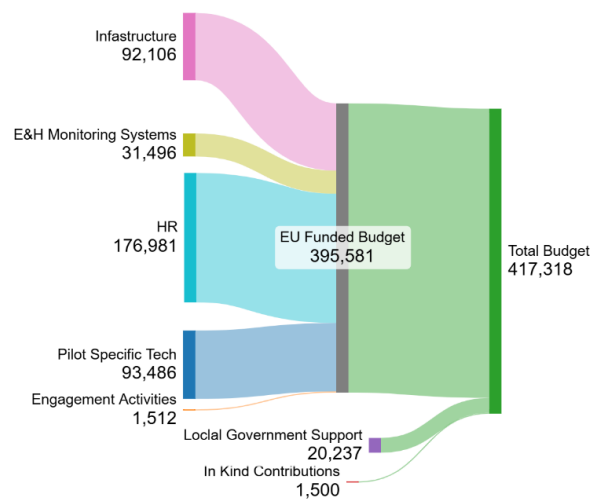


Figure 382: Current public & private investment in Skellefteå



Figure 383: Future Public & private investment in Skellefteå