



Deliverable 2.4

**Integration of socio-economic aspects and
analysis of sustainability**

Final 18/05/2020

SINFONIA

**“Smart INitiative of cities Fully cOmmitted to iNvest In Advanced
large-scaled energy”**

CONTRACT NUMBER	609019	INSTRUMENT	COLLABORATIVE PROJECT
START DATE	2014-06-01	DURATION	73 MONTHS



This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement No 609019

List of abbreviations

AHP	analytic hierarchy process
CE	choice experiment
CO ₂	carbon dioxide
DOW	description of work
EPC	energy performance certificate
FG	focus group
GIS	geographic information system
HP	hedonic price
ICT	information and communication technologies
MCDA	multi-criteria decision analysis
RES	renewable energy sources
SLM	spatial lag model
SSEDP	smart and sustainable energy district projects
WCM	world café method
WTP	willingness to pay



1. EXECUTIVE SUMMARY

European innovation projects are financed to pursue specific objectives. However, their ultimate success is often related to their ability to grasp, along the way, additional positive effects that emerge during the design, implementation and running phase or sometimes even after their end. Task 2.4 aims at providing a clear understanding of the positive effects of the SINFONIA project and, more in general, of smart-energy-city projects. To define and investigate these effects, we adopt the concept of “co-benefits”.

Although primarily focusing on carbon dioxide (CO₂) emission reduction, integration of renewable energy sources (RES) and energy efficiency improvement, SINFONIA is likely to deliver a wide range of co-benefits at the district and at the urban level. Co-benefits are positive impacts (e.g., social, economic and environmental) arising from the implementation of policy measures or project execution, collateral to the intended primary goal(s). Co-benefits related to energy efficiency interventions, greenhouse gasses mitigation policies, or clean energy production and delivery, are widely investigated by sectorial scientific studies and worldwide recognized by several notable organizations like the International Energy Agency (IEA) or the Intergovernmental Panel On Climate Change (IPCC) (IEA, 2014; Mayrhofer & Gupta, 2016). A famous graphic representation is the “multiple-benefits flower” developed by the IEA (see Figure 1). Our challenge is to specify which co-benefits - and to what extent - it is reasonable to expect by this project, considering its temporary endeavor, specific goals, resources and financial constraints. This latter point is particularly relevant since involved organizations, by adopting a project-oriented structure, are forced to act differently from their business as usual operation (Kerzner, 2013). More precisely, cooperation and demonstration projects, like SINFONIA, can catalyze positive effects because:

1. although generally designed for energy-environmental purposes, they may activate multiple benefits arising from complementary planned activities;



2. stressing the interaction among different stakeholders, they may generate additional benefits related to synergies and knowledge exchange.

Consequently, the co-benefits approach is adopted to address the aims of task 2.4:

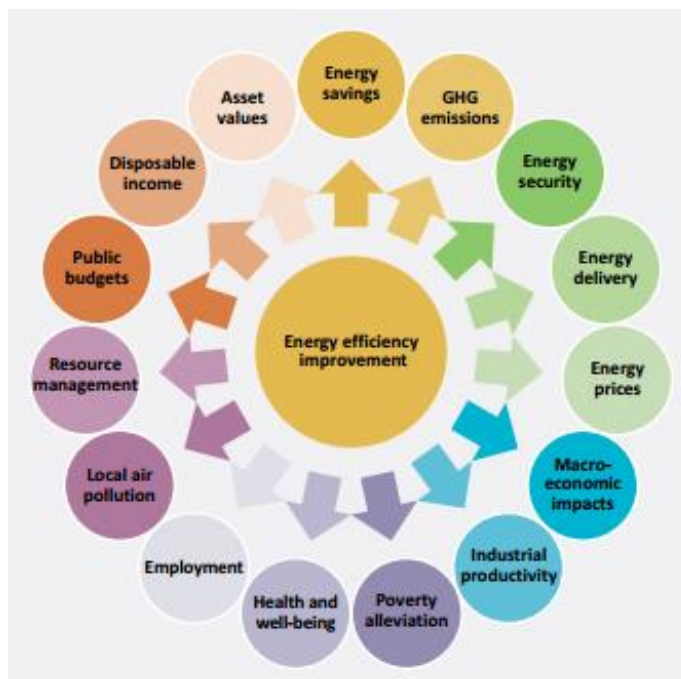


FIGURE 1 THE MULTIPLE BENEFITS FLOWER. SOURCE: IEA 2014

obtaining a multi-layer integration within the socio-economic sector and enabling a better understanding of the implication of sustainability measures (i.e. activities and intervention) delivered by the project. Assessing how such measures contribute to better environmental conditions, higher life quality for citizens, and economic performances it means, in one word, looking at the urban 'competitiveness' in a sustainable development perspective (Jiang & Shen, 2013).

Framing this concept into the smart-energy-city perspective (see Deliverable 2.1) enables the project to act as a "research reactor" for a wider urban smartness, introducing deeper awareness in stakeholders and providing knowledge to decision-makers. By so doing, the urban governance will exploit a multi-layer integration, involving all key structural dimensions of the smart-energy-city. Stakeholders¹ are the focus of this study, not only as they expect to benefit from sustainability measures, but

¹Citizens, city & district management, research centres, building owners, energy suppliers.

also for their involvement in the project. They are the ones who should be able to identify co-benefits (even unexpected and at early stages) and measure their values, as well as their impact.

According to the Description of Work (DOW), task 2.4 unfolds into three different surveys:

- Survey n°1 has a twofold aim: (1) to assess the project participants' awareness about the co-benefits concept and (2) to raise their consciousness on it. These objectives are achieved through desk research on co-benefits (to provide participants with background knowledge), by filling a semi-structured questionnaire and having group discussion based on world café methodology (WCM). Results of survey n°1 will also provide an "intermediate" assessment about co-benefits (at month 24 – M24 – of the project lifetime), to be compared with the results of the desk research on similar projects ("ex-ante" evaluation) and later on to survey n°3, performed close to the project's end ("ex-post").
- Survey n°2 serves the purpose of investigating local peculiarities to enhance synergies when implementing new integrated innovative solutions (i.e. building stock renovation, smart grids, integrated infrastructures), to consider how the project may contribute toward urban sustainable competitiveness and smartness. This is done through non-market evaluation methods (e.g. stated/revealed preferences of consumers) and a multi-criteria approach to complex decision-making.
- Survey n°3 is conducted for a re-evaluation of ranking and values assigned to co-benefits in survey n°1, close to the project's end (at month 67 – M67 – of the project lifetime), and to double-check results in comparison with the desk research performed on similar smart city projects.

The main results achieved thanks to these investigations are reported in the following paragraphs:

- Joint activities performed in survey n°1 (individual and group assessment) brought together various perspectives in an informal setting to define collective



insights, exchange ideas, and grasp the cooperative attitude towards SINFONIA co-benefits. The general interest towards co-benefits involving end-user behavior and intangible assets became clear. In particular, the expected co-benefits "Health and well-being of residents/tenants increased" emerged as the most important, followed by "Innovation in processes and decision making". The latter refers to positive changes that should be experienced by project partners, as organizations involved in the temporary consortium. "Professional skills development" and "Users' awareness on energy-related issues increased" are often found in the questionnaires and mentioned by the group discussion, although a little bit less than in the desk research.

- The investigation of three main intervention areas of the SINFONIA project within the survey n°2 returns that:
 - citizens, tourists, and city users in Bolzano see potential benefits in this new integrated smart infrastructure (called "totem"), and they have a willingness to pay (WTP) to access its features. For example, WTP for Wi-Fi connection is 1.49€ per month, while WTP for having charging points for e-cars is 1.82€ per month. For this reason, such features should be considered in the final layout of the totem;
 - beside the location (the position of the residential property in the municipality and urban context), the real estate market in Bolzano appreciates the energy efficiency of an apartment, among other technical features. *Ceteris paribus*, the price premium on the residential market is 6.3% for the A label declared in the Energy Performance Certificate (EPC), 5.4% for a B label, and 2.9% for a C label. Moreover, there might be a positive correlation between large-scale refurbishment interventions (usually coupled with energy retrofitting measures) and the prices of



surrounding properties because of the spillover effect of nearby properties;

- Inquired experts of the construction sector say that citizens in South Tyrol expect various co-benefits while undertaking deep energy retrofit works on their own residential property. Experts assigns the first place to achieving economic benefits (37%), and a remarkable similar importance both to thermo-hygrometric comfort (22%) and design and spatial quality (22%). It is interesting to note how summing up the single sub-criteria referring to "health and well-being" a relevant value emerges; some 40% of the decision involves these aspects, although they are scattered among the different criteria.
- Questionnaires delivered in the survey n°3 reports that four out of five previously identified co-benefits (by comparing M24 to M67), remain in the top five (they are the most important). The ranking is changing, except for the first place, that is still occupied by "health and well-being of residents increased". "Users' awareness on energy-related issues increased" and "Professional skills development" move up in the ranking. The main difference with the desk research is that the first position "Local labour market stimulated", formerly ranked 3rd in the WCM discussion at M24 is now totally left outside. Interestingly, the co-benefit related to the "Territorial attractiveness increased" of the city and the district, not mentioned at M24, is recovered coming to the end of the project.

In general, the journey through the co-benefits of the SINFONIA projects has achieved the goal to introduce this concept among the project partners, helping them to focus on "secondary" results and to use them in communication and dissemination activities. Stressing how retrofit intervention may increase the "health and well-being of residents" means going beyond climate-energy issues, which may be of little interest



for some stakeholders, while increasing “awareness on energy-related issues” is the complementary element to change attitudes. On the other side, measuring how much citizens are interested towards innovative infrastructure or energy efficient buildings and district are appreciated by the real estate market is the right signal to engage local authorities and developers toward the smart energy transition. There is still much to do to probe how much smart city projects may stimulate the “Local labour market” thanks to their investments, despite this co-benefit is often mentioned in the initial statements, and to demonstrate how relevant the contribution of the different co-benefits could be in the overall assessment of the project. However, methodologies are available, and SINFONIA started to implement them.



TABLE OF CONTENTS

1.	EXECUTIVE SUMMARY	2
2.	INTRODUCTION	4
3.	SURVEY 1 – VALIDATION OF THE KEY URBAN CO-BENEFITS AMONG PROJECT PARTNERS	7
	MATERIALS AND METHOD	14
	INDIVIDUAL QUESTIONNAIRES	15
	GROUP DISCUSSION - WCM.....	16
	RESULTS	17
	CONCLUSIONS	33
4.	SURVEY 2 - ESTIMATING THE VALUE OF AND INTEREST TOWARDS SINFONIA ACTIVITIES IN THE SMART GRID, SMART INFRASTRUCTURE AND BUILDING SECTOR	37
	2A – SMART GRID / SMART INFRASTRUCTURE: WILLINGNESS TO PAY	38
	MATERIALS AND METHOD	38
	RESULTS	40
	2B – HIGH ENERGY PERFORMANCE BUILDINGS: MARGINAL MARKET VALUE	43
	MATERIALS AND METHOD	44
	RESULTS	46
	2C – HIGH ENERGY PERFORMANCE BUILDINGS: HOUSE OWNERS EXPECTATION	48
	MATERIALS AND METHOD	49
	RESULTS	52
5.	SURVEY 3 – FINAL ASSESSMENT OF CO-BENEFITS ON LOCAL ECONOMY AND GOVERNANCE	56
	MATERIALS AND METHOD	56
	RESULTS	57
6.	SOCIO-ECONOMICS OF SMART CITIES – CONCLUSIONS AND OUTLOOK	73
7.	LITERATURE	77
8.	ANNEXES	81
	ANNEX 1 – CO-BENEFITS DEFINITIONS	81
	ANNEX 2 – QUESTIONNAIRE M24 - FACSIMILE	83
	ANNEX 3 – WCM PARTICIPANTS LIST	84
	ANNEX 3 – CO-BENEFITS RANKING BY WCM GROUPS	86
	ANNEX 4 – CHOICE EXPERIMENT SURVEY - TOTEM	88
	ANNEX 5 – QUESTIONNAIRE M67 - FACSIMILE	90
	ANNEX 6 – DOCUMENT INFORMATION	92



COLLABORATIVE PROJECT; GRANT AGREEMENT NO	WORK PACKAGE:	2
609019	VERSION:	0.4
	DATE:	XX.04.2020

FIGURES

FIGURE 1 THE MULTIPLE BENEFITS FLOWER. SOURCE: IEA 2014.....	3
FIGURE 2: CO-BENEFITS CONCEPTUAL FRAMEWORK- META ANALYSIS	8
FIGURE 3: RECURRENCE OF CO-BENEFITS AND CO-OPPORTUNITIES IN SMART AND SUSTAINABLE ENERGY DISTRICT PROJECTS	9
FIGURE 4: WCM DURING THE SINFONIA GENERAL ASSEMBLY IN SEVILLE (M24 – JUNE 2016).....	17
FIGURE 5: EXPECTED RELEVANCE OF THE CO-BENEFITS ON YOUR CITY	19
FIGURE 6 - CO-BENEFITS ASSESSMENT: EXPECTED LIKELIHOOD OF OCCURRENCE ON YOUR CITY	21
FIGURE 7: CO-BENEFITS ASSESSMENT: RANKING PROVIDED BY PARTNERS AT M24.....	23
FIGURE 8: SMART NATURAL ENVIRONMENT CO-BENEFITS	25
FIGURE 9: FIGURE 5 - SMART SERVICES CO-BENEFITS	25
FIGURE 10: SMART COMMUNITY CO-BENEFITS	26
FIGURE 11: SMART GOVERNANCE CO-BENEFITS.....	27
FIGURE 12: SMART ECONOMY CO-BENEFITS	28
FIGURE 13: SMART BUILT ENVIRONMENT CO-BENEFITS.....	29
FIGURE 14: RANKING OF THE CO-BENEFITS DURING THE WCM PRESENTATION.....	31
FIGURE 16: PROPORTIONAL RELEVANCE OF RANKED CO-BENEFITS	32
FIGURE 15: CO-BENEFITS THAT DID NOT RECEIVE RANKING FROM THE WORLD CAFE’ PARTICIPANTS.....	32
FIGURE 17: GRAPHIC DEPICTION OF A “TOTEM” IN BOLZANO. SOURCE: SINFONIA OFFICIAL VIDEO ITA	39
FIGURE 18: EXAMPLE OF A CHOICE CARD INCLUDED IN THE QUESTIONNAIRE	40
FIGURE 19: STATISTICS ON DATA COLLECTION SURVEY N°2	41
FIGURE 20: RESULTS OF THE CHOICE EXPERIMENT	42
FIGURE 21 DISTRIBUTION OF RESIDENTIAL PROPERTIES BY EPC CLASS IN BOLZANO	46
FIGURE 22: DECISION TREE WITH CRITERIA AND SUBCRITERIA	49
FIGURE 23: SCREENSHOTS OF SUPER-DECISIONS SOFTWARE TO MODEL AHP.....	51
FIGURE 24: AVERAGE WEIGHT OF THE CRITERIA IN THE DECISION	53
FIGURE 25: AVERAGE WEIGHT OF THE SUB-CRITERIA IN THE DECISION	54
FIGURE 26: SMART NATURAL ENVIRONMENT	59
FIGURE 27: SMART SERVICES.....	60
FIGURE 28: SMART COMMUNITY	61
FIGURE 29: SMART GOVERNANCE	62
FIGURE 30: SMART ECONOMY	63
FIGURE 31: SMART BUILT ENVIRONMENT	65
FIGURE 32: PROBABILITY OF CO-BENEFITS (M67).....	69
FIGURE 33: CO-BENEFITS ASSESSMENT: RANKING PROVIDED BY PARTNERS AT M67.....	71



TABLES

TABLE 1: LIST OF KEY URBAN CO-BENEFITS	11
TABLE 2: QUESTIONNAIRES M24 GENERAL STATISTIC	18
TABLE 3: OVERALL EXPECTED RELEVANCE OF THE CO-BENEFITS.....	20
TABLE 4: OVERALL EXPECTED OCCURRENCE OF THE CO-BENEFITS	20
TABLE 5: DESK RESEARCH VS SINFONIA PROJECT PARTNERS	33
TABLE 6: STRUCTURE OF VARIABLES HP - SHP	45
TABLE 7: MAIN RESULTS OF THE SURVEY	52
TABLE 8: QUESTIONNAIRES GENERAL STATISTIC (M67).....	57
TABLE 9: OVERALL EXPECTED RELEVANCE OF THE CO-BENEFITS (M67)	58
TABLE 10: CO-BENEFITS' RELEVANCE.....	66
TABLE 11: OVERALL PROBABILITY OF THE CO-BENEFITS (M67).....	67
TABLE 12: MOST MENTIONED IN TOP 5.....	70
TABLE 13: TOP 5: THE MOST MENTIONED AS FIRST OR SECOND MOST	70



2. INTRODUCTION

SINFONIA - the acronym for "Smart INitiative of cities Fully cOmmitted to iNvest In Advanced large-scaled energy solutions" - is a complex project applying innovative energy technologies within existing urban districts, involving multiple stakeholders. In the first stage, the project will act on selected publicly owned residential buildings (in both lighthouse cities) and schools (in Innsbruck). Its primary goals are to reduce the need for energy from fossil fuels by improving energy efficiency and shifting to local renewable energy sources (RES), and consequently cutting carbon dioxide (CO₂) emission.

Moreover, the SINFONIA project expects to deliver a wide range of co-benefits at the urban level. Co-benefits are defined as positive impacts arising from the implementation of policy measures or project execution, besides the intended primary goal(s). Those related to energy efficiency interventions, greenhouse gasses mitigation policies, or clean energy production and delivery, are widely investigated by sectorial scientific studies and worldwide recognized by several notable organizations (Mayrhofer & Gupta, 2016). The challenge is to define more clearly which co-benefits, and to what extent, is it reasonable to expect by the project, defined as a temporary endeavor, dedicated to pursuing a specific goal within precise time, resource, and financial constraints. This is a relevant point, because involved organizations, by adopting a project-oriented structure, are forced to act in a way different from business as usual operation. More precisely, cooperation and demonstration projects, like SINFONIA can be a catalyst of positive effects because:

- firstly, although generally designed for energy-environmental purposes may activate multiple benefits arising from complementary planned activities;
- secondly, because stressing the interaction among different stakeholders, they may generate additional benefits related to synergies and knowledge exchange.

Consequently, the co-benefits approach is adopted to address the objectives of task 2.4, which should be seen within the wider context of WP 2 activities and purpose. According to the Description of Work (DOW), "the WP2, providing more detailed and



manageable information, will help demonstration cities, early adopters and replication cluster members to break down overcome barriers related to context or process and to overcome them". Indeed, this means:

- going deeper in basic knowledge related to general socio-economic aspects (e.g., defining a coherent approach, as the co-benefit);
- better investigate local peculiarities, to enhance the synergies when implementing new integrated innovative solutions (e.g., understanding the physical structures, as the existing building stock and related energy systems, and the social habits);
- to take into account how the project may contribute towards the main city objectives, which are sustainable competitiveness and smartness (e.g., local economy, social capital, welfare, etc.) (Jiang & Shen, 2013).

Framing this concept into the smart-energy-city perspective (see SINFONIA Deliverable 2.1) enables the project to act as a "research reactor" for a wider urban smartness, introducing deeper awareness in stakeholders and providing knowledge to decision-makers. In that way, the urban governance will really take advantage of a multi-layer integration, involving all the key structural dimensions of the smart-energy-city. Stakeholders are the focus of this study, not only as they expect to benefit from sustainability measures, but also due to their involvement in the project, they should be able to identify co-benefits (even unexpected at an early stage) and measure their values as well as their impact.

Thus, task 2.4 is operationally developed into three different surveys:

- Survey n°1 has a twofold aim: first to introduce the project participants to the co-benefits concept, by assessing their awareness and second to raise their consciousness on this concept. This is being done through a short lecture on the topic followed by semi-structured questionnaire administration and a group discussion based on world café methodology. Results of survey n°1 provide an "interim" assessment about co-benefits, to be compared with the results of survey n°3, performed close to the project's end ("ex-post" assessment phase) and double-checked with the desk research on similar projects ("ex-ante").



- Survey n°2 serves the purpose of investigating local peculiarities, to enhance the synergies when implementing new integrated innovative solutions (i.e. building stock renovation, smart grids, integrated infrastructures), to consider how the project may contribute toward the urban sustainable competitiveness and smartness. This will be done through three different on-field experiments based on non-market evaluation methods (e.g. stated/revealed preferences of consumers) and a multi-criteria approach to complex decision-making;
- Survey n°3 is the final online questionnaire administrated at the end of the project with similar goals of ordering and assigning a value to co-benefits. This questionnaire allows us to validate previous results and could be extended further research for similar projects or planned activities in the early-adopter cities.

A more extensive discussion on co-benefits / multiple-benefits of the urban energy transition is available in Bisello & Vettorato (2018).



3. SURVEY 1 – VALIDATION OF THE KEY URBAN CO-BENEFITS AMONG PROJECT PARTNERS

Scientific literature and previous experiences of energy projects at the district scale (see for example the crucial European initiative “CONCERTO” <https://smartcities-infosystem.eu/content/concerto-projects>) suggest that multiple co-benefits should arise from the SINFONIA project development and implementation. They are expected both from building refurbishment measures and from other innovative integration measures undertaken by the project.

Specific research work on this has been done by Bisello (2017) to answer the question about which kinds of co-benefits, if any, are expected from the development and implementation of smart and sustainable energy district projects (SSEDP). To answer this, an extensive literature review of co-benefits deriving from energy-efficiency projects and CO₂ mitigation policies has been done. In parallel, a selection of 36 European SSEDP was analyzed, to understand what co-benefits they mention, both achieved and foreseen.

As a first result, co-benefits related to project-management activities are added to those traditionally derived from the execution phase, providing a comprehensive overview (a list of 19 key co-benefits). Then, co-benefits are explained and discussed, linking the expectation of projects’ positive effects on literature findings. Finally, co-benefits are subdivided among seven main “smart city components”, having the following short definitions, according to Mosannenzadeh & Vettorato (2014) (see Figure 2):

- Smart natural environment concerns environmental resources, from vegetation to air, soil, and water;
- Smart services concern citizens health and safety;
- Smart community concerns citizens welfare and behaviors;
- Smart governance concerns the administrative functions, roles, and rules of the urban government;
- Smart economy concerns local economic activities and labor market;



- Smart built environment concerns the physical and structural elements such as buildings, public spaces, and energy infrastructures; and
- Smart mobility and connectivity concern networks and systems allowing data, people and freights movement.

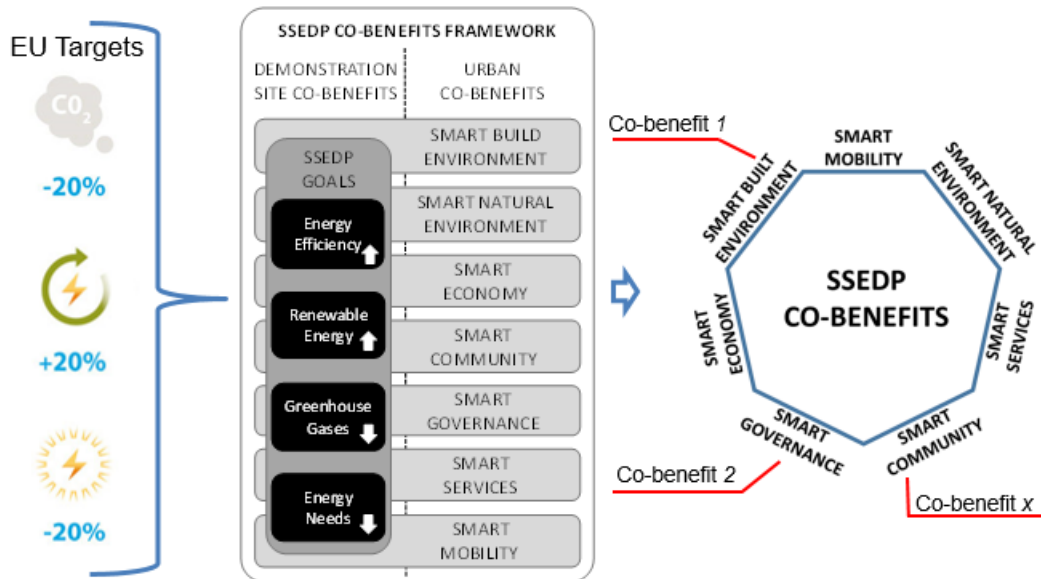


FIGURE 2: CO-BENEFITS CONCEPTUAL FRAMEWORK- META ANALYSIS

The following Figure 3 – taken from Bisello (2017) – shows the recurrent ones (those mentioned by at least half of the analyzed projects have solid fill), supporting a positive answer to the question of whether local co-benefits are expected as a consequence of SSEDP implementation. Not surprisingly, by going through the labels, it clearly emerges how all the traditional sustainable development dimensions are covered: economic, social, and environmental. There is broad agreement about: positive effects on the local labor market increased health and well-being of dwellings’ occupants, and the creation of users’ awareness of energy. Additionally, the result proves how a project assessment ignoring the “soft measures” not only leads to leaving aside at least four out of 19 potential co-benefits but interestingly, some of the most often recurring categories.

Finally, it suggests that two-thirds of co-benefits, related to the physical intervention on buildings and energy networks, can be considered as direct consequences: i.e. cause and effect are strictly related and reported. The rest can be defined as co-opportunities, that, to trigger, there is a need for additional efforts outside the project activities or specific local conditions.

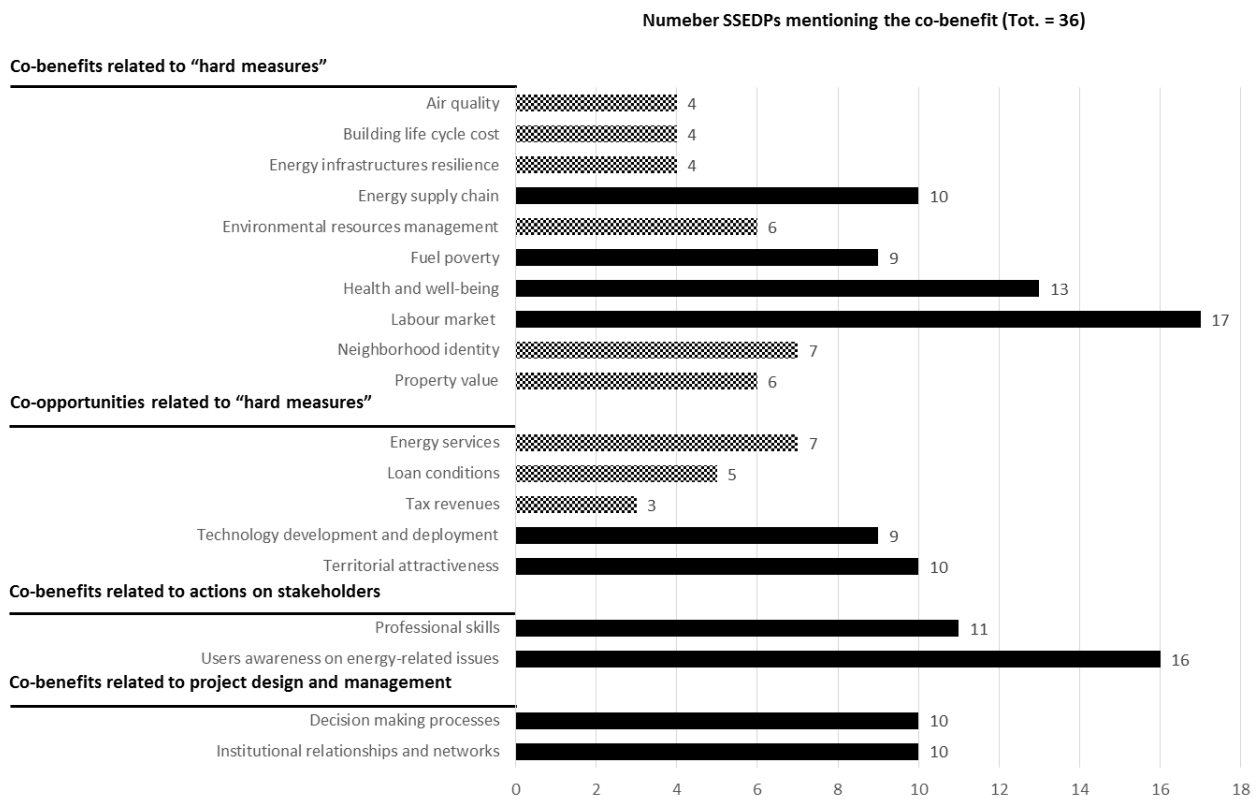


FIGURE 3: RECURRENCE OF CO-BENEFITS AND CO-OPPORTUNITIES IN SMART AND SUSTAINABLE ENERGY DISTRICT PROJECTS

The list of key urban co-benefits constitutes the "ex-ante" evaluation step, to compare the project's findings. Short definitions and a brief explanation of each co-benefit are reported in the following



Table 1.



TABLE 1: LIST OF KEY URBAN CO-BENEFITS

Smart natural environment
1. Local air quality improved. Shifting thermal energy and electricity production from fossil fuels to renewables, and decreasing energy needs, reduces local air pollutants (e.g. SO _x , NO _x , particulate matter), with positive effects on human health.
2. Environmental resources management improved. Establishing a better way to manage environmental resources reduces the environmental footprint of human activities, with positive effects on ecosystems.
Smart services
3. Health and well-being of residents increased. Improving the indoor thermal comfort and spatial quality in dwellings increases living and psychological conditions of occupants.
Smart community
4. Fuel poverty tackled. Reducing energy expenses to an affordable level, even for low-income people, can lower harmful effects on health, caused by indoor thermal shocks (in summer as in winter).
5. User's awareness on energy-related issues increased. Educational and communication activities change positively stakeholders and tenants' energy behavior and acceptance of new technologies.
6. Neighborhood identity enhanced. Creating new neighborhood relationships and a sense of place will lead to the formulation of dense social networks and ultimately better economic and social outcomes.
Smart governance
7. Innovation in processes and decision-making. The exchange of experiences introduces innovation, with a positive improvement in the quality and effectiveness of decision-making.
8. Territorial attractiveness increased. An exemplary smart and sustainable district attracts visitors interested in innovative and green solutions (e.g. institutions, public officials, researchers, or green tourists).
9. Institutional relationships and networks created. Creating and strengthening existing relationships between partners and cities leads to further joint activities and collaboration.



Smart economy
10. Positive change in local tax revenue. Creating new jobs and economic activities will positively affect local public revenues.
11. Softer loan conditions. Large scale interventions financially supported by the European Union can be interesting for banks and other investors and therefore negotiate better financial conditions.
12. Local labor market stimulated. New direct or in-direct job positions are created from the implementation of construction activities, project management, and other intervention measures.
13. Local energy supply chain established. Developing a new energy supply chain using local renewable sources or by-products (e.g. waste-to-energy, bioenergy) generates additional revenues.
14. Energy services developed. Developing innovative energy schemes allow us to cover refurbishment intervention costs without additional expenses for tenants or owners.
15. Innovation in technology development and adoption. Companies involved in the project will be frontrunners in the adoption of innovative solutions and therefore have an advantage over their competitors on the market.
16. Professional skills development. An increase in knowledge and know-how of professionals and practitioners on innovative processes and energy technologies augment productivity and competitiveness.

Smart build environment
17. Property value increased. Green (new and retrofitted) buildings with attractive features and high energy performance have a property value premium exceeding the expected economic value of energy saving.
18. Costs reduction of buildings life cycle. Large scale interventions that introduce efficient technologies, lower construction costs (allowing economy of scale) and reduce maintenance, repair and operation costs.
19. Resilience of energy infrastructures increased. Better response to loads peaks (the ability to prevent and react to them) and to adverse climatic events increases efficiency and safety in energy systems, reducing interruptions and blackouts.

Starting from the results of this work, the full list of co-benefits, attributed by smart city component and complemented with a short definition, has been explained in a dedicated lecture on this topic, then provided to the partners of the SINFONIA project



(see ANNEX 1 – CO-BENEFITS DEFINITIONS) before the administration of the survey n°1.²

The aim of survey n°1 is twofold: firstly, to assess the project participants' awareness about the co-benefit concept and secondly to raise their consciousness on this concept. In this way they will be more sensitive to the positive effects of the projects and will use it as a reference framework, which will help project participants to understand smart district activities as well as to become more competitive. Results of survey n°1 will also provide a "mid-term" assessment about perceived co-benefits, to be compared with the results of survey n°3, performed close to the project's end ("ex-post" evaluation).

To conduct it, a participatory technique is used, implementing the World Café method (WCM) and including some Delphi-method elements:

- WCM is a conversation process, involving concurrent and timely limited roundtable discussions, where participants focus on a predetermined set of questions (Brown et al., 2005);
- the Delphi method is intended to check if experts' opinions/answers have changed from the debate considering the replies of other members of the group and across the timeline.

The "café" metaphor emphasizes the informality of the context and the setting where multiple small tables are provided, to stimulate the debate and encourage conversation. The "world" stresses the inclusivity of this technique, where simultaneous communication of large numbers of people at one time is possible (Lorenzetti, Azulai, & Walsh, 2016).

WCM discussions are not strictly structured, and therefore open to unexpected perspectives. This may support the understanding of co-benefits and of other socio-

² In this research, the smart mobility component, although relevant in a holistic smart city approach, has no co-benefits, because analysed projects do not address the mobility sector with specific activities. On the other hand, SINFONIA and latest EU smart city projects are trying to include also this aspect within their sustainability measures. Therefore, this component remained in the taxonomy, to maintain the overall framework and to give to project partners the opportunity to imagine and suggest additional co-benefits in this field.



economic effects that can be associated with increased sustainability at the district level and with interactions among project partners. Project partners, although not covering the whole spectrum of urban stakeholders, are representatives of relevant groups and interests within each pilot city. Therefore, they can identify impacts and changes associated with the project development and implementation, through their direct experience. They are in addition a good sample of relevant stakeholders, and consequently representative for validating and assessing the suggested urban co-benefits, by assigning values and priorities.

By including some Delphi-Method elements, the investigation provides the chance to assess whether perspectives have been changed after performing the experiences made within the project. Therefore, it is necessary to ensure that the same participant institutions are involved in the different sessions (survey n°1 and n°3), namely: demo city & district representatives, early adopter cities, research centers, building owners, energy suppliers & utilities.

MATERIALS AND METHOD

Like other collaborative group discussions, the WCM wants to create a communicative space for sharing and developing collective knowledge. One specific aim is bringing together various perspectives in an informal setting in order to define collective goals, exchange ideas, and grasp the collective attitudes (Brown et al., 2005) towards co-benefits. Such group discussions are used to spark new ways of thinking and communications within groups and organizations (Brown et al., 2005; Chang & Chen, 2015). Most important to WCM is to ask questions not only in a topic related manner but also to initiate lively discussions with participants. Usually, three rounds of questions (or tasks) are undertaken. First, the topic is presented within the smaller groups and each participant can present her/his own point of view. Secondly, questions (or tasks) should be connected to conversations, statements, and ideas presented previously. At last, the topic is deepened with specific questions in the final discussion round (Seliger, 2015). The role of the moderator is to make sure everybody gets in touch with the discussion in order to keep the conversation alive and connect statements with each other in order to find an agreement upon asked questions or



tasks given. Furthermore, the moderator helps to navigate the topic with the group and stay focused on questions and tasks (Kühn & Koschel, 2011).

The literature on WCM (for additional references see: Lorenzetti et al., 2016) recognizes seven design principles to achieve effective results: (1) clearly setting the context, defining the purpose, the parameters, the themes, and defining the participants; (2) hosting the discussion tables in a hospitable location; (3) exploring questions that matter; (4) encouraging everyone's contribution; (5) bridging diverse points of view encouraging participants to discuss with new people, sharing ideas; (6) listening together for patterns and insights; and (7) sharing collective findings and conclusions.

To fulfill the above-mentioned points and reach the goal, the survey n°1 was implemented during the SINFONIA M24 General Assembly, held on June 8-10, 2016 in Seville (Spain), and was designed as follows.

INDIVIDUAL QUESTIONNAIRES

We have focused on finding already shared views of co-benefits and what seemed to be most important to stakeholders in the project. To introduce the theme a slide presentation from EURAC, explaining the co-benefit concept in detail, is given to participants during a plenary session (duration: 20 min + 10 min questions).

This had provided a general overview of background concepts, then an open list of 19 key urban co-benefits, based on the analysis of previous similar experiences (Bisello, 2017) has been distributed to participants.

Before starting the WCM, a short questionnaire about the co-benefit list has been filled out based on individual awareness and perception of participants. The questionnaire was designed in the shortest and easiest way, to keep the filling time concise (duration: 10 min), trying to avoid incomplete responses or sloppy and careless answers (See ANNEX 2 – QUESTIONNAIRE M24 - FACSIMILE).

The aim of the questionnaire is to elicit comprehensive responses about expectations and perceptions of key-stakeholders regarding co-benefits. It asked them, considering the SINFONIA project, to answer the three following questions:



- Q1: at the end of the project, what could be the relevance on your city of each of following co-benefits, ranging from 1 (not relevant) to 5 (very relevant)?
- Q2 how would you rate the likelihood of occurrence on your city of each of the following co-benefits, ranging from R (remote) to L (likely)?
- Q3: what do you think are the most important co-benefits delivered to your city? Please give a ranking of at least five.

In the last part of the questionnaire, respondents had the opportunity to review the suggested list, by mentioning some additional co-benefits or moving them from a "smart city component" to another.

GROUP DISCUSSION - WCM

After the communication, participants moved from the plenary conference hall to another room, large enough to host them comfortably. The room was previously arranged with discussion tables and seats. Once accomplished the questionnaire, the participants were organized and seated in small groups of 7-8 people, with a moderator on each table, to start the WCM. Tables had each previously presented co-benefits as cards on the table, blank cards for writing new ones and poster materials prepared. In order to establish an informal atmosphere, participants could get coffee or snacks anytime (see Figure 4).

Adapting from the widely used approach to WCM, an introduction phase presented the outline, introduced rules of World Café, and referred to the topic in the previously given presentation on co-benefits. Participants were then asked to answer 2 questions and find a ranking of the 5 most important co-benefits as a group:

- Q1: What do you think are the most important co-benefits for your city? (individual statements and group discussion);
- Q2: If the co-benefit expresses itself in all its potential, what would be the situation in your city at the end of the project? (co-benefits shared selection and poster design)



- Q3: On the base of your discussion, rank the top 5 important co-benefits in the poster (from 1st = the most important to 5th = the less important) for your cities.

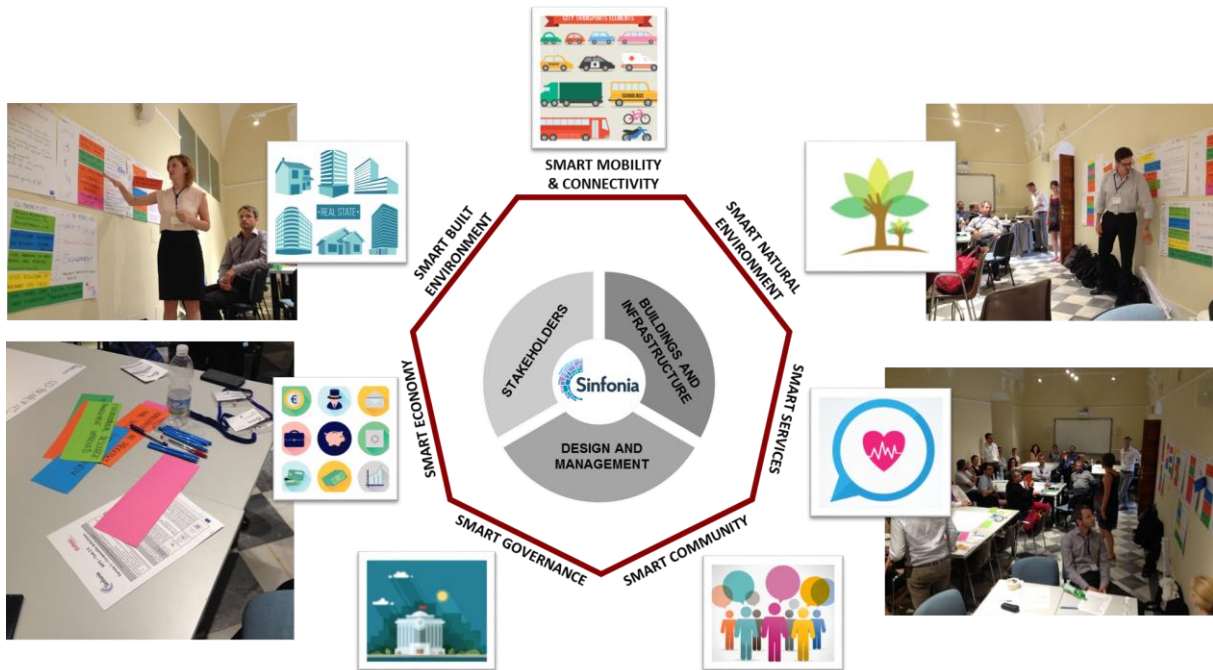


FIGURE 4: WCM DURING THE SINFONIA GENERAL ASSEMBLY IN SEVILLE (M24 – JUNE 2016)

Groups were diversely composed in order to gain meaningful discussions (see: ANNEX 3 – WCM PARTICIPANTS LIST)³. Stimulated by the moderators, each table created a poster, and after discussing for about one hour, one participant per group presented results as a poster in a plenary session.

RESULTS

The data gathered from the 39 collected questionnaires are useful to raise the individual consciousness of each project participant about the co-benefits concept and to assess his/her expectations. They provide an interesting starting point, to be

³ Cities and professional affiliations were mixed together in order to achieve effective discussions and produce new insights. Other than classic WCM, our groups did not split up during the discussion or let people switch tables. As participants were not too familiar with each other, as they had had to communicate in a second language and due to time restrictions from the assembly meeting plan, the method was changed.



compared with results of group discussion (WCM), which emerge from the convergence of different viewpoints.

INDIVIDUAL QUESTIONNAIRES

Looking at the collected questionnaires, we have:

- 25 questionnaires ranking at least the top five co-benefits in the right way;
- 6 questionnaires without ranking;
- 7 questionnaires with a ranking method not respecting the uniformity criteria;
- 1 questionnaire without individual data.

Therefore, in total 38 questionnaires were considered for general statistics concerning relevance, likelihood and for further analysis, while only 25 suitable for statistics on ranking, due to missing data or to misunderstanding ranking method.⁴

TABLE 2: QUESTIONNAIRES M24 GENERAL STATISTIC

Distributed	45	Collected	39 (87%)		
Respondents by affiliation / city	Bolzano	Innsbruck	Early ad.	Other	Total
Research	4	2	0	5	11
Consulting	1	5	1	2	9
Utility	1	2	0	1	4
Municipality	3	1	3	1	8
Social Housing	2	1	0	0	3
Other	1	2	0	0	3
Total	12	13	4	9	38

As per Table 2, more than half of the collected questionnaires were filled by people coming from one of the two demonstration cities, Bolzano (31% of all samples) and

⁴ Some participants gave the same ordinal feature to more than one item, while others applied different ranking methods, not in line with the instruction provided.



Innsbruck (33%). Representatives of early adopter cities are the smaller group (10%) while remaining refers to horizontal partners (23%).

CO-BENEFITS' RELEVANCE

The first remarkable result is that in unanswered questions are a few (1% of all sample) and that the most recurrent judgment is "relevant", which summed with the upper positive value of "very relevant", gain the 55% of all expressed scores (see Figure 5).

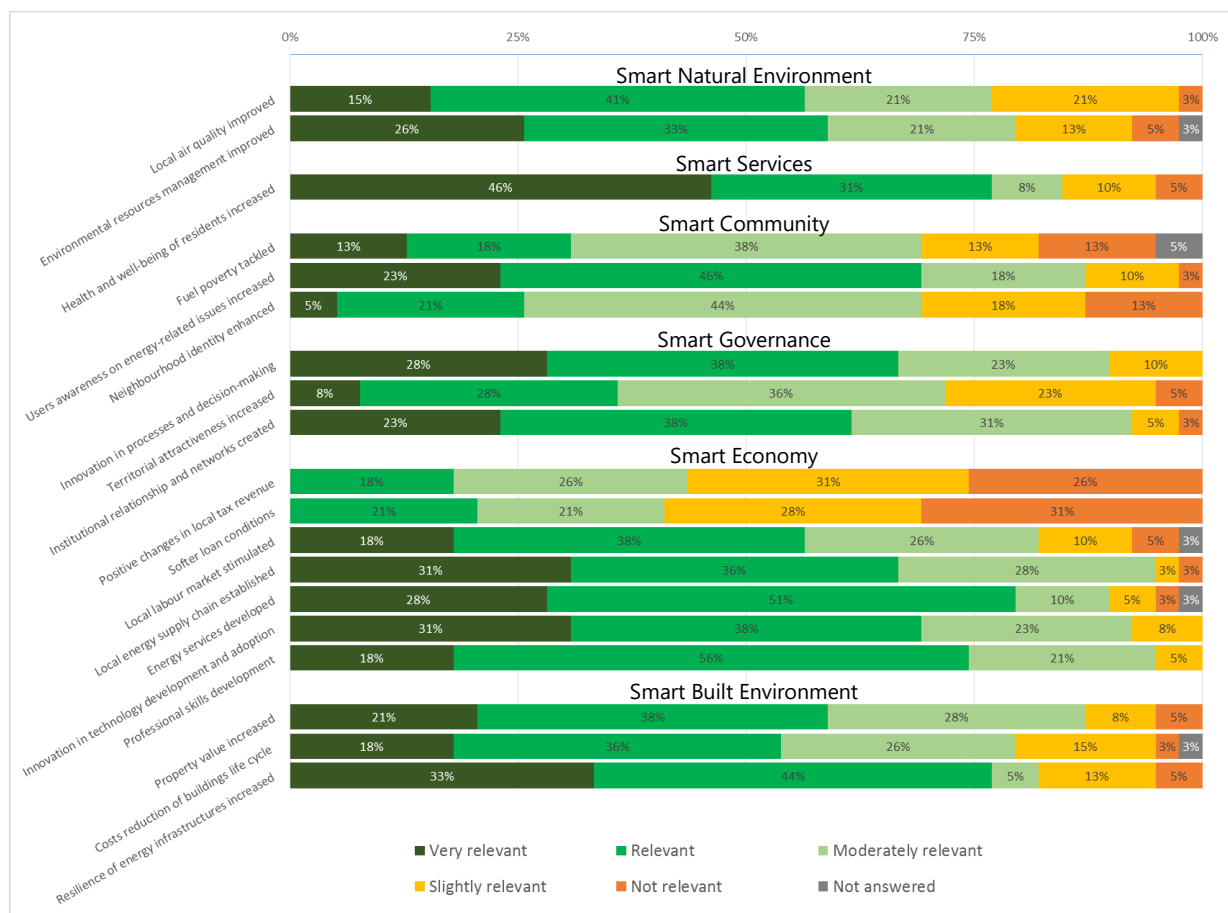


FIGURE 5: EXPECTED RELEVANCE OF THE CO-BENEFITS ON YOUR CITY

Although the judgments are very scattered, as shown in Figure 5, "health and well-being of residents increased", appears to be the most often ranked as very relevant by participants (46%), followed by "resilience of energy infrastructure increased" (33%), while "local energy supply chain established" and "innovation in technology



development and adoption” are just behind (both at 31%). On the opposite side, “positive changes in local tax revenue” and “softer loan conditions” never score so high, and they are considered slightly relevant or not relevant at all by almost half of the respondents. Excluding these two latter mentioned, the majority of other co-benefits receive positive judgments of relevance by 2/3 of respondents; only “fuel poverty tackled” and “neighborhood identify enhanced” are slightly below (see Table 3).

TABLE 3: OVERALL EXPECTED RELEVANCE OF THE CO-BENEFITS

Typology	Relevance	Observations	Percentage	Sum
Positive judgments	Very relevant	148	20%	-
	Relevant	252	35%	55%
	Moderately relevant	170	24%	79%
Negative judgments	Slightly relevant	97	13%	-
	Not relevant	50	7%	20%
Not answered		5	1%	-
Tot.		722	100%	

CO-BENEFITS' PROBABILITY

Unanswered questions concerning the probability of occurrence of co-benefits (Q2) are a few (3%), although a little more than in the previous question (Q1). The most recurrent judgment is possible, which summed with the upper positive value of likely, gains the 67% of expressed scores (see Table 4).

TABLE 4: OVERALL EXPECTED OCCURRENCE OF THE CO-BENEFITS

Typology	Probability	Observations	Percentage	Sum
Confident judgments	Likely	137	19%	-
	Possible	343	48%	67%
Skeptical judgments	Unlikely	164	23%	-
	Remote	58	8%	31%
Not answered		20	3%	34%



Tot.	722	100%	-
------	-----	------	---

Figure 6 reports the judgment expressed by project partners on each co-benefit: “innovation in technology development and adoption” and “institutional relationships and networks created” tied for first, as the most likely. Both “health and well-being of residents increased” and “professional skills development” are in the second position according to participants’ expectations. Three co-benefits, namely “users’ awareness on energy-related issues”, “energy services developed”, and “property value increased” ranked third, and “users’ awareness on energy-related issues increased” is the only one in the list never considered remote. Again, skeptical judgments are expressed on the likelihood of occurrence of “positive changes in local tax revenue” and “softer loan conditions”; the first is never considered likely.

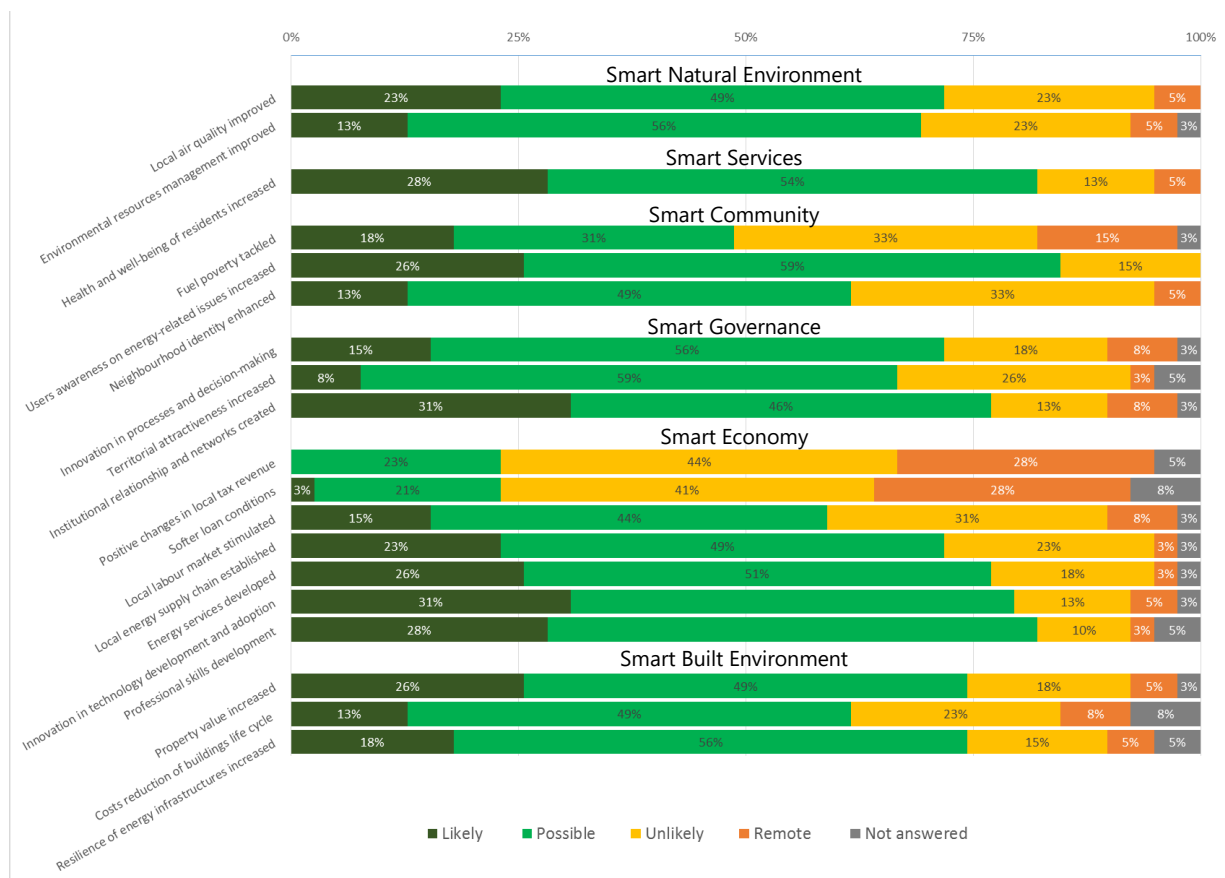


FIGURE 6 - CO-BENEFITS ASSESSMENT: EXPECTED LIKELIHOOD OF OCCURRENCE ON YOUR CITY



CO-BENEFITS' IMPORTANCE

The third question (Q3) turned out to be the most challenging for participants, maybe already tired by the effort provided in Q1 and Q2. Or, more likely, they face an intrinsic difficulty in expressing a ranking. As mentioned at the beginning of the section "Results", only 25 on 39 questionnaires (67%) ranked co-benefits in the appropriate way. In addition, the final picture they provide is quite unclear. Results on the analysis (only on the 25 valid questionnaires) are graphically reported in Figure 7.



Co-benefits “positive changes in local tax revenue”, “softer loan conditions”, and “neighborhood identify enhanced” are exclude from the top five list by almost all the

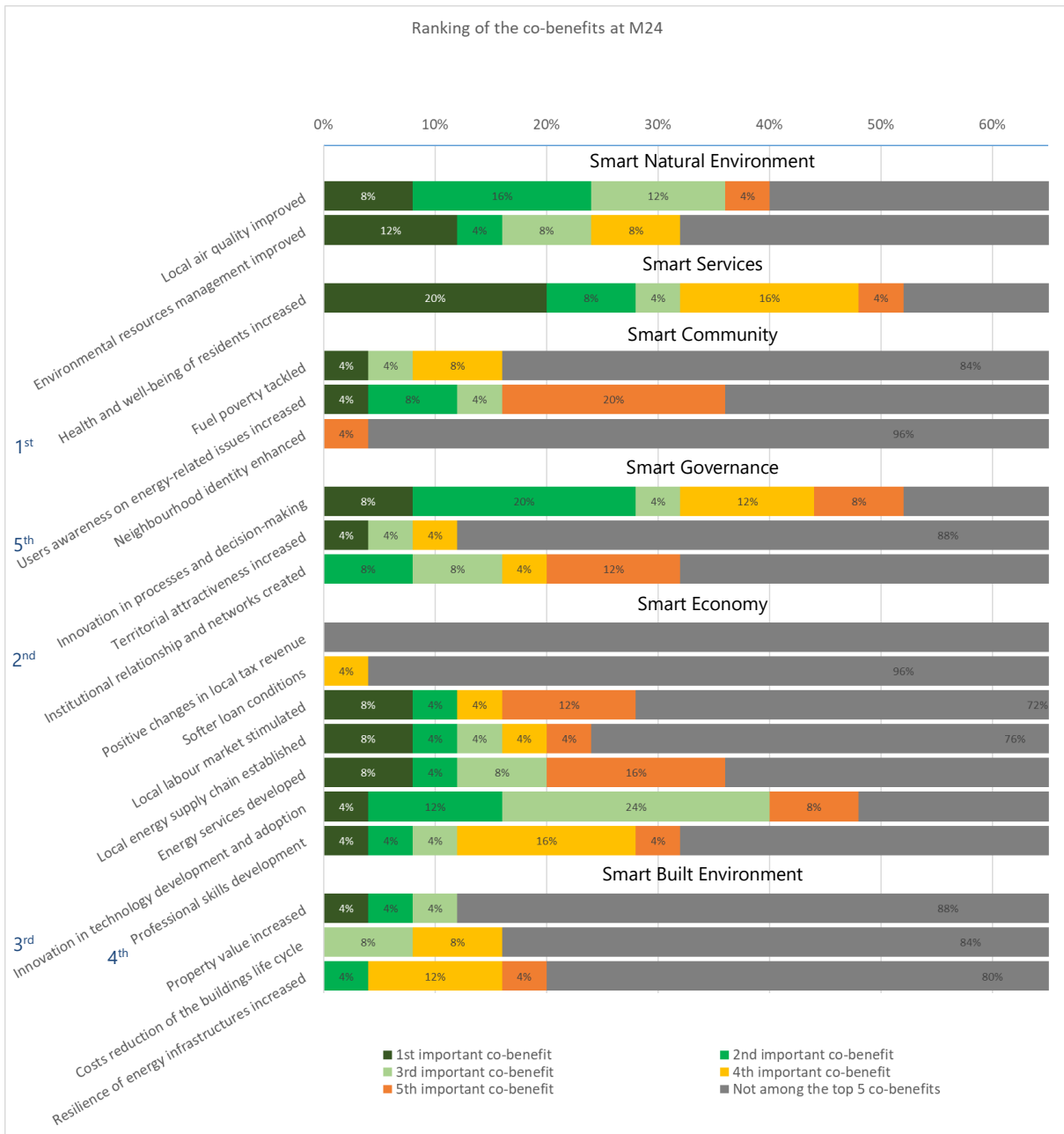


FIGURE 7: CO-BENEFITS ASSESSMENT: RANKING PROVIDED BY PARTNERS AT M24

respondents, while “health and well-being of residents increased” towers above all others in the first position.



Surprisingly, “innovation in processes and decision making” (never mentioned among the most relevant or probable) tied for second. The bigger share of consensus (24%) is expressed in the third position of “innovation in technology development and adoption”. In the fourth position, we found “professional skills developed” (because “health and well-being of residents increased” was already selected), and the top five is closed by “users’ awareness on energy-related issues”.

Additionally, to gain additional insights from questionnaires and to double-check the ranking, it is possible to visually determine the importance of each co-benefit linking the relevance to the likelihood. In following figures, from Figure 8 to Figure 13, the relevance is on the horizontal axis (it represents the measure of the positive impact of the co-benefit if it occurs; the larger the impact the more interesting the co-benefit), while the probability is on the vertical axis (it represents how likely it is for the co-benefit to occur, ranging between 0 and 1, where it will become certainty)⁵. Considering these two dimensions, all co-benefits can be ideally divided into four types as explained below:

- Low relevance, low probability (lower left quadrant). These co-benefits are less important in project assessment;
- Low relevance, high probability (upper left quadrant). These co-benefits are not very important, although project partners are quite sure they could happen. They should be considered in the assessment phase, according to the effort needed to measure them;
- High relevance, low probability (lower right quadrant). These co-benefits are important because they usually deliver positive effects, but project partners are quite sure they will not happen. They should be considered in the assessment phase, according to the effort needed to measure them;

⁵ The size of the bubble increases accordingly to the number of answers expressing the same combination of relevance by probability.



- High relevance, high probability (upper right quadrant). These co-benefits are expected by the partner and ranked as very important. Since a proper consideration of them can substantially modify (in positive) the judgment on the project effectiveness, they must be integrated into the assessment phase.

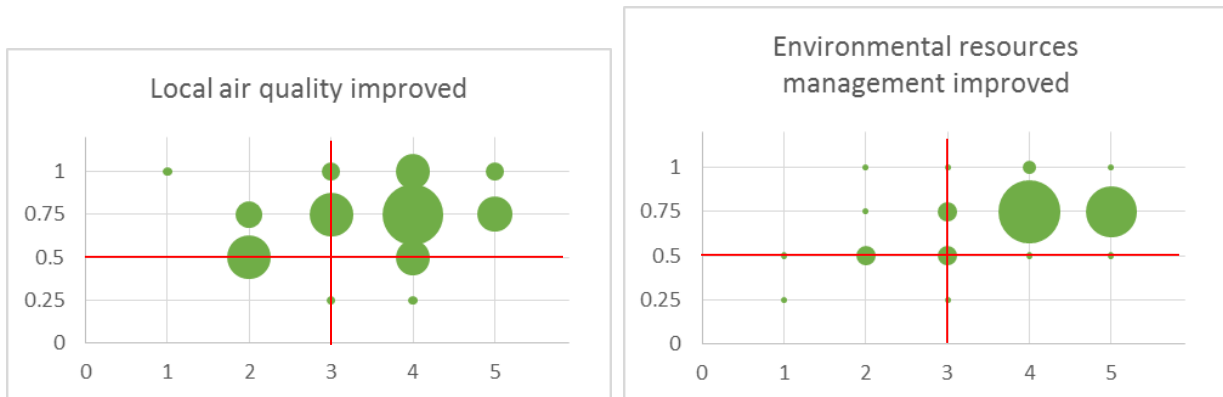


FIGURE 8: SMART NATURAL ENVIRONMENT CO-BENEFITS

Under this perspective, both “smart natural environment” co-benefits shown a good importance; however, judgement on “environmental resource management” are less dispersed, while those referring to “local air quality improvement” agree more on the

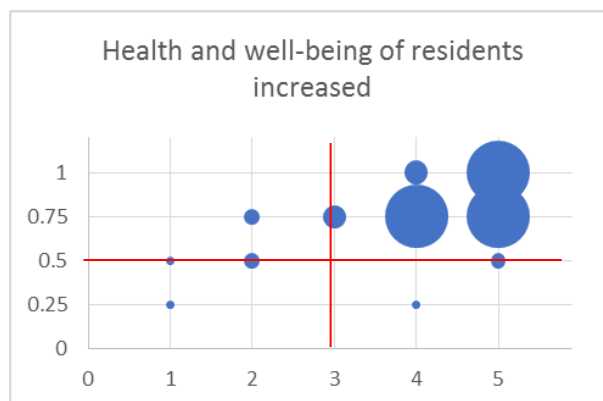


FIGURE 9: FIGURE 5 - SMART SERVICES CO-BENEFITS

high probability of occurrence, that on the relevance.

Project partners are unanimous in considering “health and well-being increased” a very important co-benefit, and they are almost sure to experience it, thus it should be investigated in the assessment phase of the project.



FIGURE 10: SMART COMMUNITY CO-BENEFITS

Among the three co-benefits referring to “smart community”, only “users’ awareness” is both expected by the partners and ranked as very important, and therefore very relevant. More skeptical is the overall judgment on “fuel poverty tackled”, and on “neighborhood identity enhanced”.

While in the next group, referring to “smart governance”, we found “innovation in processes and decision making” and “institutional relationships and networks created” in the upper right quadrant. Thus, they are considered very important co-benefits delivered by the project to the involved cities and organizations. Not equally sure seems to be the judgment on the third co-benefit: “territorial attractiveness increased”.



This is expected, however, the positive contribution to the urban appeal is not recognized by all partners.

Almost all the “smart economy” co-benefits are in the upper left quadrant, according



FIGURE 11: SMART GOVERNANCE CO-BENEFITS

to the individual judgments expressed by partners. Thus, they must be carefully considered in project assessment, in particular, “energy services development”.

Only two of them are negligible: “softer loans condition” and “positive changes to local tax revenue”.

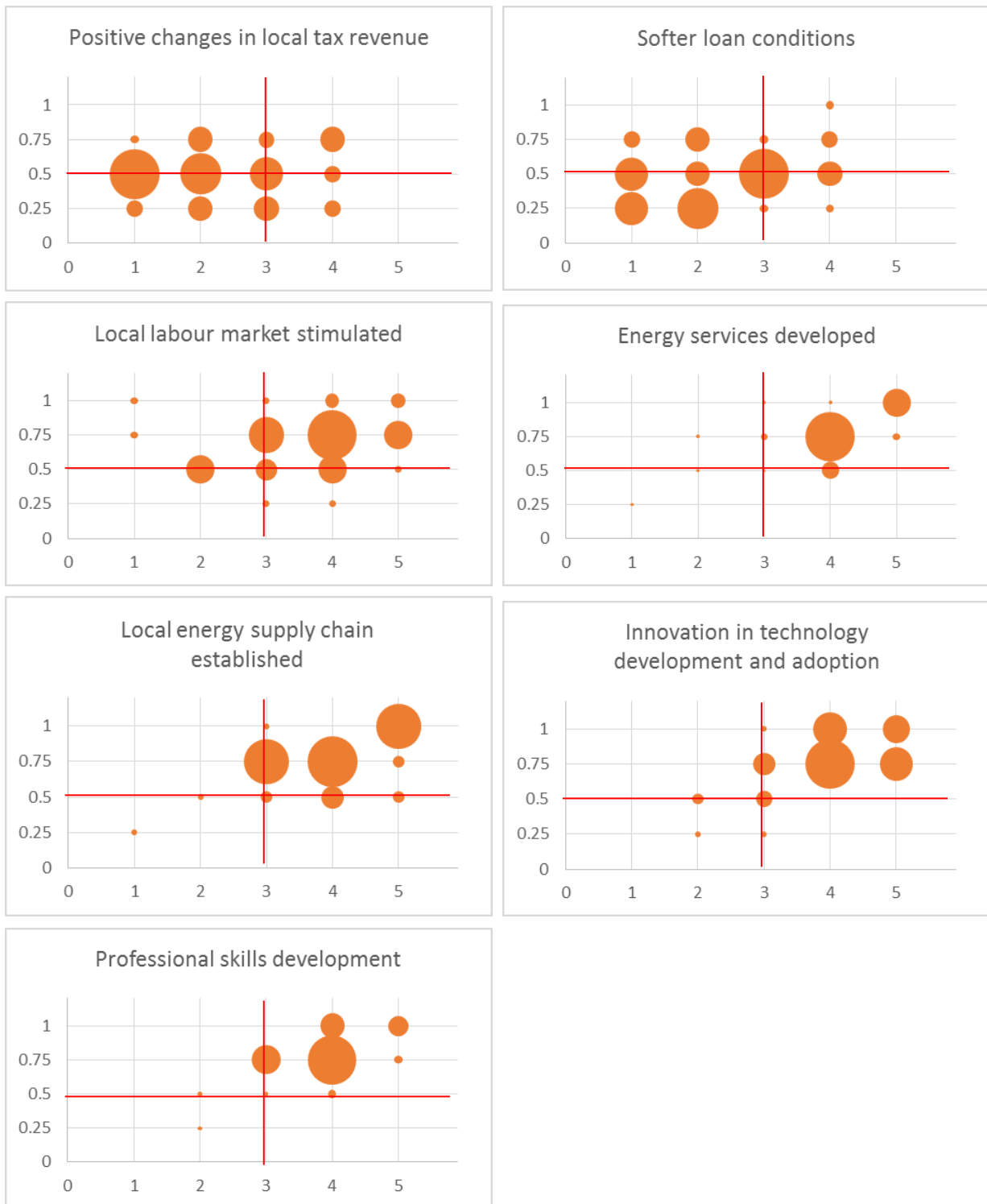


FIGURE 12: SMART ECONOMY CO-BENEFITS

Finally, within the last group of analyzed co-benefits, those referring to the “smart built environment”, we found quite scattered judgment, although substantially positive,



about the three suggested co-benefits. The majority of respondents place this in the upper right quadrant, nevertheless some project partners are more prone to express a lower relevance or probability of occurrence.

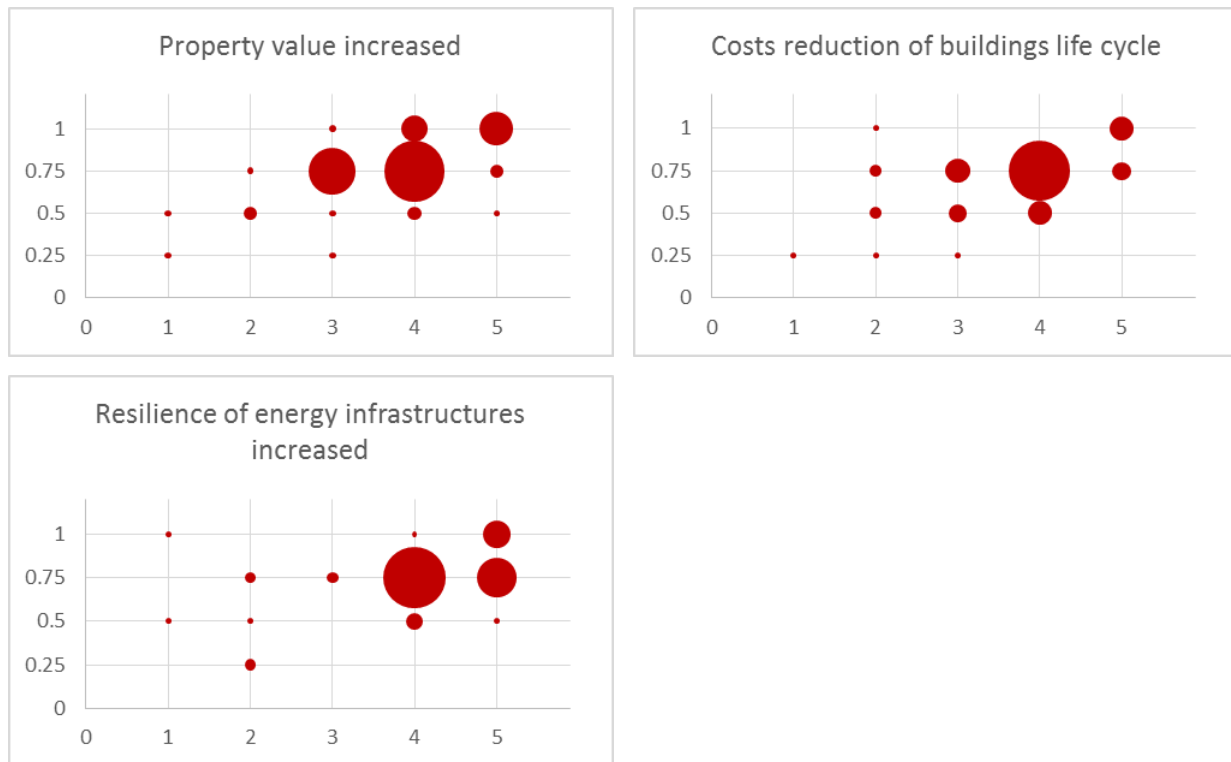


FIGURE 13: SMART BUILT ENVIRONMENT CO-BENEFITS

WORLD CAFÈ ANALYSIS

Given the lack of a very specific agreement in questionnaires, the WCM provides data to clarify collective attitudes. Moderator's notes collected after the WCM were helpful to document each group's dynamic during the discussions. They showed that the groups were uncertain about how to start, what they had to do at the beginning of the discussion or had long debates about certain issues that seemed more relevant in certain cities (or to some stakeholders) than others (group C) and how to deal with a long discussion who seemed not to and with a final agreement (group D). During the process, unclear references of co-benefits have been changed (e.g. "residents" to

"tenants" for co-benefit "health and well-being") and new co-benefits added which shows rich engagement with the task and material.

Two groups showed concerns about how to measure some co-benefits and their direct connection to the SINFONIA project within its lifetime (e.g. "Improvement of the local air quality", "local labor market stimulated"). Group E acknowledged the importance of these issues (ranked them) but questioned whether the project can be concerned with such long-term goals that reach beyond the project's grasp.

Most prominent themes may be grouped as improved living conditions, technical innovation, building social capital (institutional networks, relationships), and skills. Many groups and participants connected or even paired co-benefits e.g. mobility with fuel poverty and in the end "health and well-being increased". The latter being the highest-ranked and most dominant co-benefit in all groups. Group F debated the value of "Softer loan conditions" and argued that it is important to invest in order to get projects started. Still, the group ended up ranking "Institutional relationships and networks created" instead of as they felt that this was the much-needed baseline for improving relations between partners and later tackling environmental issues. In the end, 14 of the suggested 19 co-benefits plus two new ones were ranked in the final presentation phase, as reported in Figure 14.⁶ Some groups listed two co-benefits under one ranking (See ANNEX 3 – CO-BENEFITS RANKING BY WCM GROUPS).

⁶ Colours are attributed on the basis of previously defined smart categories (see Fig. from 4 to 9).





FIGURE 14: RANKING OF THE CO-BENEFITS DURING THE WCM PRESENTATION

Mentioned co-benefits show a great variety of topics: ecologic, social, and economic. Participants pointed out the most important co-benefits as related to community, governance, innovation, environmental and energy issues.

Two new co-benefits were made up during the discussion: "Degree of satisfaction of end-users" (Group D) and "Transforming innovation in mainstream life" (Group F). Both once again related to the effects of the SINFONIA project on the user's habits. Of interest are also those co-benefits left out of the ranking by all groups, see Figure 16. Indications for reasons not to rank co-benefits were found in the moderator's notes. In particular, some co-benefits were seen to cover similar concepts (e.g. "Local energy supply chain established" and "Resilience of energy infrastructures increased" (Group F)).



FIGURE 16: CO-BENEFITS THAT DID NOT RECEIVE RANKING FROM THE WORLD CAFE' PARTICIPANTS

For others, participants found it hard to apply a co-benefit to the conditions under which measurements were taken in their city (e.g. "Increased assets value" was defined not possible for social housing in Innsbruck (Group C), while possible. It did not end up in one of the rankings in the end, although debated in the group sessions).

Almost all groups (five out of six) ranked "Health and well-being of residents increased"

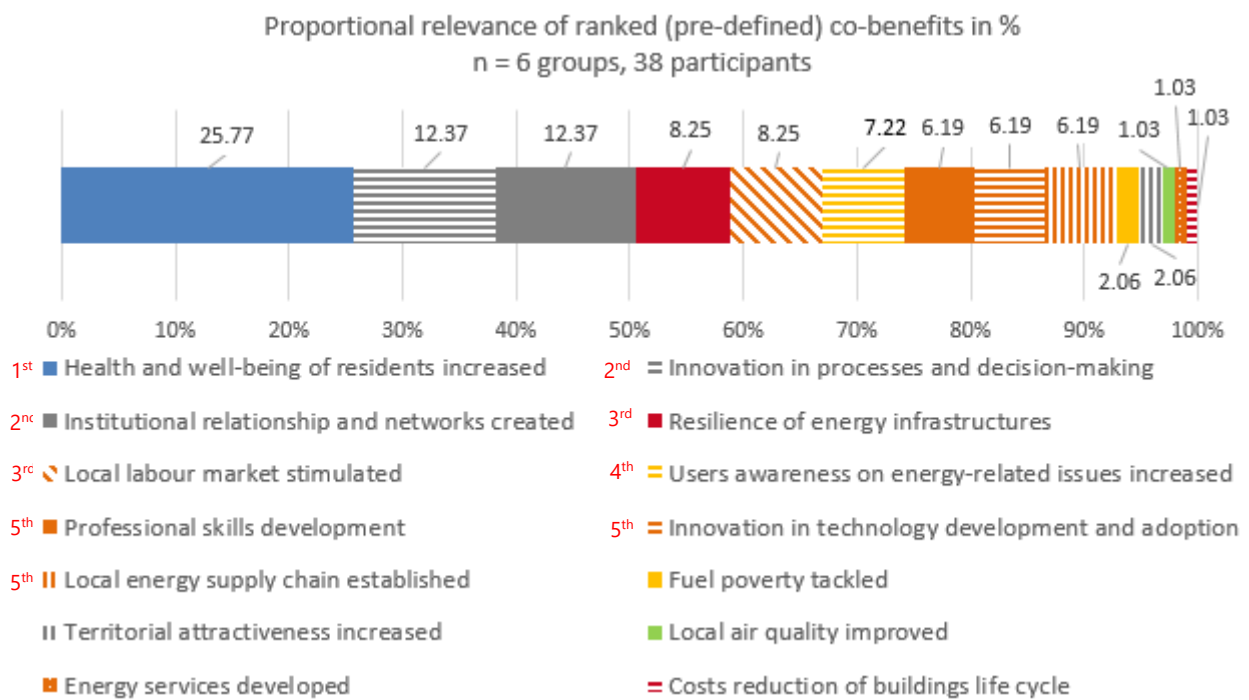


FIGURE 15: PROPORTIONAL RELEVANCE OF RANKED CO-BENEFITS

as the most important co-benefit. Although Group C made the distinction of "tenants" instead of "residents", this shows a clear collective interest with the direct social impact



of the project and the aim of increasing life quality. The final ranking given by the proportional relevance of each co-benefit is synthesized in Figure 15Figure 16⁷.

CONCLUSIONS

The two activities of individual questionnaire filling and WCM group discussion were really appreciated by project partners. In both, they were forced to be focused on a specific and quite complex approach (the co-benefits, introduced in a short lecture), in assessing the project outcomes and to think about their personal expectations, answering to detailed questions (ranking and evaluating). Following Table 5 compares the results from desk research to questionnaires and group discussion.

TABLE 5: DESK RESEARCH VS SINFONIA PROJECT PARTNERS

	Desk research on similar smart and sustainable city projects	Individual questionnaires at M24	WCM discussion at M24
1st.	Local labour market stimulated	Health and well-being of residents increased	Health and well-being of residents increased
2nd.	Users' awareness on energy-related issues increased	Innovation in processes and decision-making	Institutional relationships and networks created
			Innovation in processes and decision-making
3rd.	Health and well-being of residents increased	Innovation in technology development and adoption	Local labour market stimulated
			Resilience of energy infrastructure
4th.	Professional skills	Professional skills development	Users' awareness on energy-related issues increased
5th.	Local Energy supply chain established	Users' awareness on energy-related issues increased	Professional skills development
	Territorial attractiveness increased		Local Energy supply chain established
	Innovation in processes and decision-making		Innovation in technology development and adoption

⁷ The relevance is calculated for each co-benefit as the median of inverted ranking (from 1=highest to 5 = lowest) multiplied by the number of groups mentioning the co-benefit. Then, values are normalized and expressed as a percentage.



Institutional relationships and networks created
--

The main goal of bringing together various perspectives in an informal setting to define collective insights, exchange ideas and grasp the cooperative attitude (Juanita Brown & Isaacs, 2007) towards co-benefits of the SINFONIA project was reached. Discussions were sometimes long and difficult at the start, as moderators indicated. However, the questions and tasks given in WCM brought out at least some agreements and positive conversations between different positions. Other than an individual questionnaire, participants were understood as a group(s) and became to understand each other and themselves as a collective with common goals (co-benefits) to strive for.

It clearly emerges how geographical belonging and social, political and economic contexts influence discussion on co-benefits.

At the end of this first attempt of practical application, the general interest towards co-benefits involving end-user behavior and intangible assets became clear: "Health and well-being of residents/tenants increased" emerges as the most important expected co-benefit. In this case, the beneficiaries are citizens living in the demonstration sites, directly experiencing the deep energy retrofit measures. Project partners seriously consider the achievement of high quality indoor environmental conditions as a vector to achieve better mental and health status. This can have positive effects on the personal/familiar sphere, as well as on the local community, and finally on reduced public expenses related to healthcare and social services. After decades of low quality and poor energy-efficient buildings, heartier, low energy demand and more comfortable dwellings are going to be even more appreciated by the users (and hence welcome on the real estate market). In fact, another quite important co-benefits delivered by the project is having an increase of "users' awareness on energy issues". This point needs careful consideration, especially in view of replication activities or large-scale intervention including private owned buildings (see survey n°2).



The second most important co-benefits “Innovation in processes and decision making” directly affect the project partners, as organizations involved in the temporary consortium. They feel, or expect, that the innovative internal relationships established by working on the project will improve the decision-making process. Innovation can emerge both from the creation of “ad hoc working groups” within the organization (overcoming the business as usual processes and chain of command) and from the exchange of experiences and approaches between stakeholders. Thus, this co-benefit was often related to “Institutional relationships and networks created”, to stress how establishing or reinforcing personal knowledge among partners is considered a positive gain an advantage for further cooperation activities.

An additional consideration is needed about a couple of economic co-benefits, namely “Professional skills development” and “Innovation in technology adoption”. The partners of the consortium expect to deliver to the local workers and professionals, as well as to companies involved in the project activities the opportunity to take a great leap forward, and thus to be more competitive and effective on the markets (mainly in the construction or energy sector). This package of co-benefits targets stakeholders that are neither beneficiaries of the implementation of the project measures (as the residents/tenants) nor exclusively partners of the consortium. It exceeds the project boundaries, is delivered to the local community/economy, and in a more extensive sense may sustain the urban competitiveness and “stimulate the local labor market”.

Finally, there are three co-benefits related to the energy sector expected by project partners: “energy services developed” more at the individual level, while “resilience of energy infrastructure” and “local energy supply chain” at the group level. Surprisingly, the environmental co-benefit “local air quality improved”, which results in the second position of importance according to individual answers slips down in the group debate outputs. A further research step will be to reassess the same group in a similar way after the project has finished, to compare answers and expectations with achieved



results and consideration on events (see survey n°3). Introducing this additional element, we will borrow the logic from the Delphi method, which lets participants predict future events or compare them later on with an earlier investigation (Linstone & Turoff, 1975). By doing so, a threefold goal is achievable: understand our group's collective evaluation of co-benefits, compare it to their individual answers in a questionnaire and – in the last instance – see if they can report how expectations of co-benefits have met with reality.

Most relevant methodological steps of WCM adopted and results obtained by the survey n°1 are published in Bisello, Boczy, & Balest (2018).



4. SURVEY 2 - ESTIMATING THE VALUE OF AND INTEREST TOWARDS SINFONIA ACTIVITIES IN THE SMART GRID, SMART INFRASTRUCTURE AND BUILDING SECTOR

Once created a group knowledge among stakeholders about co-benefits, it is necessary to test if these positive effects are observable in the real world. Because of the breadth of the subject, we decided to focus on a few specific co-benefits and target groups.

We would like to answer some questions, strictly related to the implementation of activities already foreseen by the project, or to the extension of its approach at the urban level:

- A. In view of the development of an innovative urban information infrastructure or smart-grid services: (i) Do people prefer only information or do they need additional services? (ii) What services mostly increase the perceived benefits? (iii) Is there any kind of willingness to pay (WTP) for them?
- B. What will be the effect of deep-energy retrofit interventions, similar to those tested on public-owned buildings, on the local residential property market? Does energy efficiency have a price premium as the co-benefits literature suggests?
- C. Which co-benefits are expected by citizens undertaking deep energy retrofit works on their own residential building? Do they care only about economic issues?

A first attempt to describe the overall methodological approach behind the survey n°2 has been described in Bisello, Marella, & Grilli (2016), while suggested assessment methods for co-benefits are extensively described in Bisello, Grilli, Balest, Stellin, & Ciolli (2017).



2A – SMART GRID / SMART INFRASTRUCTURE: WILLINGNESS TO PAY

The diffusion and integration of information and communication technologies (ICT) in the urban environment is a pillar of the current smart city development approach. In designing and construction of innovative urban information infrastructure, enabling the user's interaction and communication, it plays a prominent role to understand how and if the project meets users' expectations. New public infrastructure aims to increase the quality of life of residents, meeting their needs and satisfying their expectations. In a context of scarcity of public budgets, investments should be done carefully, without following the "smart city" fascination uncritically. In some cases, a merge between innovation and traditional solutions, well designed for the specific context, makes possible the best result. An example of the technological tools that are currently installed in many cities is represented by information points. These infrastructures, informally called "totems", enable users to obtain information about local events, parking availability, weather conditions and much more (see Figure 17).

When planning the introduction of new information technologies, such as these totems, policymakers should be concerned not only with their cost-effectiveness but also with the features and attributes that people will likely prefer and that offer to the general public innovative solutions.

MATERIALS AND METHOD

In this context, by recording the stated preferences of users is possible to determine the perceived value of the new services offered. Thus, a Choice Experiment valuation method (CE) is applied to estimate the economic value of the innovative infrastructure, as a non-market good, realized by the SINFONIA project in the pilot city of Bolzano.



According to the CE rules, a specific survey is designed: in a face to face interview specific hypothetical scenarios are presented, describing the offered services and costs (Adamowicz, Boxall, Williams, & Louviere, 1998; Carson et al., 1994).

People are questioned for the best and worst option, in order to determine their



FIGURE 17: GRAPHIC DEPICTION OF A "TOTEM" IN BOLZANO. SOURCE: SINFONIA OFFICIAL VIDEO ITA

willingness to pay (WTP). The survey involves a sample representative of the whole potential users, including citizens, commuters, and tourists. In this context, CE allows researchers to estimate the perceived benefits of forthcoming smart points, and to provide designers with insights on the better combination of services or additional attributes.

Data were collected by means of personal, face-to-face interviews, carried out by different interviewers, from July to October 2016.



People were engaged in some strategic places of the city and invited to participate in the survey, by expressing their personal preference (best and worst solution). Possible solutions for smart points have been presented under the form of choice cards (see Figure 18) combining different services and a theoretical monthly fee for the right to access the totem.










	SERVICES	OPTION 1	OPTION 2	OPTION 3
	SOS	NO	YES	NO
	WATER	YES	NO	NO
	WI-FI	YES	NO	NO
	ELECTRICITY	• TABLET or SMARTPHONES	• TABLET or SMARTPHONES • ELECTRIC BICYCLES	NO
	INFO	• WEATHER and ENVIRONM. CONDITIONS	• WEATHER and ENVIRONM. CONDITIONS • TOURISTIC and CULTURAL	NO
	MOBILITY	• FREE PARKING SPACES • FREE CHARGING POINTS	• FREE PARKING SPACES • FREE CHARGING POINTS • TRAFFIC CONDITIONS and PUBLIC TRANSPORTS	NO
	COST	2.00 €	2.50 €	0 €
	BEST OPTION			
	WORST OPTION			

FIGURE 18: EXAMPLE OF A CHOICE CARD INCLUDED IN THE QUESTIONNAIRE

Suggested services encompass SOS point (i.e., emergency-call service), water supply, hotspots for Wi-Fi, some level of information about the city (in particular, information about weather conditions, tourist attractions and services for residents), electricity supply (for charging the tablet and smartphone electric bicycle or electric car) and information about mobility (parking slots availability, free charging points for EV and traffic information).

RESULTS

Interviewers collected 221 complete questionnaires that, considering eight choice cards per respondents answered with the best-worst method, lead to 3536



observations (the questionnaire has been provided both in Italian and German, see Figure 19 and ANNEX 4 – CHOICE EXPERIMENT SURVEY - TOTEM).

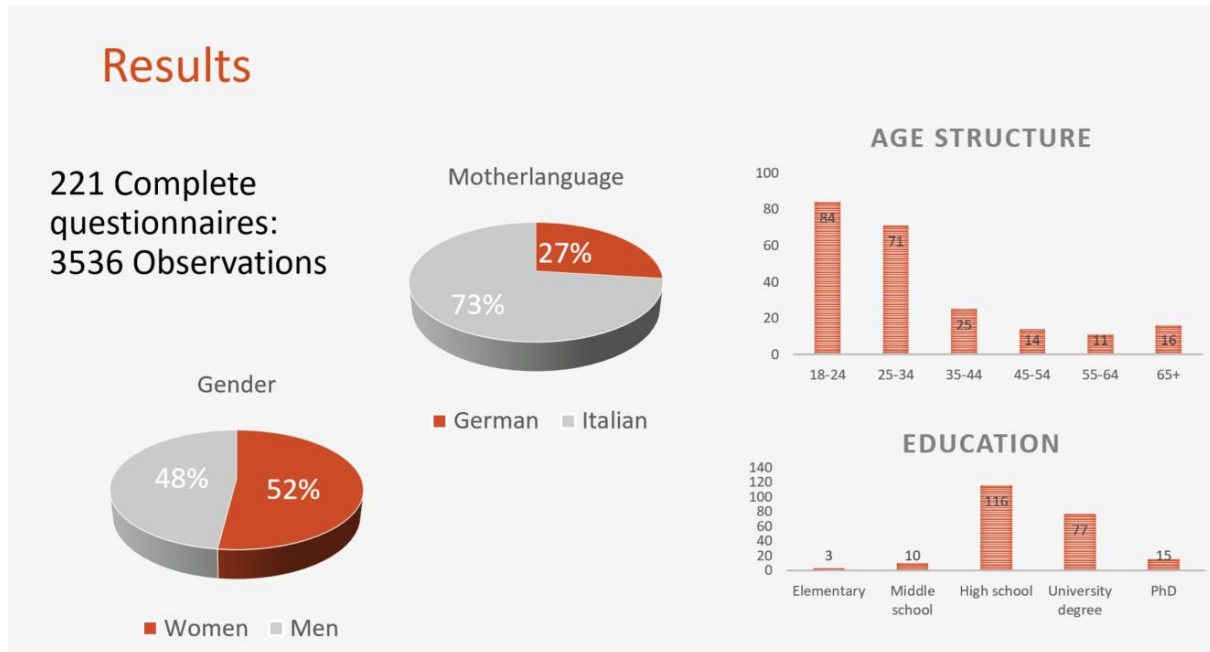


FIGURE 19: STATISTICS ON DATA COLLECTION SURVEY N°2

The main results of this investigation are that almost all the attributes are statistically significant, except for info concerning wheatear conditions and a status quo situation without totems⁸.

Conversely, relevant attributes for individuals are the possibility to call the emergency service (SOS), having access to drinkable water, as well as Wi-Fi hot spot connection. People stated an average WTP for Wi-Fi of about 1.49€ per month, while for SOS and WATER 0.94 and 0.97€ per month, respectively. Concerning electricity-charging points, people are willing to pay for each of the proposed solutions, i.e., 1.27€ for devices (such as smartphones or tablets), 0.94€ for e-bikes and 1.82€ for e-cars. A high level of WTP for e-cars might be reasonable because their share on the market is growing and

⁸ Probably because most of the people have a smart phone, already reporting weather conditions and forecasts. For this reason, this attribute might be ignored by respondents in choosing alternatives. Similarly, the status quo is non-significant, which means that people tends not to consider the current situation (i.e., the city without totems) while choosing among alternatives.



considering this trend, wide territorial coverage of charging stations is a fundamental requirement for an increase in public acceptance and trust toward EVs. Results suggest that citizens, tourists and city users in Bolzano see potential benefits in this new integrated smart infrastructure, and they are willing to pay to access it. Attributes such as Wi-Fi connection, information about mobility and charging points for e-cars are relevant for respondents, regardless of the analysis method (mixed-logit model – MXL or multinomial logit model – MNL) (Figure 20). For this reason, they should be included in the final layout of the totems to accomplish the stated preferences of potential users. Conversely, including information about weather conditions seems to be irrelevant for respondents, thus it could be not included in the totem if it requires substantial additional investments.

The most relevant methodological steps of CE and extensive results obtained by the survey n°2A are published in Grilli, Tomasi, & Bisello (2018).

Results				Results			
	MNL				MXL		
Attributes	Estimate	Std. error	Signif.	Attributes	Estimate	Std. error	Signif.
SOS	0.98	0.24593	***	SOS	1.02	0.2315	***
WATER	0.94	0.17552	***	WATER	0.94	0.1893	***
WIFI	1.49	0.20919	***	WIFI	1.23	0.2558	***
E_DEVICES	1.27	0.24841	***	E_DEVICES	1.03	0.2517	***
E_BIKES	0.94	0.26922	***	E_BIKES	0.92	0.3865	*
E_CARS	1.82	0.34712	***	E_CARS	1.73	0.4248	***
I_WHETHER	0.38	0.30919		I_WHETHER	0.13	0.2815	
I_TOURISTS	0.95	0.24985	***	I_TOURISTS	0.46	0.3285	
I_RESIDENTS	1.41	0.24156	***	I_RESIDENTS	1.07	0.3636	**
M_CHARGE	0.71	0.24982	**	M_CHARGE	0.66	0.1436	***
M_TRAFFIC	1.51	0.24229	***	M_TRAFFIC	1.25	0.2299	***
M_PARKING	1.58	0.23408	***	M_PARKING	1.23	0.2778	***
SQ	0.53	0.34851		SQ	0.43	0.6942	
COST	-0.415	0.03587	***	COST	-1.0121	0.1390	***

FIGURE 20: RESULTS OF THE CHOICE EXPERIMENT



2B – HIGH ENERGY PERFORMANCE BUILDINGS: MARGINAL MARKET VALUE

The value of a real estate propriety, defined as the most probable selling price on the market, is estimable by applying different appraisal methods. Having an existing and active market, with real transactions, the analysis is usually done with a comparison between the object to be evaluated and the market prices of similar proprieties. Such direct appraisal methods are in turn classified as nonparametric or multiparametric. The first is based on the comparison of a single paramount characteristic, mainly the dwelling's surface, and provide reliable results only if considered goods are enough homogeneous. The latter investigates multiple variables affecting the property value and is useful in contexts where good's heterogeneity is predominant. Multiparametric methods are based on multiple regressions models and allow the identification of the marginal contribution of a certain variable in the price function. Hedonic price (HP) is an econometric technique based on the rationale that the price of a certain good is a function, combining proper characteristics as well as external factors (Rosen, 1974). By analyzing a sample of real transactions or property for sale in the housing market, it is possible extrapolating the implicit price of a single characteristic and, consequently, understanding how the price is expected to change with respect to a reference case. Among others, HP has been recently adopted to investigate how house prices may change due to better energy performance achievement, or by adopting renewable energy systems. For example, Bonifaci & Copiello (2015) and Bottero et al. (2018) recently analyzed the price premium of energy efficiency in the real estate market in a northern Italian city, while De Ayala, Galarraga, & Spadaro (2016) did the same in Spain, and Dastrup et al. (2012) estimated the benefit of having solar panels on the roof in San Diego County, California - US.



MATERIALS AND METHOD

A spatial econometric method has been applied in conjunction with a basic hedonic housing price model to measure the marginal value of energy efficiency. Energy efficiency in buildings should be an established concept, on European real-estate markets at least, given that the Energy Performance of Buildings Directive (EPBD) was issued more than fifteen years ago, “envisaging that when buildings are constructed, sold or rented out, an Energy Performance Certificate (EPC) is made available to the owner, or by the owner to the prospective buyer” (De Ayala, Galarraga and Spadaro, 2016: 17). In this case, the spatial approach has been used to incorporate spatial effects into the hedonic regression model (Krause & Bitter, 2012). By adopting a spatial hedonic price (SHP) approach, it is possible to identify positive changes in property value related to the implementation of deep energy retrofit measures (moving from lower “G” to upper class “A”). Thus, we applied an SHP model to a compact and dense urban environment, as the pilot city of Bolzano, where developers depict locational factors as the most relevant market driver. This is also an area where, in principle, there is considerable interest in energy performance, but in practice, it has little influence on the multifamily housing market.

The first attempt in Bolzano has been done in June 2016, by collecting transaction prices with the cooperation of local real estate agencies. Unfortunately, the sample size resulted in too small to guarantee the adequate statistical significance of the analysis. Similarly, any attempt to execute the same investigation in the pilot city of Innsbruck, by involving local partners, ended with not enough records to build up a sufficient dataset or missing relevant variables.

Finally, in March 2018, a dataset of 849 house listing prices and characteristics in Bolzano, has been retrieved from a popular property website, because of the availability of its Application Programming Interface (API). The dataset was selected from an



original sample of automatically gathered data on 1,058 house prices by eliminating listings obviously inappropriate or inaccurate.

Apart from the EPC label, which is mandatory in real-estate advertisements in Italy, the data consider characteristics of a building known to affect house prices and considered in HP. The data are organized as cardinal, dichotomy dummy, and ordinal variables, and summarized in Table 6.

TABLE 6: STRUCTURE OF VARIABLES HP - SHP

Category of variables	Variable
Cardinal	(Log) List price by area (dependent)
	Area
	Bedroom
	Bathroom
	Floor
Dichotomy Dummy	Parking space
	Private garden
	Lift
	New development
	Balcony
	Other (cellar, pool, etc.)
	EPC (A, B, C, D, E, F, G)
neighbourhood (Centro, Piani, Don Bosco, Rencio, Oltre Isarco, Europa)	
Ordinal	State of repair (poor, good, excellent)



RESULTS

Data has been spatialized by using X-Y coordinates provided by the website, allowing to analyze them also from a spatial distribution perspective (see Figure 21; the darker the green, the higher the class, while a darker red indicates a worse energy performance) using the Geoda software.

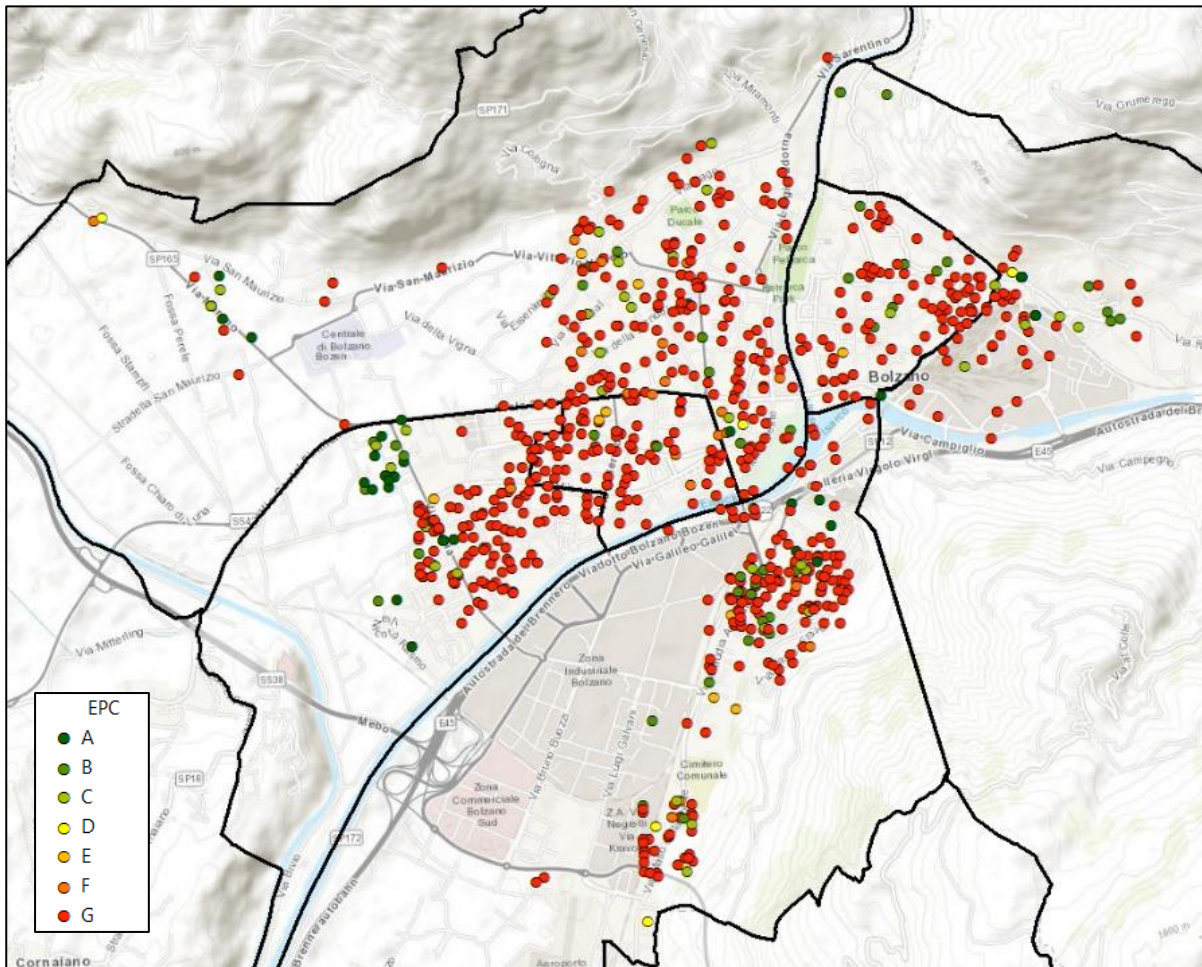


FIGURE 21 DISTRIBUTION OF RESIDENTIAL PROPERTIES BY EPC CLASS IN BOLZANO

In this model the listed prices (transformed as logarithm) is explained as a function of i) location, where “Center” is the default for each dummy; ii) features of the housing unit, and notably the number of rooms and bedrooms, the presence of a lift, car



parking, private garden, balcony, and other features; iii) EPC class A, B, or C, where “EPC G” is the default variable.

All the estimations by neighborhood are negative, from -6.4% in Gries (which, together with the Centro, is the most attractive district on the market) to -18.1% in Oltre Isarco, the worst performer. The sign and magnitude of the three higher EPC classes are also as expected: the price premium on the residential market *ceteris paribus* is 6.3% for an EPC A label, 5.4% for a B label, and 2.9% for a C label. The influence of EPC D, E, and F labels is not statistically significant. These results give a clear indication of how the market considers the EPC. Although higher EPC classes mean “better construction quality” and “greater cost savings”, the demand for housing does not distinguish between the values attributable to the lower-intermediate EPC labels, and clearly does not perceive the differences between them. This result is aligned to other similar studies on this issue and confirmed in magnitude and sign by introducing a spatial specification in the model. There is ultimately an exogenous effect on the price of each property given by a spillover effect of nearby properties, identified by the lag coefficient ρ (0.69), and the coefficients for EPC classes A, B and C are slightly higher. In conclusion, having found a spatial autocorrelation in the explanatory variables, we introduce the spatial lag model (SLM) to identify the exogenous effect of the prices of nearby properties on the price of each apartment. The two methods, HP and SLM provide convergent results: EPC labels strongly influence list prices, with a price premium of around 6.5%, 5.5% and 3% for A-, B-, and C-labeled houses, respectively. Both models clearly show, however, that accessibility, and location are still the most important features in the housing price structure.

Finally, having found a spillover effect also implies a possible positive correlation between large-scale refurbishment interventions (usually coupled with energy retrofitting measures nowadays) and the prices of surrounding properties. This



confirms the existence of an additional co-benefit of urban regeneration programs in generating positive changes in people's welfare.

The most relevant methodological steps of the SHP method adopted and the results obtained by the survey n°2B are published in Bisello, Antonucci, & Marella (2020).

2C – HIGH ENERGY PERFORMANCE BUILDINGS: HOUSE OWNERS EXPECTATION

By investigating house owners' expectations, it is possible to better understand why energy-efficient buildings are attractive, and what are the motivations driving the decision to undertake energy-refurbishment works on residential properties. Recent studies in this field suggest the relevance, besides monetary savings, of expected co-benefits dealing with the health and well-being of building occupants, the pleasure of enjoying higher spatial quality, etc. It has been found that expected benefits come from the reduction of external noise, due to the better acoustic insulation of windows (Jakob, 2006; Üрге-Vorsatz et al., 2010) and the achievement of better indoor comfort, due to thermal bridges reduction (Jakob, 2006). Acre & Wyckmans (2015) also investigate the added value of having better spatial conditions, including the physical distribution of rooms, glazing surfaces, and daylight.

A deep understanding of house owner preferences is necessary for the decision-making process, to avoid project failures or underperformance in promoting this kind of intervention in the urban context. To investigate this, a multi-criteria decision analysis (MCDA) approach is suggested, as a helpful tool in setting up problems characterized by a set of possible solutions (also called alternatives), that are evaluated on multiple points of view (usually called criteria). While MCDA methods enable finding compromise solutions along with a rational path, in this case, the aim is to set relative values for the expected utilities from deep energy-retrofitting interventions.



MATERIALS AND METHOD

We used an Analytic Hierarchy Process (AHP), developed by Saaty (1980), as AHP is one of the most widely applied MCDA technique (Ishizaka & Nemery, 2013), often used in energy-related decision making, from planning (Pohekar & Ramachandran, 2004) to indoor comfort assessment (Chiang & Lai, 2002).

In this way, it will be possible to assess the relative percentage of contribution of each co-benefit (e.g. energy bill reduction, an increase in thermal comfort, noise reduction, etc.) in the decision-making process supporting the decision to refurbish a residential property (house or apartment).

After having defined the main decision problem in the form of a complex question, the problem is detailed through a set of criteria, which are detailed via sub-criteria in turn. Through the pairwise comparisons and using the semantic scale proposed by Saaty, it

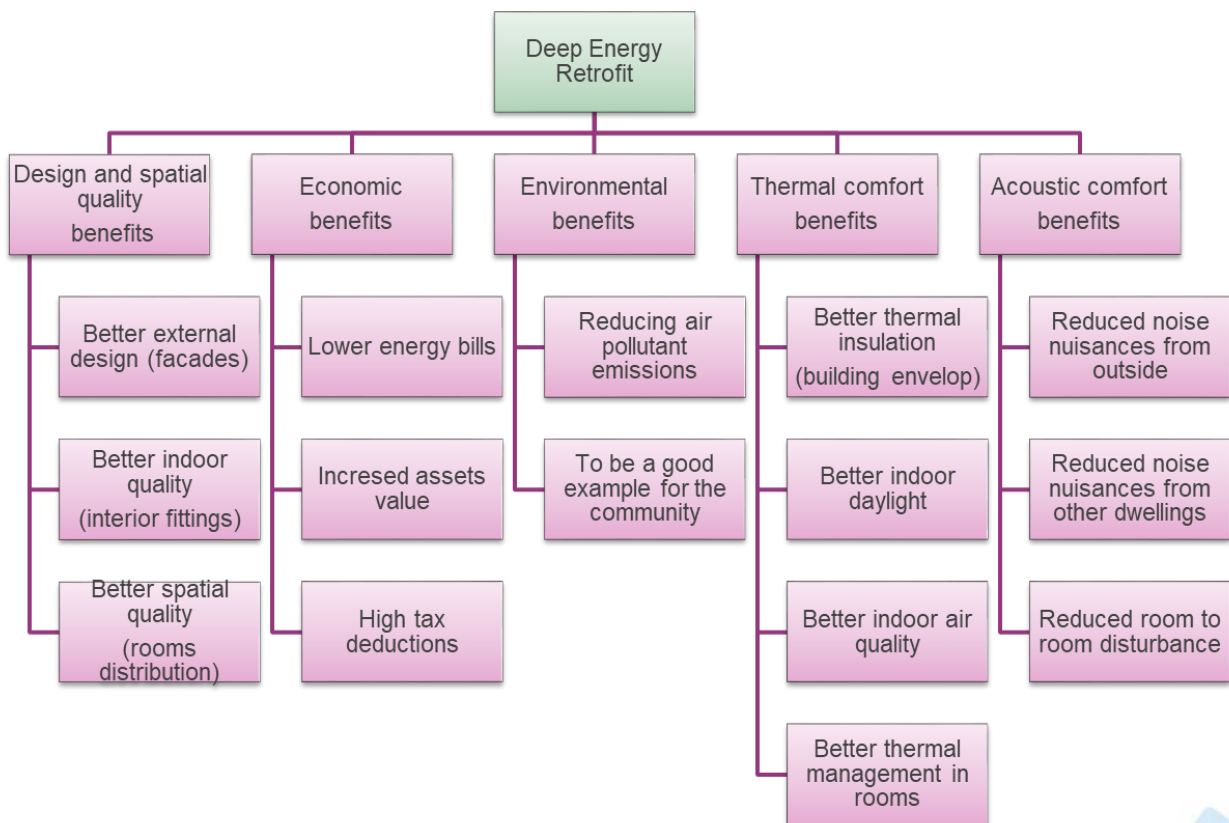


FIGURE 22: DECISION TREE WITH CRITERIA AND SUBCRITERIA



is possible to assess the relative importance of criteria and sub-criteria for each respondent. (5 criteria and 15 sub-criteria in this case, see Figure 22)

Because the procedure used to express preferences does not provide for the collection of information about the absolute importance of the criteria, but only about their relative importance (pairwise comparison), there may be some inconsistencies, i.e., violations of transitivity in expressed judgments. Therefore, a check for the logical consistency of each matrix is required; for this reason, the results of each phone interview were simultaneously recorded in the “Super Decisions” free software, specifically developed to support the data collection and results from validation by implementing this technique (see: www.superdecisions.com and Figure 23 **Fel! Hittar i nte referenskälla.**).

Since energy behaviors and expectations may be very context-dependent, it is necessary to interview a pool of local experts/stakeholders. Thus, we asked the SINFONIA project partner “CasaClima – KlimaHaus” (responsible in south Tyrol province for buildings energy audit and certification) to contribute to the investigation inviting its associates to join the research. As a result, during June and July 2016, we conducted ten phone interviews, collecting information from local engineers, architects, and experts in the building sector. We invited respondents to answer based on their personal and professional experiences with local customers, asking for a “deep energy retrofit” intervention. We established the general framework with the introductory phrase:

“Please, think about your local customers. In asking for deep energy retrofit of their dwelling/house, what are the most relevant benefits they expected, among the following?”



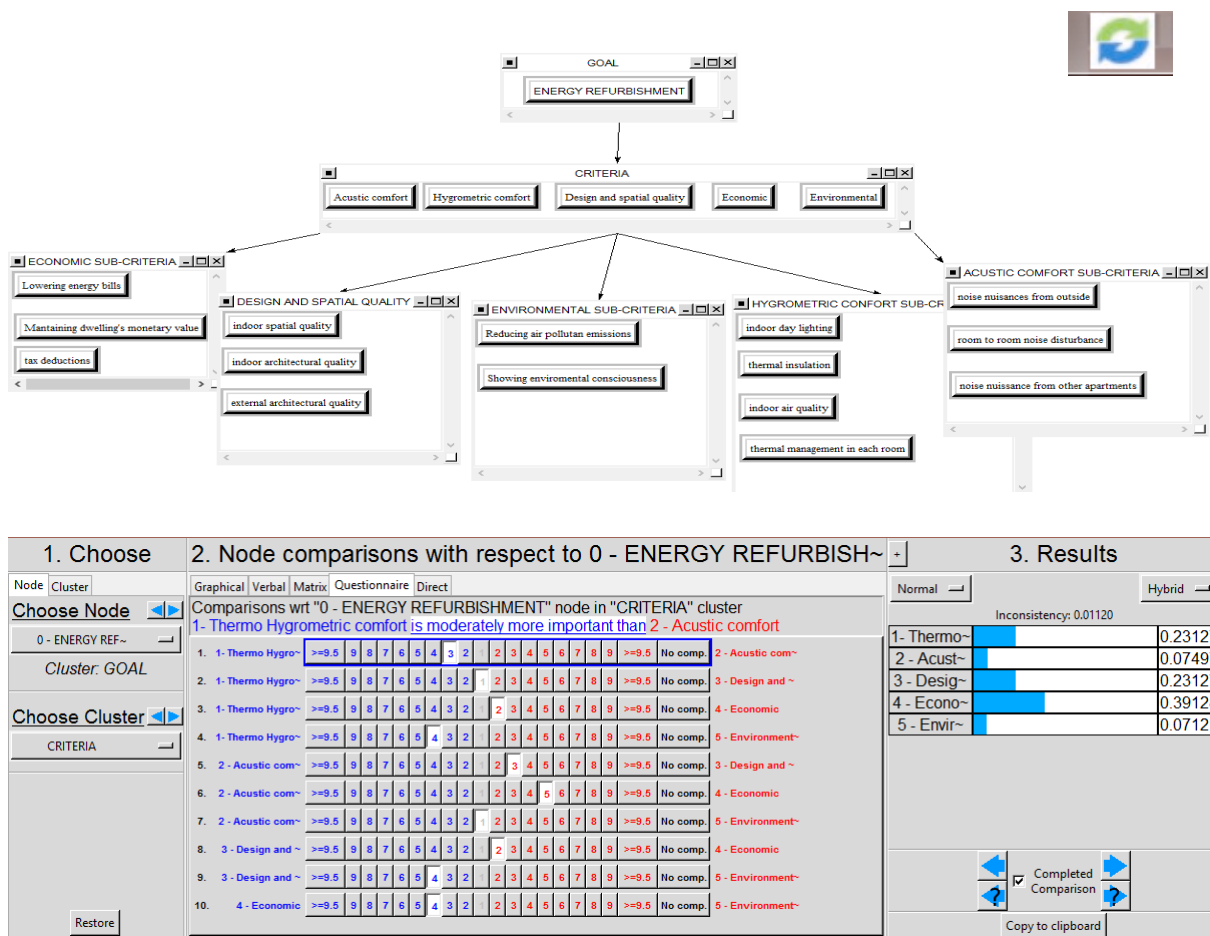


FIGURE 23: SCREENSHOTS OF SUPER-DECISIONS SOFTWARE TO MODEL AHP

As previously recalled, the set of criteria and related sub-criteria was defined based on research questions and results suggested by previous studies in this field. Moreover, we included in our investigation a criterion related to sustainability, trying to trace the attitude of house owners to environmental issues as well as their social behavior. Thus we explicitly mentioned the decrease of air-pollutant emission produced by energy generation and the expression of an individual green social status, due to the adoption of sustainability measures, as a benefit for themselves and an incentive for others; Dastrup et al. (2012) identified this as an expression of the “warm glow” phenomenon. We obtained a decision tree with five criteria and 15 sub-criteria: four in “thermal and hygrometric comfort”, three in “design and architectural quality”, “acoustic comfort”



and “economic benefits”, and two in “sustainability” (see Figure 22 **Fel! Hittar inte r eferenskölla.**).

RESULTS

The main results of our survey are summarized in Table 7. The median and mean of the sample are similar in quite all the variables, therefore the center of the data seems to be not too much influenced by outliers.

TABLE 7: MAIN RESULTS OF THE SURVEY

Criteria	Min	1 Quart	Median	Mean	3 Quart	Max	Var.	SD
Thermo-Hygrometric comfort	7%	13%	17%	22%	33%	41%	1.3%	11.6%
Acoustic comfort	6%	8%	9%	9%	11%	14%	0.0%	2.2%
Design and spatial quality	5%	13%	17%	22%	34%	44%	1.4%	12.0%
Economic benefits	22%	30	38%	37%	44%	56%	0.9%	9.7%
Sustainability benefits	3%	4%	9%	10%	15%	21%	0.3%	5.8%

As graphically shown in Figure 24, the mean of the judgments deduced from the pool of experts assigns the first place to economic benefits (37%), and remarkable similar importance both to thermo-hygrometric comfort (22%) and design and spatial quality (22%).



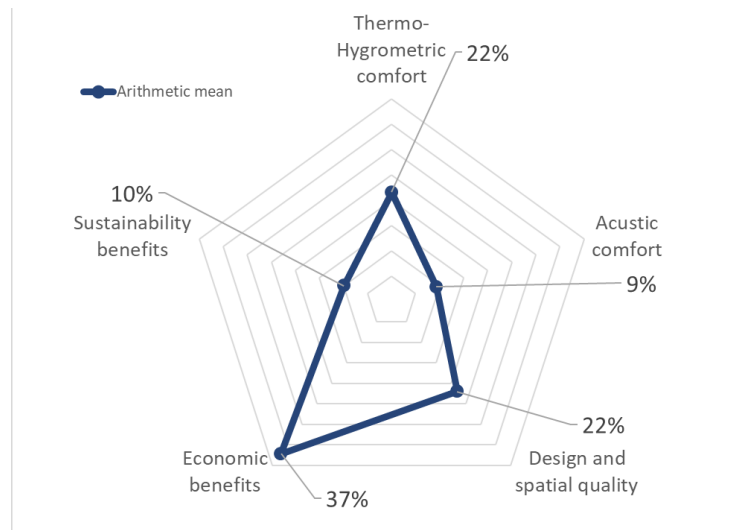


FIGURE 24: AVERAGE WEIGHT OF THE CRITERIA IN THE DECISION

The less-relevant values result in an equal level (9%) for acoustic comfort and sustainability benefits (10%).

The analysis of the results reveals that among experts there is an overall agreement on judging many of the benefits related to the “deep energy retrofit”. Interestingly, the larger disparities concern “tax deduction” and “thermal insulation” sub-criteria, which are also the sub-criteria with the highest average values (respectively 23% and 10%).

By decomposing the “deep energy retrofit” into “micro” elements, the research confirms, on one hand, how the “economic-benefits” area plays a relevant role in the decision to undertake a deep energy retrofit (37% of the global importance), while, on the other hand, it reports how house owners only less seriously considered other potential benefits, such as the acoustic insulation improvement (9% of the global importance).

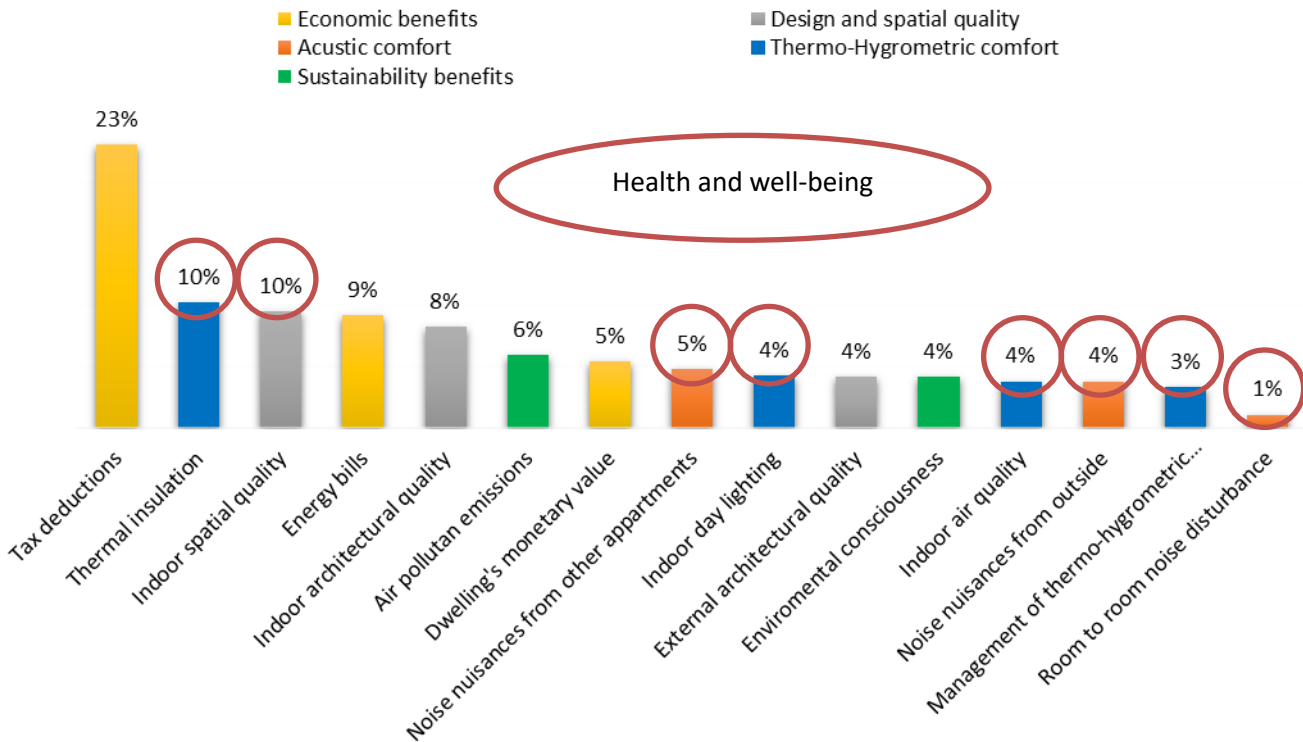


FIGURE 25: AVERAGE WEIGHT OF THE SUB-CRITERIA IN THE DECISION

Similarly, other elements positively contributing to indoor comfort such as better air quality or improved daylight are not fully understood. There is a need to increase citizens' awareness about the possibility to adopt in refurbishment activities the whole-building approach, achieving multiple benefits, and to find different management and business models to approach the complexity expressed by the social environment of the apartment building or by certain types of building. In this regard, it is interesting to note how summing up the single sub-criteria related to health and well-being a relevant value emerges (see Figure 25). One may argue that some 40% of the decision involves these aspects, although they are scattered among the different criteria, and thus only implicitly considered as a whole. To support this awareness, "cultural" and "sensitization" activities should be more envisaged, to make this argument more explicit in the decision-making process. Similarly, citizens need to familiarize themselves with the technological innovation in buildings possible today and to appreciate how they can improve the quality of life given by better indoor comfort.



Otherwise, this will be not fully accepted and exploited. The acoustic design probably needs a deeper investigation also from the experts' side, because currently, they consider this as uncertain in potentially achievable results.

From the general perspective, it is clear the low appeal of the positive environmental effect (currently 9% of the global importance), although a multitude of single interventions may undoubtedly lead to relevant impacts.

The results of this survey should be considered as a picture of a particular context at a certain time: weights currently assigned by experts in Bolzano and South Tyrol may be useful only to interpret the decision-making process of the local population and to define specific strategies as soon as the legal framework does not change⁹. Any inference of applicability within a larger population or in other places may lead to biases in the priorities. However, on the other hand, the methodological approach and the experimental design can be replicated in other contexts and to sustain the design phase of smart-city projects or to compare whether experts' perceptions and beliefs really capture the citizens' expectations, making the latter more explicit through a massive local online or phone survey. The most relevant methodological steps of the AHP method adopted and the first results obtained by the survey n°2C are published in Bisello, Attardi, & Vettorato (2016)¹⁰.

⁹ For example, "tax deduction", the most prominent sub-criteria is a particular feature related to the national Italian legal framework. Since 2007, energy upgrading of existing buildings is promoted through tax benefits. The mechanism consists of the deduction from income tax of a share of the costs incurred for the energy refurbishment (actually around 65% over ten fiscal years). Beneficiaries include all taxpayers, such as individuals, professionals, companies, and other enterprises.

¹⁰ This work presents the data gathered from the first eight interviews. After its publication, other two have been conducted. However, general results and findings remain almost unchanged.



5. SURVEY 3 – FINAL ASSESSMENT OF CO-BENEFITS ON LOCAL ECONOMY AND GOVERNANCE

In the last phase of the SINFONIA project, a re-evaluation of ranking and values assigned to co-benefits in survey n°1 is done. The same, or at least similar, group composition is wanted because participants are asked to re-evaluate co-benefits based on their own experience in the second half of the SINFONIA project. The idea is that participants of the project are now able to recognize co-benefits and their values not only from a theoretical perspective but having had the opportunity to experience some of them.

MATERIALS AND METHOD

In this phase, a new questionnaire is drafted, very similar to the one provided in survey n°1, with some adjustments needed to simplify its digital distribution and filling. The project coordinator distributed the questionnaire through the official SINFONIA mailing list to all project partners in January 2020 (M67).

The questionnaire was designed in the shortest and easiest way, to keep the filling time concise (duration: 10 min), trying to avoid incomplete responses or sloppy and careless answers (See ANNEX 5 – QUESTIONNAIRE M67 - FACSIMILE).

The aim of the questionnaire is to elicit comprehensive responses about expectations and perceptions of key-stakeholders regarding co-benefits. It asked them, considering the SINFONIA project, to answer the three following questions:

- Q1. What is the relevance of each of the following co-benefits, ranging from 1 (not relevant) to 5 (very relevant) in making your city both sustainable and better places to live?



- Q2. What is the probability of occurrence on your city of each of the following co-benefits, ranging from 1 (no chance, even in the future) to 5 (already happened)?
- Q3. What do you think are the 5 most important co-benefits delivered or going to be delivered soon by the project (the ones that should be stressed in the communication of project results)? Please identify them and give a rank of the first 5.

RESULTS

More than half of collected on-line questionnaires were filled by people affiliated to the local cluster of Innsbruck (53%), one of the two demonstration cities, while Bolzano and representatives of early adopter cities count the same (18% of all sample) and the remaining refers to horizontal partners (12%). Because answered questionnaires from Bolzano are only three, results related to this lighthouse city are difficult to cluster (see Table 8).

TABLE 8: QUESTIONNAIRES GENERAL STATISTIC (M67)

Distributed	-	Collected	17		
Respondents by affiliation / city	Bolzano	Innsbruck	Early ad.	Other	Total
Research		4		1	5
Consulting		1		1	2
Utility		1			2
Municipality	1	1	3		5
Social Housing	1	2			3
Other	1				0
Total	3	9	3	2	17



RELEVANCE

Generally speaking, the most recurrent judgment provided by respondents is “relevant”, which summed with the upper positive value of “very relevant”, gain the 52% of all expressed scores, close to the same value we found in the first round (see Table 9 below).

TABLE 9: OVERALL EXPECTED RELEVANCE OF THE CO-BENEFITS (M67)

Typology	Relevance	Observations	Percentage	Sum
Positive judgments	Very relevant	71	21% (+1%)	-
	Relevant	106	33% (-4%)	52% (-3%)
	Moderately relevant	80	24%	76% (-3%)
Negative judgments	Slightly relevant	35	10% (-3%)	-
	Not relevant	44	13% (+6%)	23% (+3%)
Not answered		2	1%	-
Tot.		338	100%	

Although the judgments are often widely distributed across all values as shown in the following figures, “health and well-being of residents increased”, confirms itself as the co-benefit most often ranked as very relevant by respondents (47%, +1%).

On the contrary, the two previously ranked in second place dropped down, namely “resilience of energy infrastructure increased” (18%; -15%) and “local energy supply chain established” (12%; -19%).

A good result is performed by “innovation in technology development and adoption”, which increases (41%; +10%) up to take the second place, together with professional skills development (41%; +23%).

On the opposite side, “positive changes in local tax revenue” once again never gain this score (the only one), and they are considered slightly relevant or not relevant at all by almost half of respondents.



Excluding these two latter mentioned many other co-benefits receive positive judgments of relevance by 2/3 of respondents; only “fuel poverty tackled” and “neighbourhood identify enhanced” are slightly below.

The following paragraphs report the main changes that occurred in the comparison between answers provided in June 2016 (month 24 – M24) and in January 2020 (month 67 – M67).

SMART NATURAL ENVIRONMENT

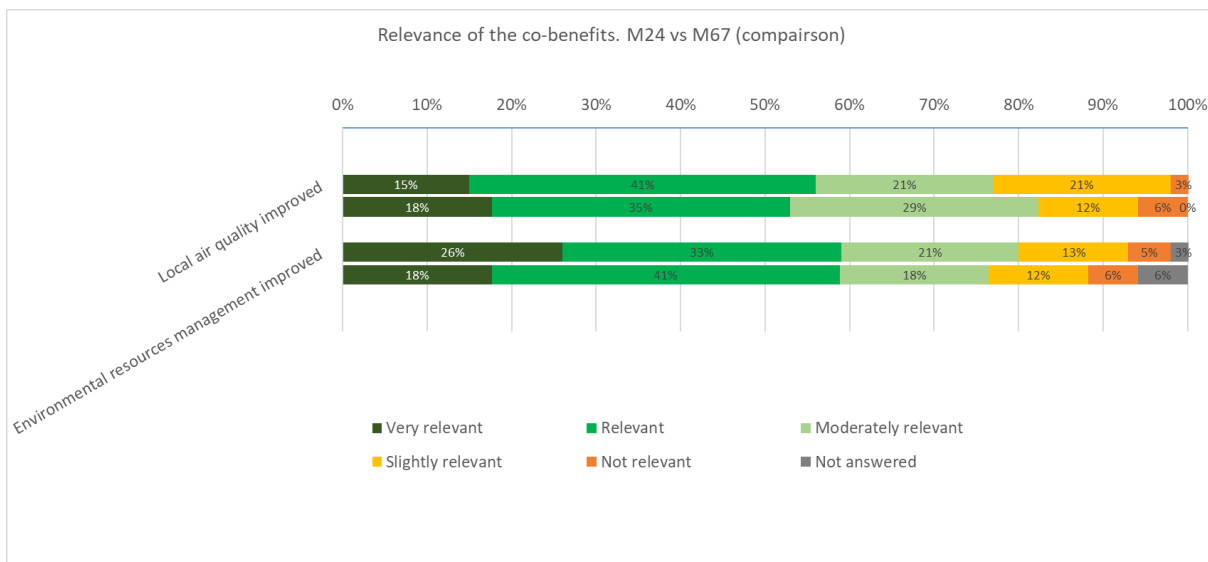


FIGURE 26: SMART NATURAL ENVIRONMENT

Local air quality improved was considered mainly “relevant” (41%) or “moderately relevant” (21%) by most respondents (62%). In survey n°3 the share of “relevant” decreased (-6%), while “moderately relevant” and “very relevant” increased (respectively +7% and +3%). Thus, it can be finally considered RELEVANT-MODERATELY RELEVANT. Looking to lighthouse cities feedback, it is RELEVANT for Innsbruck, while MODERATELY RELEVANT for Bolzano



Environmental resources management improved was considered “very relevant” (26%) or at least “relevant” (33%) by most respondents (59%), and has kept the same cumulative share, even though “very relevant” decreased (-8%). Thus, it can be finally considered RELEVANT, with a downward trend during the project. Looking at lighthouse cities feedback, it is RELEVANT for Innsbruck, while answers in Bolzano are heterogeneous.

SMART SERVICES

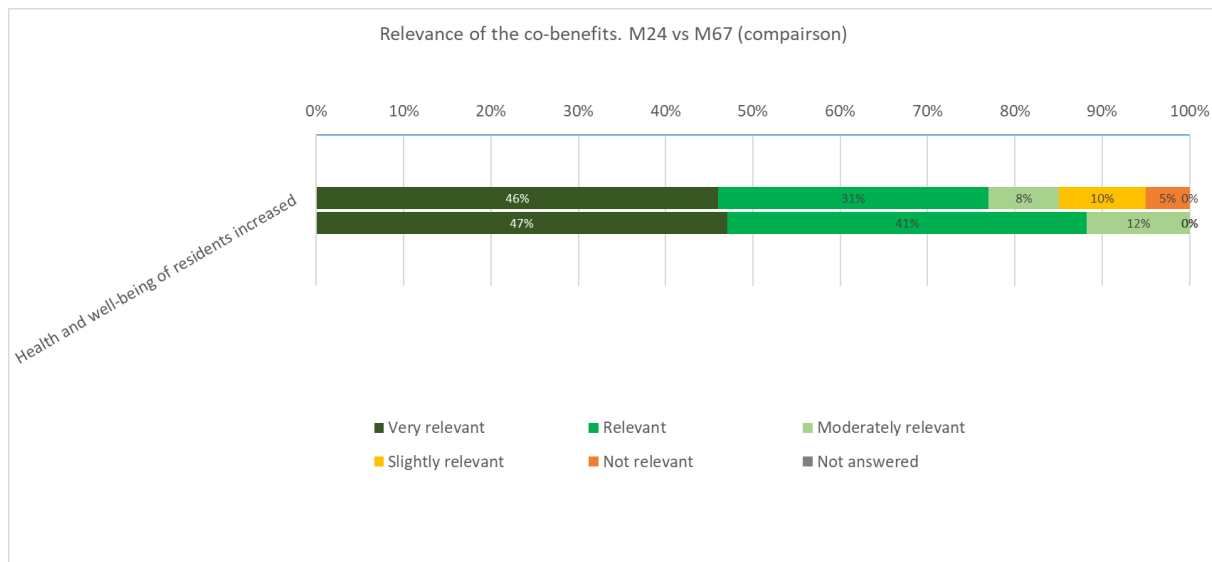


FIGURE 27: SMART SERVICES

Health and well-being of residents increased was considered “very relevant” by close to half of respondents (46%) and confirmed this position (+1%). In addition, those mentioning it as “relevant” increased (from 31% to 41%), reducing to zero those considering this co-benefit “slightly relevant” or “not relevant” at all. It confirms itself as VERY RELEVANT, with an upward trend during the project. VERY RELEVANT for Innsbruck, positive expectations, but more heterogeneous answers in Bolzano.

SMART COMMUNITY



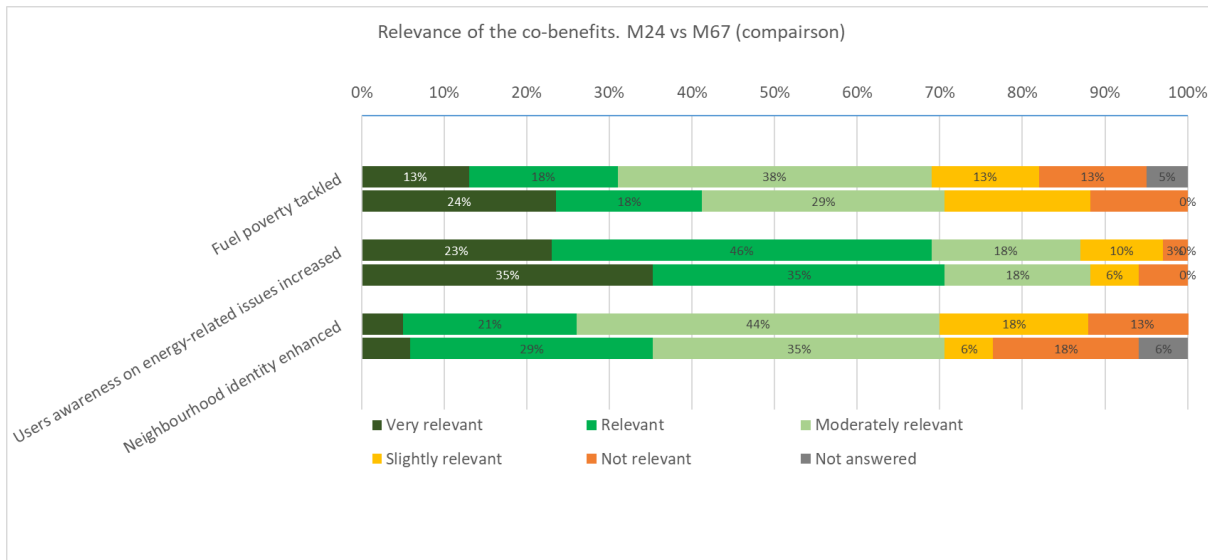


FIGURE 28: SMART COMMUNITY

Fuel poverty tackled was considered mainly “moderately relevant” (38%) or “relevant” (18%). In survey n°3, “moderately relevant” decreased (-9%) while “relevant” remains stable and “very relevant” considerably increased (+11%). It can be considered RELEVANT on average, with an upward trend during the project. Interestingly, answers from Innsbruck converge towards MODERATELY RELEVANT.

Users' awareness on energy-related issues was considered “relevant” by close to half of respondents (46%) and “very relevant” by a quarter (23%). Now the two shares are aligned (both 35%), while “moderately” relevant has not changed (18%). It has become almost VERY RELEVANT, with an upward trend during the project in both lighthouse cities it is RELEVANT.

Neighbourhood identity enhanced was considered mainly “moderately relevant” (44%) or “relevant” (21%). In survey n°3, “moderately relevant” decreased (35%) while “relevant” increased (29%), keeping the same cumulative share (65%). It can be still considered MODERATELY RELEVANT, although with an upward trend during the project. Answers in Bolzano are quite heterogeneous.



SMART GOVERNANCE

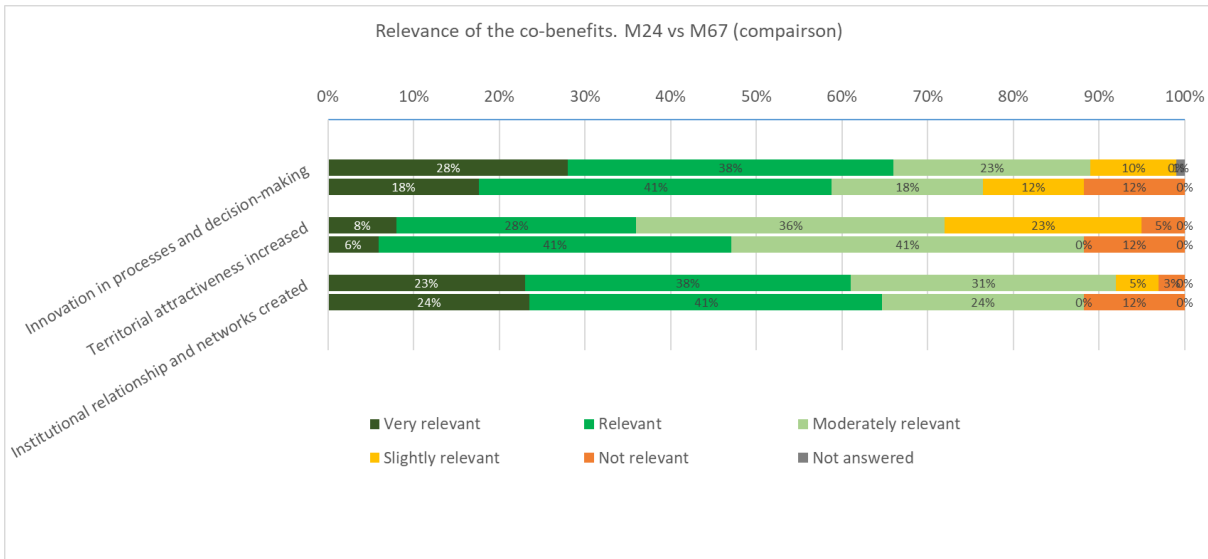


FIGURE 29: SMART GOVERNANCE

Innovation in processes and decision-making was considered mainly “relevant” (38%) or “very relevant” (18%). In survey n°3, “very relevant” decreased (-9%) while “relevant” remains stable and “slightly relevant” decreased too (-5%). Moreover, “not relevant” emerged (from 0% to 12%). There is a contrasting view between those mentioning it still as RELEVANT (even though with a downward trend) and those who have become sceptical about this co-benefit during the project. In both lighthouse cities it is considered RELEVANT.

Territorial attractiveness increased was considered mainly “moderately relevant” (36%) or “relevant” (28%). Now both judgments increased (reaching 41% each one), revising upwards the cumulative share (from 64 to 82%). It can be considered in between MODERATELY RELEVANT and RELEVANT, with an upward trend during the project. In both lighthouse cities it is considered RELEVANT.

Institutional relationship and networks created was considered mainly “relevant” (38%) or “moderately relevant” (31%). In survey n°3, “relevant” increased (+3%) and “moderately relevant” decreased (-6%) becoming equal to “very relevant” (24%). It is



thus a RELEVANT co-benefit in both lighthouse cities, but a few have become sceptical on this during the project ("not relevant" raised from 3% to 12%).

SMART ECONOMY

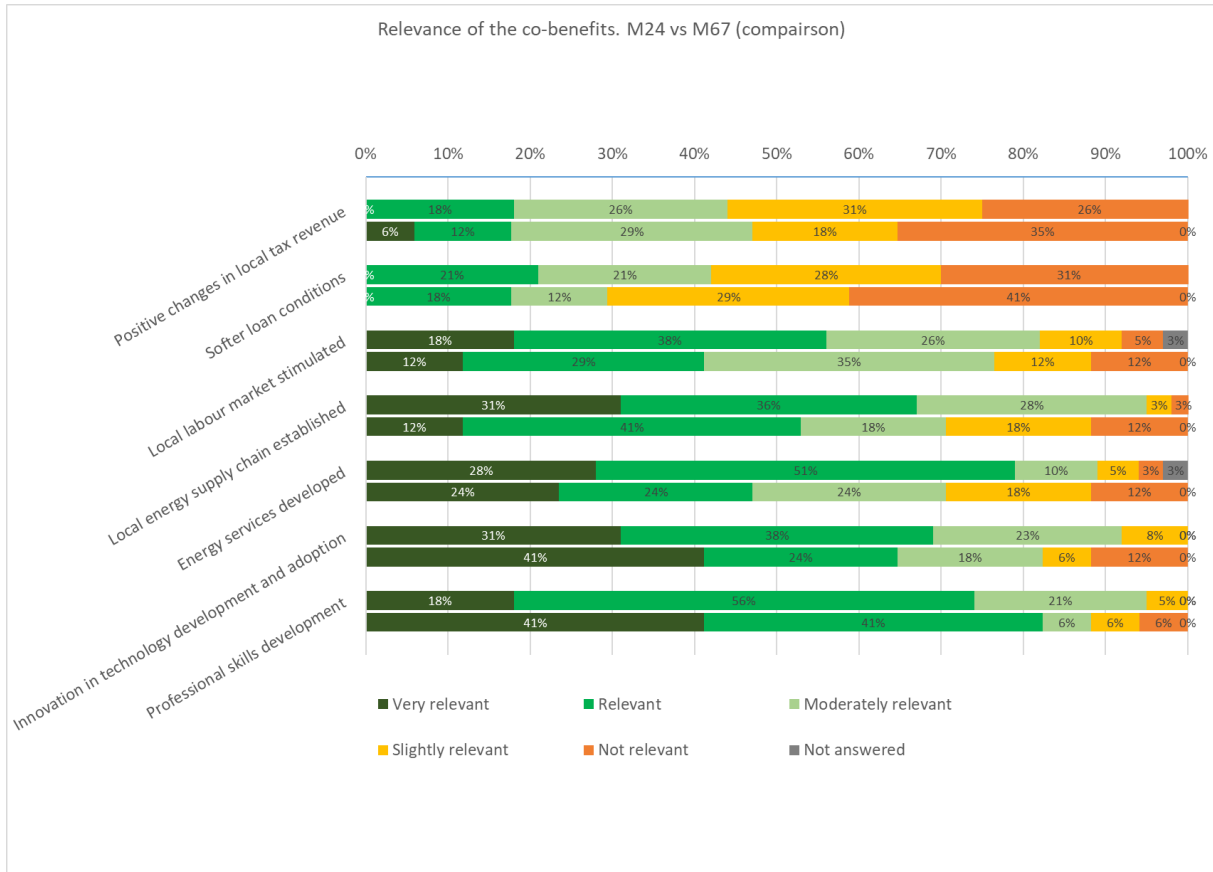


FIGURE 30: SMART ECONOMY

Positive changes in local tax revenue continue to be unpopular among suggested co-benefits. It was considered mainly "slightly relevant" (31%) and with the same magnitude either "moderately relevant" or "not relevant" (both 26%). In survey n°3, "not relevant" increased (35%), keeping the cumulative share of the three options almost unchanged (83- 82%). By contrast, as a small minority considering it "very relevant" emerged (from 0% to 6%). It can be finally considered NOT RELEVANT, with a downward trend during the project, even though a few become more optimistic



during the project (maybe in a specific local cluster?). Results are heterogeneous in Innsbruck, while answers converge to NOT RELEVANT in Bolzano

Softer loan conditions also continue to be unpopular among suggested co-benefits. It was considered mainly "not relevant" (31%) or "slightly relevant" (28%), and now "not relevant" substantially increased (+10%). No one has defined it as "very relevant". It is a NOT RELEVANT co-benefit.

Local labour market stimulated was considered mainly "relevant" (38%) or "moderately relevant" (26%). In survey n°3, "moderately relevant" increased (+9%), while "relevant" equally dropped down (-9%). Also "not relevant" raised from 5% to 12%. It is a MODERATELY RELEVANT co-benefit, which had a downward trend during the project. Answers in Bolzano tend to RELEVANT-MODERATELY RELEVANT

Local energy supply chain established was considered "very relevant" (31%), "relevant" (36%), or "moderately relevant" (28%) by almost the totality of respondents (95%). In survey n°3, "relevant" increased (41%), while "very relevant" and "moderately relevant" dropped down (respectively -19% and -10%), consistently lowering the cumulative share (from 95% to 71%). It is still considered RELEVANT, especially in Innsbruck, but with a consistent downward trend during the project.

Energy services developed were considered "relevant" by half of the respondents (51%), "very relevant" by a large share (28%) and "moderately relevant" by some others (10%). In survey n°3, the three categories become equal (24% each), thus there is a consistent reduction of "relevant" and an overall reduction of the cumulative share (from 89% to 71%). Despite the downward trend during the project, it is still considered VERY RELEVANT - RELEVANT in Innsbruck, while answers in Bolzano are less positive.

Innovation in technology development and adoption was considered mainly "relevant" (38%) or "very relevant" (31%) by most respondents (69%). Now "relevant" decreased (24%), while "very relevant" increased (41%). By contrast, a minority considering it "not



relevant” emerged (from 0% to 12%). It is thus a VERY RELEVANT co-benefit, especially in Innsbruck, but some have become sceptical during the project.

Professional skills development was considered “relevant” by more than half of respondents (56%) and “very relevant” by some others (18%). At the end of the project “relevant” decreased (41%), while “very relevant” increased to the same magnitude (41%), enlarging the cumulative share (from 74 to 80%). Surprisingly, a small minority declared it “not relevant” (from 0% to 6%). It is thus a VERY RELEVANT co-benefits, with an upward trend during the project, but some have become sceptical during the project.

SMART BUILT ENVIRONMENT

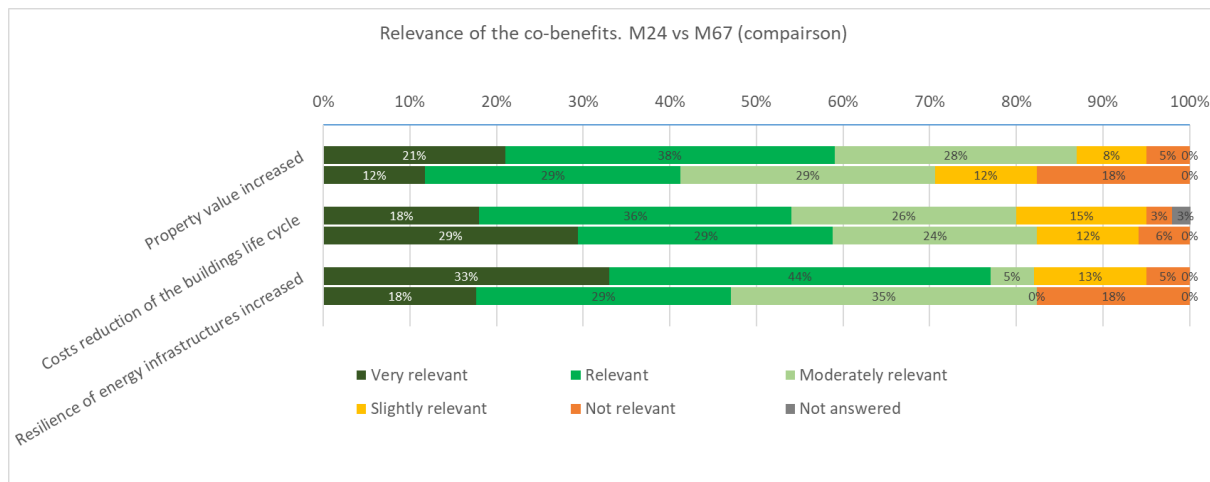


FIGURE 31: SMART BUILT ENVIRONMENT

Property value increased was considered “relevant” by the majority of respondents (38%) and “moderately relevant” by some others (28%). In survey n°3 more than half of the respondents declared this co-benefit “relevant” or “moderately relevant” (both 29%). Moreover, “not relevant” raised (from 5% to 18%). It is thus in between RELEVANT and MODERATELY RELEVANT in both lighthouse cities and some have become sceptical during the project.



Costs reduction of the building's life cycle was considered "relevant" by the majority of respondents (36%) and "moderately relevant" by some others (26%). In survey n°3 more than half of the respondents declared this co-benefit "very relevant" or "relevant" (both 29%). It is finally a VERY RELEVANT co-benefit, which experienced an upward trend during the project. Answers in Innsbruck converge to VERY RELEVANT, while in Bolzano results are more heterogeneous.

The resilience of energy infrastructures increased was considered "relevant" by close to half of respondents (44%) and "very relevant" by a large share (33%). In survey n°3 the most popular judgment becomes "moderately relevant" (35%), while "relevant" and "very relevant" dropped down (29% and 18% respectively). It is finally a RELEVANT - MODERATELY RELEVANT co-benefit, with a downward trend and some have become sceptical during the project.

GENERAL TREND - RELEVANCE

The following Table 10 recaps the trends observed in the co-benefits' relevance and the main judgment expressed by respondents.

TABLE 10: CO-BENEFITS' RELEVANCE

	Main judgment	Trend of positive judgments
Health and well-being of residents increased.	VERY RELEVANT	↑ ↑ ↑
Users' awareness on energy-related issues increased.	VERY RELEVANT	↑ ↓ =
Innovation in technology development and adoption.	VERY RELEVANT	↑ ↓ ↓
Professional skills development.	VERY RELEVANT - RELEVANT	↑ ↓ ↓
Costs reduction of buildings life cycle.	VERY RELEVANT - RELEVANT	↑ ↓ ↓
Institutional relationship and networks created.	RELEVANT	↑ ↑ ↓
Fuel poverty tackled.	RELEVANT	↑ = ↑
Local air quality improved.	RELEVANT	↑ ↓ ↑



Environmental resources management improved.	RELEVANT	↓ ↑ ↓
Innovation in processes and decision-making.	RELEVANT	↓ ↑ ↓
Local energy supply chain established.	RELEVANT	↓ ↑ ↓
Energy services developed.	RELEVANT	↓ ↓ ↑
Territorial attractiveness increased.	RELEVANT - MODERATELY RELEVANT	↓ ↑ ↑
Property value increased.	RELEVANT - MODERATELY RELEVANT	↓ ↓ ↑
Neighbourhood identity enhanced.	MODERATELY RELEVANT	↑ ↑ ↓
Local labour market stimulated.	MODERATELY RELEVANT	↓ ↓ ↑
Resilience of energy infrastructures increased.	MODERATELY RELEVANT	↓ ↓ ↑
Positive change in local tax revenue.	NOT RELEVANT	↑ ↓ ↑
Softer loan conditions.	NOT RELEVANT	≠ ↓ ↓

PROBABILITY

The most recurrent judgment of probability is “likely in the future” (32%), but it is very interesting that half of the answers report about co-benefits that already happened (22%) or are happening right now (28%), while only at 18% co-benefits are considered remote in the future or not likely at all.

TABLE 11: OVERALL PROBABILITY OF THE CO-BENEFITS (M67)

Typology	Probability	Observations	Percentage	Sum
Observation	Already happened	75	22%	50%
	Happening now	94	28%	
Estimate	Likely in the future	107	32%	82%
	Remote in the future	49	14%	
	No Chance	12	4%	



Not answered	1	0%	
Tot.	338	100%	

Figure 32 reports the judgment expressed by project partners concerning the observed or expected probability of each co-benefit.

The four co-benefits that were meant to be the most likely or possible are now widely recognized as “already happened” or “happening now”:

- “professional skills development” (41% + 53% = 94%)
- “innovation in technology development and adoption” (41% + 29% = 70%)
- “institutional relationships and networks created” (35% + 35% = 70%)
- “health and well-being of residents increased” (18% + 53% = 71%)



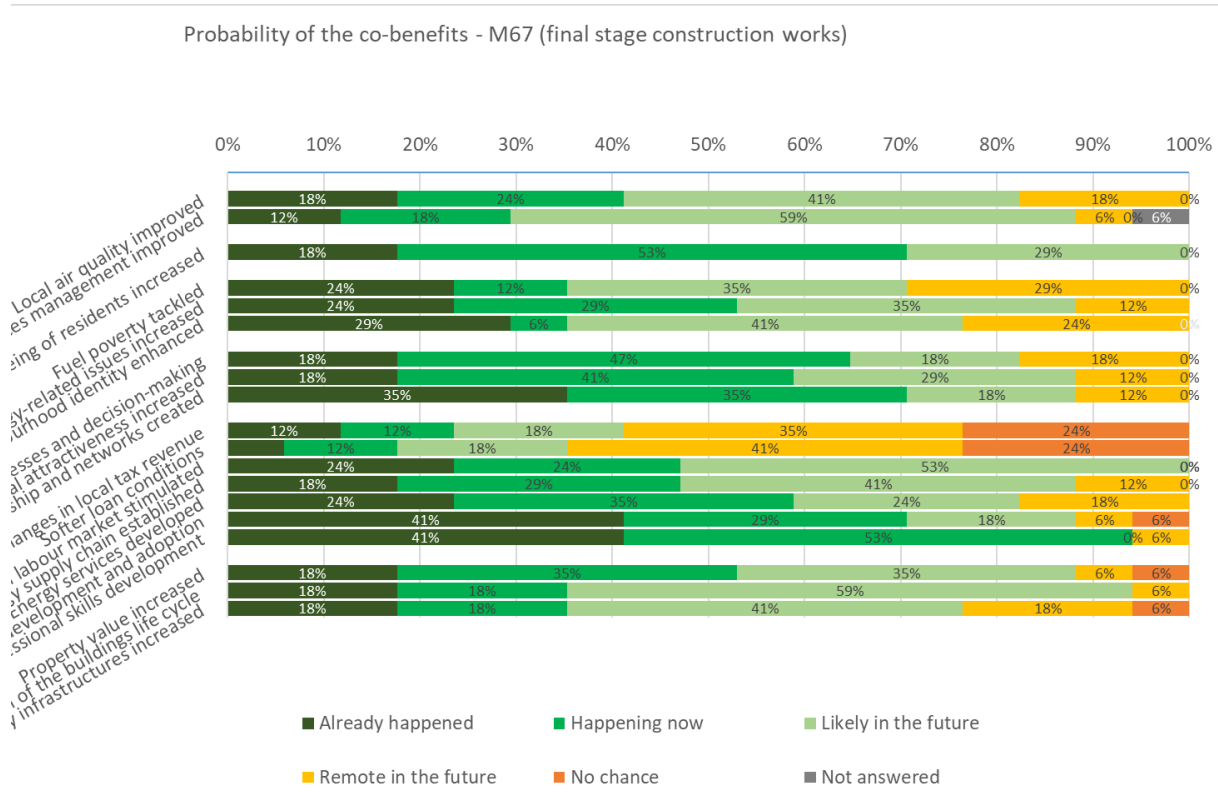


FIGURE 32: PROBABILITY OF CO-BENEFITS (M67)

Moreover, no one is questioning that the “health and well-being of residents increased” can be delivered in the future (in case not yet occurred). Similarly, a high expectation deserves the “costs reduction of the buildings life cycle” (59%), the “Environmental resources management” (59%) and the “local labour market stimulation” (53%).

The sceptical judgments previously expressed on the likelihood of occurrence of “positive changes in local tax revenue” and “softer loan conditions” are also confirmed: they respectively scored 59% and 65% by summing up those answering “remote in the future” or “no chance”.



TOP 5 CO-BENEFITS

By comparing current results with answers in survey n°1, the “health and well-being of residents” remains, while others two change (see Table 12).

TABLE 12: MOST MENTIONED IN TOP 5

M24	M67
<ul style="list-style-type: none"> • Innovation in processes and decision-making (52%) • Health and well-being of residents increased (52%) • Innovation in technology development and adoption (45%) 	<ul style="list-style-type: none"> • Users awareness on energy-related issues increased (65%) • Health and well-being of residents increased (59%) • Costs reduction of the building’s life cycle (47%)

(% of answers placing them in one of the top 5 positions)

Looking at the specific result of each one, the situation is more stable: four out of five still remain in the top five, although the ranking is changing, except for the first place, that’s is occupied by health and well-being of residents increased (see Table 13).

TABLE 13: TOP 5: THE MOST MENTIONED AS FIRST OR SECOND MOST

Desk research on similar smart and sustainable city projects	SINFONIA project partners at M24	SINFONIA project partners at M67
<ol style="list-style-type: none"> 1. Local labour market 2. Users’ awareness on energy-related issues increased 3. Health and well-being of residents increased 4. Professional skills 5. Energy supply chain / Territorial attractiveness increased / Innovation in processes and decision-making / Institutional relationships and networks created 	<ol style="list-style-type: none"> 1. Health and well-being of residents increased (20%) 2. Innovation in processes and decision-making (20%) 3. Innovation in technology development and adoption (24%) 4. Professional skills development (16%) 5. Users’ awareness on energy-related issues increased (20%) 	<ol style="list-style-type: none"> 1. Health and well-being of residents increased (29%) 2. Users’ awareness on energy-related issues increased (18%) 3. Professional skills development (24%) 4. Territorial attractiveness increased (18%) / Neighbourhood identity enhanced (18%) 5. Innovation in technology development and adoption (18%)

(% of consensus)



In conclusions, we found that partners involved in the SINFONIA project have confirmed the following co-benefits, among the suggested ones, as the most relevant: “Health and well-being of residents increased” (smart services), “Users’ awareness on energy-related issues increased” (smart community), “Professional skills development and Innovation in technology development and adoption” (smart economy). They are coloured in red in Table 13.

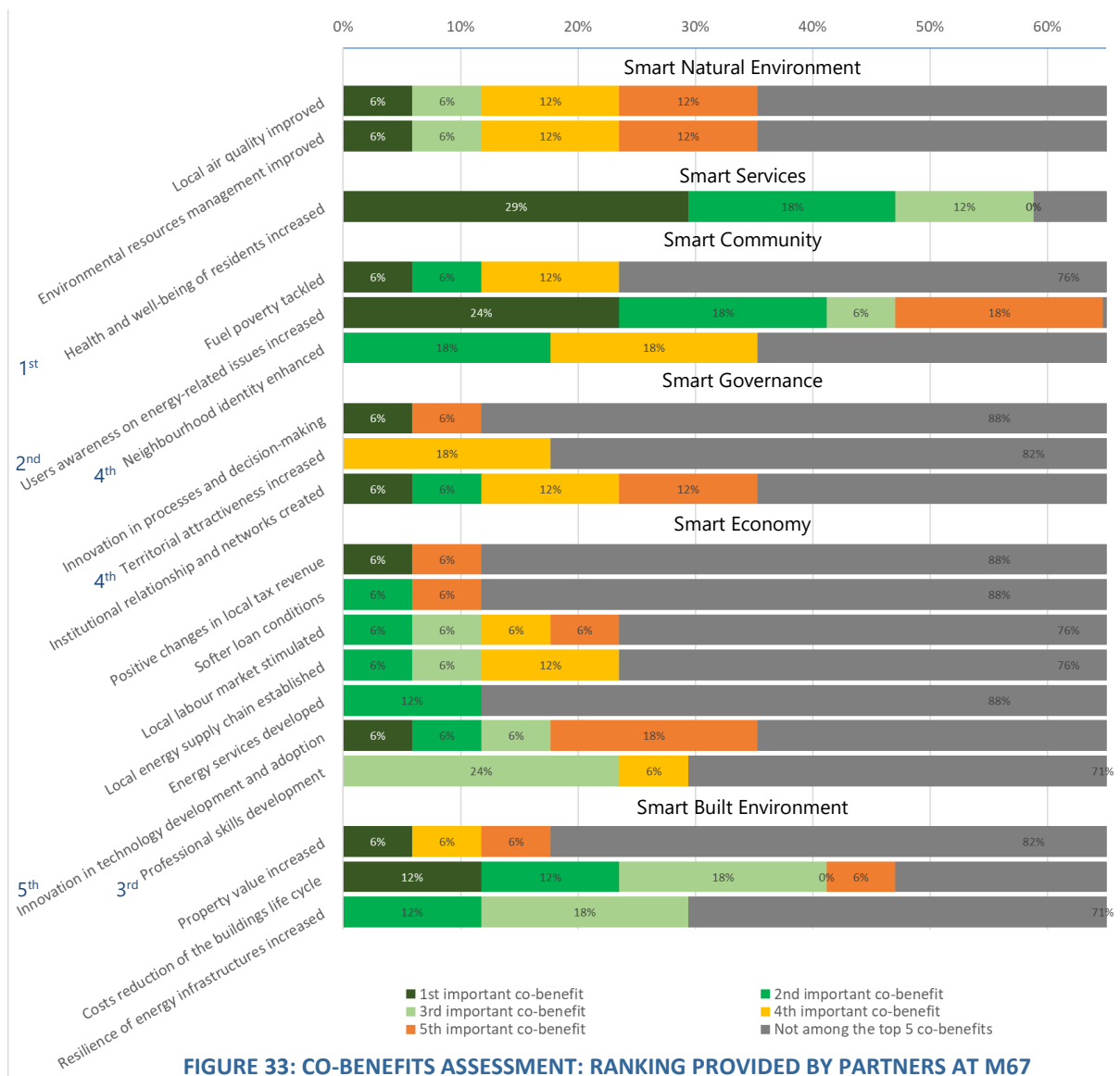


FIGURE 33: CO-BENEFITS ASSESSMENT: RANKING PROVIDED BY PARTNERS AT M67

In the early stage of the project, “Innovation in processes and decision-making” (smart governance) was ranked second, while in this last phase it is rarely appointed. It is now



replaced by “Territorial attractiveness increased” (smart governance) and “Neighbourhood identity enhanced” (smart community), both almost neglected at M24

This means that at least one co-benefit in each of these four smart dimensions is recognized in the top five and to some extent, the focus shifted from the internal process (interaction among actors of the same institution) to social and territorial relationships (interaction among actors of the same district or coming from different cities) (see Figure 33). It is quite interesting that neither co-benefits related to the smart built environment nor the smart natural environment are sufficiently mentioned with enough singularity in judgment to enter in the list. Only considering the cumulative result of the assessment done by project partners (by summing up the recurrence of all the answers placing a certain co-benefit in the top five, regardless from the position), the co-benefit “costs reduction of the buildings life cycle” (smart built environment) is of particular importance at the end of the project. By contrast, the majority still neglect those related to the smart natural environment.

By comparing SINFONIA results with previously desk research on similar projects (referring to the smart city and Concerto calls for funding) a remarkable similarity arises. In fact, “users’ awareness on energy-related issues increased”, “health and well-being of residents increased” and “Professional skills increased” are found in all three research tests. Moreover, “Territorial attractiveness increased” and “Innovation in processes and decision-making” are confirmed by SINFONIA partners, at a different stage of project implementation. Conversely, “Local labour market simulation” that was the most recurrent in the desk research never gain high importance for the project partners of SINFONIA.



6. SOCIO-ECONOMICS OF SMART CITIES – CONCLUSIONS AND OUTLOOK

Smart cities and communities' projects, like SINFONIA, are a preview of what our cities are going to be soon thanks to the sustainable energy transition and implementation of the quadruple helix innovation model. Such projects offer the opportunity to test in the demonstration cities cutting-edge technologies and innovative approaches to make the energy transition to clean and renewable resources smoother and faster. Nevertheless, smart city projects are long, complex and require a huge effort by partners. To be fully appreciated and supported (by stakeholders and local decision-makers), and to be best devised by researchers and technicians, they must be framed within an adequate assessment scheme, beyond merely to their contributions to CO₂ emissions reduction and energy savings. Also, it should be not overlooked that high-level policy debate and scientific research take seriously the climate-energy issues on the global scale, while some citizens and local actors are interested in more immediate arguments, dealing directly with daily well-being and the quality of life.

Thus, introducing the co-benefits paradigm into the assessment approach may help in improving their acceptance and collaboration among stakeholders. This is a straightforward way to look at the project in all its positive impacts and regard them as goods, and, to involve citizens, tenants, and house owners in matters of interest to them. Based on this consideration, the Deliverable 2.4 addresses the co-benefits topic starting from its introduction into the consortium (survey n°1), going through three practical on-field tests (survey n°2) and finishing with an ex-post assessment (survey n°3).

The first result achieved by the survey n°1 is letting project partners familiarize with a shortlist of 19 key urban co-benefits, as derived from similar experiences, framed into the smart-city development approach. This is done through an individual survey and an interactive group discussion (world café method - WCM), asking project partners to



focus on co-benefits relevance (theoretic importance), the likelihood of occurrence (their expectation to see them really appearing) and importance. This is done at halfway of the project (M24), when the practical implementation of the construction works was going to start. Desk research on similar projects also found that one-third of co-benefits related to the physical intervention on buildings and energy networks should be defined as co-opportunities. That means, there is a need for additional efforts outside the project activities or for specific local conditions to enable them. For example, the creation of innovative long term “energy services” mentioned by some projects seem to remain often an unexploited potential. Hopefully the implementation of the EU Clean Energy Package into the national frameworks will enable this – allowing the creation of citizen energy communities and renewable energy communities. And, consequently, and the achievement of expected purpose, which is “to provide environmental, economic or social community benefits for its shareholders or members or for the local areas where it operates, rather than financial profits” (see Article 2(16) Renewables Directive – ‘Renewable Energy Community’ and Article 2(11) Electricity Directive – ‘Citizen Energy Community’).

The survey n°2 has brought the theory into practice, investigating 3 different aspects related to the main areas of intervention of the SINFONIA project:

- Has defined the willingness to pay (WTP) of citizens for innovative infrastructure or smart-grid services and what services mostly increase the perceived benefits;
- Has identified to what extent high energy performance buildings are appreciated by the residential property market. Thus, using the spatial hedonic price method (SHP), it answered the question about the marginal value of energy efficiency defined by the Energy Performance Certificate and possible positive spillover effect of urban regeneration projects on surroundings properties;



- Has discovered, using the analytic hierarchy process (AHP), what are the main motivations behind the decision of a private owner to start deep energy retrofit works on its residential building.

These on-field investigations sheds light on a few co-benefits, leaving to further research the room to improve the overall results. Their relevant contribution is in showing the way to the next smart city projects, to fully implement the co-benefits assessment paradigm.

Survey n°3 has closed the co-benefit investigation process giving the partners the possibility to focus again on the concept in the last phase of the project (M67) and to reassess their experience and expectation. We found that partners involved in the SINFONIA project have confirmed the following co-benefits, among the suggested ones, as the most relevant:

- Health and well-being of residents' increased (smart services);
- Users' awareness on energy-related issues increased (smart community),
- Professional skills development and Innovation in technology development and adoption (smart economy).

Including some Delphi-Method elements, as planned, was not possible because along the project lifetime about 1/3 of the consortium member changed (institutions or responsible persons). In this sense the investigation only partially provides the chance to assess whether perspectives have been changed after performing the experiences made within the project. It would be desirable to implement this in a stricter way at the next chance.

Some words should be saying on "Local labour market simulation", that was the most recurrent co-benefits found in the desk research and conversely never gain high importance for the project partners of SINFONIA. Recent research findings indicate that in a time span of 14 years (2005–2018), an amount of about 260 million Euros has been invested in buildings refurbishment related to smart and sustainable district projects,



equivalent to roughly estimated 1,000 jobs with an average duration of 5 years (Zambotti, Pezzutto, & Bisello 2019). Taking into consideration that most of such investments occurred during the latest economic recession, the impact of dis co-benefit appears to be not negligible. However, it is not so clearly perceived.

In any case, the wide spectrum of discussed co-benefits clearly shown the complexity of smart city projects, given by the new opportunities and challenges made possible by the innovative energy solutions, the changes in people's habits introduced by new devices or by enhanced energy efficiency (i.e. the rebound effect), new competencies needed. In this sense, an even more integrated evaluation framework is needed. This means, to take a holistic approach to the issues being evaluated and to be capable to create mixed assessment tools, where coupling various approaches deliver synergies. Obviously, criticalities must be considered, to avoid disproportionality between the effort needed and the reliability and usefulness of the results. Thus, better understanding citizen needs, expectations, ambitions, and priorities (by mixing the multi-criteria method with non-market valuation techniques) could be the key to success for a project and for the whole city, especially in an era of uncertainty and scarcity of resources.



7. LITERATURE

- Acre, F., & Wyckmans, A. (2015). Dwelling renovation and spatial quality. *International Journal of Sustainable Built Environment*, 4(1), 12–41. <https://doi.org/10.1016/j.ijbsbe.2015.02.001>
- Adamowicz, W., Boxall, P., Williams, M., & Louviere, J. (1998). Stated Preference Approaches for Measuring Passive Use Values: Choice Experiments and Contingent Valuation. *American Journal of Agricultural Economics*, 80(1), 64–75. <https://doi.org/10.2307/3180269>
- Bisello, A. (2017). *Smart and sustainable projects at the energy-district level. How to assess them based on the co-benefits paradigm*. University of Padova: Ph.D thesis.
- Bisello, A., Antonucci, V., & Marella, G. (2020). Energy & Buildings Measuring the price premium of energy efficiency: A two-step analysis in the Italian housing market. *Energy & Buildings*, 208, 109670. <https://doi.org/10.1016/j.enbuild.2019.109670>
- Bisello, A., Attardi, R., & Vettorato, D. (2016). Weighting Citizens' Priorities for Deep Energy Retrofit: a Multiple Benefits Approach. In *52nd ISOCARP Congress* (pp. 548–559). Durban: On-line published.
- Bisello, A., Boczy, T., & Balest, J. (2018). World Café Method to Engage Smart Energy-District Project Partners in Assessing Urban Co-benefits. In G. Mondini, E. Fattinanzi, A. Oppio, M. Bottero, & S. Stanghellini (Eds.), *Integrated Evaluation for the Management of Contemporary Cities* (pp. 521–533). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-78271-3_41
- Bisello, A., Grilli, G., Balest, J., Stellin, G., & Ciolli, M. (2017). Co-benefits of Smart and Sustainable Energy District Projects: an Overview on Economic Assessment Methodologies. *Green Energy and Technology*, 127–164. https://doi.org/10.1007/978-3-319-44899-2_9
- Bisello, A., Marella, G., & Grilli, G. (2016). SINFONIA project mass appraisal: beyond the



- value of energy performance in buildings. *Procedia - Social and Behavioral Sciences*, 223, 37–44. <https://doi.org/10.1016/j.sbspro.2016.05.285>
- Bisello, A., & Vettorato, D. (2018). Multiple Benefits of Smart Urban Energy Transition. In P. Droege (Ed.), *Urban Energy Transition* (second edi, pp. 467–490). Elsevier. <https://doi.org/10.1016/B978-0-08-102074-6.00037-1>
- Bonifaci, P., & Copiello, S. (2015). Price premium for buildings energy efficiency: empirical findings from a hedonic model. *Valori e Valutazioni*, (14), 5–15.
- Bottero, Marta; Bravi, Marina; Dell'Anna, Federico; Mondini, G. (2018). Valutazione dell'efficienza energetica degli edifici con il metodo dei prezzi edonici: gli effetti spaziali sono rilevanti? *Valori e Valutazioni*, (21), 27–39.
- Brown, J, Isaacs, D., & World Cafe Community. (2005). *The World Café: Shaping Our Futures Through Conversations That Matter*. (Berrett-Koehler Publishers Inc, Ed.). San Francisco .
- Brown, Juanita, & Isaacs, D. (2007). *Kreative Zukunftsgestaltung in Organisationen und Gesellschaft*. Heidelberg: Carl-Auer Systeme Verl.
- Carson, R. T., Louviere, J. J., Anderson, D. a., Arabie, P., Bunch, D. S., Hensher, D. a., ... Wiley, J. B. (1994). Experimental analysis of choice. *Marketing Letters*, 5(4), 351–367. <https://doi.org/10.1007/BF00999210>
- Chang, W.-L., & Chen, S.-T. (2015). The impact of World Café on entrepreneurial strategic planning capability. *Journal of Business Research*, 68(6), 1283–1290. <https://doi.org/10.1016/j.jbusres.2014.11.020>
- Chiang, C.-M., & Lai, C.-M. (2002). A study on the comprehensive indicator of indoor environment assessment for occupants' health in Taiwan. *Building and Environment*, 37(4), 387–392. [https://doi.org/10.1016/S0360-1323\(01\)00034-8](https://doi.org/10.1016/S0360-1323(01)00034-8)
- Dastrup, S. R., Graff Zivin, J., Costa, D. L., & Kahn, M. E. (2012). Understanding the Solar Home price premium: Electricity generation and "Green" social status. *European Economic Review*, 56(5), 961–973.



<https://doi.org/10.1016/j.euroecorev.2012.02.006>

De Ayala, A., Galarraga, I., & Spadaro, J. V. (2016). The price of energy efficiency in the Spanish housing market. *Energy Policy*, *94*, 16–24.

Grilli, G., Tomasi, S., & Bisello, A. (2018). Assessing Preferences for Attributes of City Information Points: Results from a Choice Experiment. *Green Energy and Technology*, (Smart and Sustainable Planning for Cities and Regions), 197–209. https://doi.org/10.1007/978-3-319-75774-2_14

IEA. (2014). *Capturing the Multiple Benefits of Energy Efficiency: A Guide to Quantifying the Value Added*. Paris: OECD/IEA. <https://doi.org/10.1787/9789264220720-en>

Ishizaka, A., & Nemery, P. (2013). *Multi-Criteria Decision Analysis: Methods and Software*. Wiley. <https://doi.org/10.1002/9781118644898>

Jakob, M. (2006). Marginal costs and co-benefits of energy efficiency investments. *Energy Policy*, *34*(2), 172–187. <https://doi.org/10.1016/j.enpol.2004.08.039>

Jiang, Y., & Shen, J. (2013). Weighting for what? A comparison of two weighting methods for measuring urban competitiveness. *Habitat International*, *38*, 167–174. <https://doi.org/10.1016/j.habitatint.2012.06.003>

Kerzner, H. R. (2013). *Project Management: A Systems Approach to Planning, Scheduling, and Controlling*. Wiley.

Krause, A. L., & Bitter, C. (2012). Spatial econometrics, land values and sustainability: Trends in real estate valuation research. *Cities*, *29*, S19–S25. <https://doi.org/10.1016/j.cities.2012.06.006>

Kühn, T., & Koschel, K.-V. (2011). *Gruppendiskussionen Ein Praxis-Handbuch*. VS Verlag für Sozialwissenschaften / Springer Fachmedien Wiesbaden GmbH, Wiesbaden.

Linstone, H. A., & Turoff, M. (1975). *The Delphi method: techniques and applications*. Addison-Wesley Pub. Co., Advanced Book Program.

Lorenzetti, L. A., Azulai, A., & Walsh, C. A. (2016). Addressing Power in Conversation: Enhancing the Transformative Learning Capacities of the World Cafe. *Journal of*



Transformative Education, 1541344616634889-
<https://doi.org/10.1177/1541344616634889>

Mayrhofer, J. P., & Gupta, J. (2016). The science and politics of co-benefits in climate policy. *Environmental Science & Policy*, 57, 22–30.
<https://doi.org/10.1016/j.envsci.2015.11.005>

Mosannenzadeh, F., & Vettorato, D. (2014). Defining smart city. a conceptual framework based on keyword analysis. *TeMA*, (Special issue), 683–694.

Pohekar, S. D., & Ramachandran, M. (2004). Application of multi-criteria decision making to sustainable energy planning–A review. *Renewable and Sustainable Energy Reviews*, 8(4), 365–381. <https://doi.org/10.1016/j.rser.2003.12.007>

Rosen, S. (1974). Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition. *The Journal of Political Economy*, 82(1), 34–55.

Saaty, T. (1980). *The Analytic Hierarchy Process*. New York: McGraw Hill.

Seliger, R. (2015). *Einführung in Großgruppen-Methoden*. Heidelberg: Carl-Auer Systeme Verl.

Ürge-Vorsatz, D., Arena, D., Tirado Herrero, S., Butcher, A., Telegdy, A., Fegyverneky, S., & Csoknyai, T. (2010). *Employment impacts of a large-scale deep building energy retrofit programme in Hungary*. Budapest.

Zambotti, S., Pezzutto, S., & Bisello, A. (2019). Multiple-Benefits from Buildings' Refurbishment: Evidence from Smart City Projects in Europe. In F. Calabrò, L. Della Spina, & C. Bevilacqua (Eds.), *New Metropolitan Perspectives* (pp. 157–164). Cham: Springer International Publishing.



8. ANNEXES




ANNEX 1 – CO-BENEFITS DEFINITIONS



WP2 – Task 2.4

Survey 1 – Co-benefits definitions

Smart and Sustainable Energy District Projects (SSEDPs)
<p>Smart and Sustainable Energy District Projects are complex projects applying innovative energy technologies within urban settlements and involving multiple stakeholders.</p> <p>The primary goals of these projects are basically:</p> <ul style="list-style-type: none"> (i) reducing CO₂ emissions, and (ii) reducing the need for energy from fossil fuels by improving energy efficiency and shifting to local renewable sources. <p>The primary goals are translated into benefits for the district and for the city.</p>

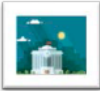



Co-benefits	
<p>A co-benefit is any positive socio-economic and environmental effect on the district (and on the city), regardless if intentional or not, related to the execution of a Smart and Sustainable Energy District Project, exceeding the primary goal(s).</p>	
Smart city components	Definitions
<p>Smart natural environment</p> 	<p>Local air quality improved. Shifting heat and power production from fossil fuels to renewables, and decreasing energy needs, reduces air pollutants (e.g. SO_x, NO_x, particulate matter), with positive effects on human health.</p> <p>Environmental resources management improved. Establishing a better way to manage environmental resources reduces the environmental footprint of human activities, with positive effects on ecosystems.</p>
<p>Smart services</p> 	<p>Health and well-being of residents increased. Improving the indoor thermal comfort and spatial quality in dwellings increases living and psychological conditions of occupants.</p>
<p>Smart community</p> 	<p>Fuel poverty tackled. Reducing energy expenses to an affordable level, even for low-income people, can lower harmful effects to health, caused by indoor thermal shocks (in summer as in winter).</p> <p>Users awareness on energy-related issues increased. Educational and communication activities change positively stakeholders and tenants energy behaviour and acceptance of new technologies.</p> <p>Neighbourhood identity enhanced. Creating new neighbourhood relationships and sense of place will lead to the formulation of dense social networks and ultimately better economic and social outcomes.</p>



SINFONIA stands for “Smart Initiative of cities Fully cOmitted to iNvest In Advanced large-scaled energy”. This project has received funding from the European Union’s Seventh Programme for research, technological development and demonstration under grant agreement No 609019



WP2 – Task 2.4: Integration of socio-economic aspects.
Definitions of co-benefits for key stakeholders

<p>Smart governance</p> 	<p>Innovation in processes and decision-making. The exchange of experiences introduces innovation, with a positive improvement of the quality and effectiveness of decision-making.</p> <p>Territorial attractiveness increased. An exemplary smart and sustainable district attracts visitors interested in innovative and green solutions (e.g. institutions, public officials, researchers or green tourists).</p> <p>Institutional relationship and networks created. Creating and strengthening existing relationships between partners and cities leads to further joint activities and collaboration.</p>
<p>Smart economy</p> 	<p>Positive change in local tax revenue. Creating new jobs and economic activities will positively affect the local public revenues.</p> <p>Softer loan conditions. Large scale interventions financially supported by the European Union can be interesting for banks and other investors and therefore negotiate better financial conditions.</p> <p>Local labour market stimulated. New direct or in-direct job positions are created from the implementation of construction activities, project management and other intervention measures.</p> <p>Local energy supply chain established. Developing new energy supply chain using local renewable sources or by-products (e.g. waste-to-energy, bio-energy) generate additional revenues.</p> <p>Energy services developed. Developing innovative energy schemes allow us to cover refurbishment intervention costs without additional expenses for tenants or owners.</p> <p>Innovation in technology development and adoption. Companies involved in the project will be frontrunners in the adoption of innovative solutions and therefore have an advantage over their competitors on the market.</p> <p>Professional skills development. An increase in knowledge and know-how of professionals and practitioner on innovative processes and energy technologies augment productivity and competitiveness.</p>
<p>Smart build environment</p> 	<p>Property value increased. Green (new and retrofitted) buildings with attractive features and high energy performance have a property value premium exceeding the expected economic value of energy saving.</p> <p>Costs reduction of buildings life cycle. Large scale interventions which introduce efficient technologies, lower construction costs (allowing economy of scale) and reduce maintenance, repair and operation costs.</p> <p>Resilience of energy infrastructures increased. Better response to loads peaks (the ability to prevent and react to them) and to adverse climatic events increases efficiency and safety in energy systems, reducing interruptions and blackouts.</p>
<p>Smart mobility & connectivity</p> 	

ANNEX 2 – QUESTIONNAIRE M24 - FACSIMILE



WP2 – Task 2.4

Survey 1 – Questionnaire on co-benefits

Co-benefits assessment												
<p>Considering the SINFONIA project:</p> <ol style="list-style-type: none"> at the end of the project, what could be the relevance on your city of each of following co-benefits, ranging from 1 (not relevant) to 5 (very relevant)? how would you rate the likelihood of occurrence on your city of each of the following co-benefits, ranging from R (remote) to L (likely)? what do you think are most important co-benefits delivered to your city? Please give a ranking of at least five. 												
Smart city components	Co-benefits of SINFONIA project	Relevance Please check the boxes 1 = not relevant 2 = slightly 3= moderately relevant 4 = relevant 5 = very relevant					Likelihood Please check the boxes R = Remote U = Unlikely P = Possible L = Likely					Ranking Please give a position from 1 st to 10 th
Smart natural environment	Local air quality improved	1	2	3	4	5	R	U	P	L		
	Environmental resources management improved	1	2	3	4	5	R	U	P	L		
Smart services	Health and well-being of residents increased	1	2	3	4	5	R	U	P	L		
Smart community	Fuel poverty tackled	1	2	3	4	5	R	U	P	L		
	Users awareness on energy-related issues increased	1	2	3	4	5	R	U	P	L		
	Neighbourhood identity enhanced	1	2	3	4	5	R	U	P	L		



SINFONIA stands for "Smart Initiative of cities Fully cOmitted to iNvest In Advanced large-scaled energy". This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement No 609019

WP2 – Task 2.4: Integration of socio-economic aspects.
Questionnaire on co-benefits for key stakeholders

Smart city components	Co-benefits of SINFONIA project	Relevance Please check the boxes 1 = not relevant 2 = slightly relevant 3= moderately relevant 4 = relevant 5 = very relevant					Likelihood Please check the boxes R = Remote U = Unlikely P = Possible L = Likely					Ranking Please give a position from 1 st to 10 th
Smart governance	Innovation in processes and decision-making	1	2	3	4	5	R	U	P	L		
	Territorial attractiveness increased	1	2	3	4	5	R	U	P	L		
	Institutional relationship and networks created	1	2	3	4	5	R	U	P	L		
Smart economy	Positive changes in local tax revenue	1	2	3	4	5	R	U	P	L		
	Softer loan conditions	1	2	3	4	5	R	U	P	L		
	Local labour market stimulated	1	2	3	4	5	R	U	P	L		
	Local energy supply chain established	1	2	3	4	5	R	U	P	L		
	Energy services developed	1	2	3	4	5	R	U	P	L		
Smart build environment	Innovation in technology development and adoption	1	2	3	4	5	R	U	P	L		
	Professional skills development	1	2	3	4	5	R	U	P	L		
	Property value increased	1	2	3	4	5	R	U	P	L		
Smart mobility & connectivity	Costs reduction of buildings life cycle	1	2	3	4	5	R	U	P	L		
	Resilience of energy infrastructures increased	1	2	3	4	5	R	U	P	L		
Smart mobility & connectivity	Any suggestions?	1	2	3	4	5	R	U	P	L		

SINFONIA stands for "Smart Initiative of cities Fully cOmitted to iNvest In Advanced large-scaled energy". This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement No 609019



WP2 – Task 2.4: Integration of socio-economic aspects.
Questionnaire on co-benefits for key stakeholders

Co-benefits review												
Considering the SINFONIA project:												
> can you imagine other co-benefits delivered by the project , other than those above mentioned? Please describe them and indicate the relevance from 1 (not relevant) to 5 (very relevant) and rate the likelihood of occurrence.												
Considering the SINFONIA project:												
> would you like to move any co-benefits from a "smart city component" to another?												
Personal data												
Your affiliation Please check the box	Research	Consulting	Utility	Municipality	Social Housing	Other		Your city Please check the box	Bozano	Innsbruck	Early adopter city	Other

The data collected will be treated with strict confidentiality and processed and published only in aggregated form, in accordance with the Legislative Decree no. 196/2003 (Italian legislation).

Thank you for your kind cooperation



SINFONIA stands for "Smart Initiative of cities Fully cOmitted to iNvest In Advanced large-scaled energy". This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement No 609019



ANNEX 3 – WCM PARTICIPANTS LIST

Partner Number	Partner Name	Number of Attendees	Name of Attendees
1	SP	4	Håkan Perslow
			Inger-Lise Svensson
			Kaisa Svennberg
			Jenny Lööf
2	MAGIBK	1	Petra Mautner
3	IKB	2	Marco Casotti
			Simon Grutsch
	USI	1	Daniel Münch
	e3	1	Jürgen Neubarth
	ATB	2	Gernot Becker
Karin Treschnitzer			
4	NHT	1	Gerda Maria Embacher
5	UIBK	3	Wolfgang Streicher
			Tatjana Boczy
	Alois Ilmer		
ALPS	1	Dennis Fricken	
6	TZS	2	Klaus Klewein
			Barbara Wille
7	BOZ	3	Emanuele Sascor



SINFONIA; "Smart Initiative of cities Fully cOmitted to iNvest In Advanced large-scaled energy solutions" has received funding from the European Union's Seventh Programme for research, technological development and demonstration.

COLLABORATIVE PROJECT; GRANT AGREEMENT NO
609019

WORK PACKAGE:
VERSION:
DATE:

2
0.4
XX.04.2020

			Rosita Izzo
			Gianluca Baldisserri
	IDM	2	Virgilio Garavaglia
			Davide Gigli
8	EURAC	4	Daniele Vettorato
			Alyona Zubaryeva
			Adriano Bisello
			Jessica Balest
9	IPES	2	Gianfranco Minotti
			Barbara Andergassen
10	ALPERIA	2	Karen Stocker
			Alessandro Mazzocato
11	CASACLIMA	1	Martina Demattio
12	BORAS STAD	1	Susanne Arneborg
14	EMASESA	1	Joaquin Buendia
15	PAFOS	1	Andri Christodoulidou Tsartsali
16	GIE	1	Guillaume Corradino
	ATLANTIS	1	Elias Eliades
	MH	1	Michael Heidenreich
17	ZABALA	2	Javier González
			Artiza Elosequi
18	TECHNOFI	1	Karine Laffont
26	CSTB	1	Vincent Partenay
20	PHI	1	Harald Konrad Malzer
21	ROSE	1	Constanze Müller
22	ALFA LAVAL	1	Mårten Ahlm
25	IIG	1	Elisabeeth Meze

WCM moderators are in red



ANNEX 3 – CO-BENEFITS RANKING BY WCM GROUPS
TABLE 1 RANKING OF CO-BENEFITS BY WORLD CAFE' PARTICIPANTS

	GROUP A (6)	GROUP B (6)	GROUP C (6)	GROUP D (7)	GROUP E (7)	GROUP F (6)
Health and well-being of residents increased	1	1	1	1	1	
Innovation in processes and decision-making	3		2	2		
Resilience of energy infrastructures	2					2
Users awareness on energy-related issues increased					2	3
Institutional relationship and networks created			3	2	3	4
Professional skills development		3		3		
Innovation in technology development and adoption	4		2			
Local energy supply chain established		4				2
Fuel poverty tackled				4		
Local labor market stimulated	5	2	4		4	
Territorial attractiveness increased			5	5		
Local air quality improved					5	
Energy services developed		5				
Costs reduction of buildings life cycle						5
Degree of satisfaction of end-users*				1		
Transforming innovation in mainstream life*						1

Ranks from 1 (highest) to 5 (lowest) given by each group (posters). * New, made-up co-benefit

TABLE 2 MOST CITED CO-BENEFITS

	How many groups cited it	Ranking mean**
Health and well-being of residents increased	5	1
Innovation in processes and decision-making	3	2
Resilience of energy infrastructures	2	2
Users awareness on energy-related issues increased	2	2.5
Institutional relationship and networks created	4	3
Professional skills development	2	3
Innovation in technology development and adoption	2	3
Local energy supply chain established	2	3
Fuel poverty tackled	1	4
Local labor market stimulated	4	4
Territorial attractiveness increased	2	5
Local air quality improved	1	5



COLLABORATIVE PROJECT; GRANT AGREEMENT NO
609019

WORK PACKAGE:
VERSION:
DATE:

2
0.4
XX.04.2020

Energy services developed	1	5
Costs reduction of buildings life cycle	1	5
Degree of satisfaction of end-users*	1	
Transforming innovation in mainstream life*	1	

* New, made-up co-benefit

** Except new, made-up co-benefit



ANNEX 4 – CHOICE EXPERIMENT SURVEY - TOTEM

EURAC research

Questionario sui "TOTEM"

Il presente questionario è stato ideato dall'Istituto per le Energie rinnovabili di Eurac (Bolzano), non ha carattere commerciale o pubblicitario, ma una finalità esclusivamente scientifica. Il questionario è anonimo e i dati dei fornitori saranno trattati esclusivamente in forma aggregata. Desideriamo informarLa che l'intervista rispetterà e garantirà tutti i Suoi diritti in termini di privacy e riservatezza, secondo quanto previsto dal Decreto Legislativo 196/03.

Domande introduttive

1) Lei si trova a Bolzano in quanto:

Residente	Non residente, ma pendolare quotidiano	Non residente, ma frequentatore occasionale	Altro
-----------	--	---	-------

2) Motivo principale per il quale è a Bolzano (ovvero per il quale è uscito di casa oggi e per cui è qui ora):

Lavoro	Studio	Shopping	Svago	Turismo	Altro
--------	--------	----------	-------	---------	-------

3) Qual è il mezzo di trasporto che usa più frequentemente per i suoi spostamenti all'interno della città di Bolzano?

Vettura privata	Trasporti pubblici	Bicicletta	Va a piedi	Altro
-----------------	--------------------	------------	------------	-------

Domande attitudinali

4) Si ritiene aggiornato sulle tecnologie informatiche (internet, smartphone, tablet)?

Estremamente	Molto	Mediamente	Scarsamente	Per niente
--------------	-------	------------	-------------	------------

5) Fa uso di internet ed altre tecnologie informatiche per ottenere le informazioni che Le interessano?

Estremamente	Molto	Mediamente	Scarsamente	Per niente
--------------	-------	------------	-------------	------------

6) Preferisce la televisione a internet per documentarsi su quello che avviene nella città di Bolzano?

Estremamente	Molto	Mediamente	Scarsamente	Per niente	Nessuna di queste
--------------	-------	------------	-------------	------------	-------------------

7) Preferisce la carta stampata alla televisione per documentarsi su quello che avviene nella città di Bolzano?

Estremamente	Molto	Mediamente	Scarsamente	Per niente	Nessuna di queste
--------------	-------	------------	-------------	------------	-------------------

8) Secondo Lei le amministrazioni pubbliche dovrebbero facilitare l'accesso dei cittadini alle nuove tecnologie informatiche?

Estremamente	Molto	Mediamente	Scarsamente	Per niente
--------------	-------	------------	-------------	------------

9) I progetti denominati "smart city" ovvero "città intelligente" cercano di migliorare la qualità di vita dei cittadini anche utilizzando nuovi dispositivi e tecnologie. Ad esempio per lo scambio di informazioni in tempo reale su servizi, traffico, meteo e qualità dell'aria. Ritiene che questo sia un modo efficace di aiutare i cittadini a vivere meglio?

Estremamente efficace	Molto efficace	Mediamente efficace	Scarsamente efficace	Per niente efficace
-----------------------	----------------	---------------------	----------------------	---------------------

Domande sulle situazioni di scelta

Il comune di Bolzano vorrebbe collocare in alcuni punti strategici della città delle installazioni chiamate "TOTEM", che potrebbero offrire alcuni servizi, tra cui:

- Chiamate "SOS" in caso di emergenza o pericolo;
- Possibilità di accesso rapido ad internet tramite connessione Wi-Fi;
- Erogazione di acqua potabile;
- Alimentazione elettrica, per ricaricare smart-phone, tablet, bici e auto elettriche;
- Informazioni su traffico e mobilità (trasporti pubblici, disponibilità di parcheggi e di spazi per la ricarica dei veicoli elettrici);
- Informazioni ai cittadini e turisti su situazione meteorologica e ambientale (qualità dell'aria), eventi culturali e sociali, interazione con Ufficio Relazioni con Pubblico del Comune (U.R.P.).

10) Ha mai utilizzato o visto delle simili installazioni in altre città?

SI, li ho visti in altre città e li ho utilizzati	SI, li ho visti in altre città ma non li ho utilizzati	NO, non li ho mai visti, però ne ho sentito parlare	NO, non li ho mai visti, e non ne ho mai sentito parlare
---	--	---	--

Se ha risposto NO e vuole vedere un esempio di un TOTEM di un'altra città vada all'ultima pagina del questionario

Istruzioni per la compilazione delle schede

Immagini ora di partecipare ad un referendum per decidere sulle diverse combinazioni dei servizi che potrebbero essere offerti. Le presentiamo nelle pagine seguenti 8 IPOTETICI REFERENDUM.

In ogni referendum ci sono 3 alternative di scelta:

- ALTERNATIVA "A": realizzare i TOTEM con alcuni servizi e un determinato contributo mensile degli utenti;
- ALTERNATIVA "B": realizzare i TOTEM con altri servizi e un altro contributo mensile degli utenti;
- ALTERNATIVA "C": non realizzare i TOTEM.

Per ogni ipotetico referendum **esamini le 3 alternative ("A", "B" e "C")** e indichi con una "X":

- ALTERNATIVA MIGLIORE tra le 3;
- ALTERNATIVA PEGGIORE tra le 2 rimanenti.

Il suo contributo in questa ricerca è particolarmente importante per comprendere al meglio le esigenze dei possibili utilizzatori dei TOTEM e progettari nella maniera più idonea, le chiediamo quindi di essere accurato nelle risposte.

REFERENDUM 1

SERVIZI	ALTERNATIVA "A"	ALTERNATIVA "B"	ALTERNATIVA "C"
SOS	NO	SI	NO
ACQUA POTABILE	SI	NO	NO
WI-FI	SI	NO	NO
RICARICA ELETTRICA	NO	• TABLET e SMART-PHONE	NO
INFORMAZIONI	NO	• METEO e AMBIENTALI	NO
INFORMAZIONI SULLA MOBILITA'	• PARCHEGGI LIBERI • STAZIONI DI RICARICA LIBERE • TRAFFICO E TRASPORTI	• PARCHEGGI LIBERI • STAZIONI DI RICARICA LIBERE	NO
CONTRIBUTO MENSILE	2,00 €	1,50 €	0 €

ALTERNATIVA MIGLIORE
 ALTERNATIVA PEGGIORE

REFERENDUM 2

SERVIZI	ALTERNATIVA "A"	ALTERNATIVA "B"	ALTERNATIVA "C"
SOS	SI	NO	NO
ACQUA POTABILE	SI	NO	NO
WI-FI	NO	SI	NO
RICARICA ELETTRICA	• TABLET e SMART-PHONE • BICI ELETTRICHE	• TABLET e SMART-PHONE • BICI ELETTRICHE • AUTO ELETTRICHE	NO
INFORMAZIONI	• METEO e AMBIENTALI • TURISTICHE e CULTURALI	• METEO e AMBIENTALI • TURISTICHE e CULTURALI • ACCESSO U.R.P. COMUNALE	NO
INFORMAZIONI SULLA MOBILITA'	• PARCHEGGI LIBERI	NO	NO
CONTRIBUTO MENSILE	1,00 €	0,50 €	0 €

ALTERNATIVA MIGLIORE
 ALTERNATIVA PEGGIORE

REFERENDUM 3

SERVIZI	ALTERNATIVA "A"	ALTERNATIVA "B"	ALTERNATIVA "C"
SOS	NO	SI	NO
ACQUA POTABILE	SI	NO	NO
WI-FI	NO	SI	NO
RICARICA ELETTRICA	• TABLET e SMART-PHONE	NO	NO
INFORMAZIONI	• METEO e AMBIENTALI • TURISTICHE e CULTURALI • ACCESSO U.R.P. COMUNALE	• METEO e AMBIENTALI	NO
INFORMAZIONI SULLA MOBILITA'	• PARCHEGGI LIBERI • STAZIONI DI RICARICA LIBERE • TRAFFICO E TRASPORTI	NO	NO
CONTRIBUTO MENSILE	2,50 €	3,00 €	0 €

ALTERNATIVA MIGLIORE
 ALTERNATIVA PEGGIORE

REFERENDUM 4

SERVIZI	ALTERNATIVA "A"	ALTERNATIVA "B"	ALTERNATIVA "C"
SOS	SI	NO	NO
ACQUA POTABILE	NO	SI	NO
WI-FI	NO	SI	NO
RICARICA ELETTRICA	• TABLET e SMART-PHONE • BICI ELETTRICHE • AUTO ELETTRICHE	• TABLET e SMART-PHONE • BICI ELETTRICHE	NO
INFORMAZIONI	• METEO e AMBIENTALI • TURISTICHE e CULTURALI	NO	NO
INFORMAZIONI SULLA MOBILITA'	• PARCHEGGI LIBERI • STAZIONI DI RICARICA LIBERE	• PARCHEGGI LIBERI	NO
CONTRIBUTO MENSILE	2,50 €	3,00 €	0 €

ALTERNATIVA MIGLIORE
 ALTERNATIVA PEGGIORE



REFERENDUM 5

SERVIZI	ALTERNATIVA "A"	ALTERNATIVA "B"	ALTERNATIVA "C"
SOS	NO	SI	NO
ACQUA POTABILE	SI	NO	NO
WI-FI	SI	NO	NO
RICARICA ELETTRICA	• TABLET e SMART-PHONE • BICI ELETTRICHE • AUTO ELETTRICHE	• TABLET e SMART-PHONE • BICI ELETTRICHE	NO
INFORMAZIONI	• METEO e AMBIENTALI	NO	NO
INFORMAZIONI SULLA MOBILITA'	• PARCHEGGI LIBERI • STAZIONI DI RICARICA LIBERE	• PARCHEGGI LIBERI • STAZIONI DI RICARICA LIBERE • TRAFFICO E TRASPORTI	NO
CONTRIBUTO MENSILE	0,50 €	1,00 €	0 €

ALTERNATIVA MIGLIORE
 ALTERNATIVA PEGGIORE

REFERENDUM 6

SERVIZI	ALTERNATIVA "A"	ALTERNATIVA "B"	ALTERNATIVA "C"
SOS	NO	SI	NO
ACQUA POTABILE	SI	NO	NO
WI-FI	NO	SI	NO
RICARICA ELETTRICA	• TABLET e SMART-PHONE	NO	NO
INFORMAZIONI	• METEO e AMBIENTALI • TURISTICHE e CULTURALI	• METEO e AMBIENTALI • TURISTICHE e CULTURALI • ACCESSO U.R.P. COMUNALE	NO
INFORMAZIONI SULLA MOBILITA'	NO	• PARCHEGGI LIBERI	NO
CONTRIBUTO MENSILE	1,50 €	2,00 €	0 €

ALTERNATIVA MIGLIORE
 ALTERNATIVA PEGGIORE

REFERENDUM 7

SERVIZI	ALTERNATIVA "A"	ALTERNATIVA "B"	ALTERNATIVA "C"
SOS	SI	NO	NO
ACQUA POTABILE	SI	NO	NO
WI-FI	SI	NO	NO
RICARICA ELETTRICA	• TABLET e SMART-PHONE	• TABLET e SMART-PHONE • BICI ELETTRICHE • AUTO ELETTRICHE	NO
INFORMAZIONI	• METEO e AMBIENTALI	• METEO e AMBIENTALI • TURISTICHE e CULTURALI	NO
INFORMAZIONI SULLA MOBILITA'	• PARCHEGGI LIBERI	• PARCHEGGI LIBERI • STAZIONI DI RICARICA LIBERE • TRAFFICO E TRASPORTI	NO
CONTRIBUTO MENSILE	2,50 €	1,00 €	0 €

ALTERNATIVA MIGLIORE
 ALTERNATIVA PEGGIORE

REFERENDUM 8

SERVIZI	ALTERNATIVA "A"	ALTERNATIVA "B"	ALTERNATIVA "C"
SOS	NO	SI	NO
ACQUA POTABILE	NO	SI	NO
WI-FI	SI	NO	NO
RICARICA ELETTRICA	• TABLET e SMART-PHONE • BICI ELETTRICHE	NO	NO
INFORMAZIONI	NO	• METEO e AMBIENTALI • TURISTICHE e CULTURALI • ACCESSO U.R.P. COMUNALE	NO
INFORMAZIONI SULLA MOBILITA'	• PARCHEGGI LIBERI • STAZIONI DI RICARICA LIBERE	NO	NO
CONTRIBUTO MENSILE	0,50 €	1,50 €	0 €

ALTERNATIVA MIGLIORE
 ALTERNATIVA PEGGIORE

SOLO SE HA RISPOSTO SEMPRE ALTERNATIVA "C" - MIGLIORE

11) Potrebbe indicare il motivo per cui ha scelto di non contribuire a questo progetto? (una sola risposta)

Non ritengo che questa spesa debba essere sostenuta dai cittadini
 Non posso permettermi una tale spesa in questo momento
 Non sono interessato ad una simile iniziativa
 Non ritengo di avere bisogno di tali servizi in futuro
 Non ritengo realistico un simile scenario
 Non mi sembra una buona soluzione per Bolzano
 Le tariffe per i servizi urbani sono già abbastanza elevate
 Credo che ci siano altre priorità
 Altro _____

Per concludere un paio di domande su di Lei

12) Genere:

Maschio Femmina

13) Fascia di età

18-24 25-34 35-44 45-54 55-64 Più di 65

14) Formazione:

Elementare Media Superiore Laurea Post-lauream

15) Occupazione:

Full-time Part-time Autonomo/a Studente Casalingo/a Pensionato/a Disoccupato/a

16) Numero di componenti del nucleo familiare:

1 2 3 4 Più di 4

17) Reddito personale netto medio mensile:

Non ho reddito 0€ - 1.000€ 1.001€ - 2.000€ 2.001€ - 3.000€ Oltre 3.000€

18) Secondo Lei quale è la probabilità che i risultati dell'indagine siano effettivamente utilizzati nella realizzazione del Totem?

Molto alta Alta Media Bassa Molto bassa

La ringraziamo per la sua cortese collaborazione!



ANNEX 5 – QUESTIONNAIRE M67 - FACSIMILE



WP 2.4 – Survey on the co-benefits of SINFONIA

Considering your personal experience in the SINFONIA project:

1. what is the **relevance** of each of the following co-benefits, ranging from 1 (not relevant) to 5 (very relevant) in making your city¹ both sustainable and better places to live?
2. what is the **probability** of occurrence on your city² of each of the following co-benefits, ranging from 1 (no chance, even in the future) to 5 (already happened)?
3. what do you think are **the 5 most important co-benefits delivered or going to be delivered in the near future by the project (the ones that should be stressed in the communication of project results)?** Please identify them and give a rank of the first 5.

Smart city components	Co-benefits of SINFONIA project	Relevance	Probability	Importance
 Smart natural environment	Local air quality improved	Choose an item.	Choose an item.	Not among the top 5 co-benefits
	Environmental resources management improved	Choose an item.	Choose an item.	Not among the top 5 co-benefits
 Smart build environment	Property value increased	Choose an item.	Choose an item.	Not among the top 5 co-benefits
	Costs reduction of the buildings life cycle	Choose an item.	Choose an item.	Not among the top 5 co-benefits
	Resilience of energy infrastructures increased	Choose an item.	Choose an item.	Not among the top 5 co-benefits
 Smart services	Health and well-being of residents increased	Choose an item.	Choose an item.	Not among the top 5 co-benefits
 Smart community	Fuel poverty tackled	Choose an item.	Choose an item.	Not among the top 5 co-benefits
	Users awareness on energy-related issues increased	Choose an item.	Choose an item.	Not among the top 5 co-benefits
	Neighbourhood identity enhanced	Choose an item.	Choose an item.	Not among the top 5 co-benefits

Continues on the next page ->

¹ If you are not related to a specific city, please consider the two lighthouse cities.

² If you are not related to a specific city, please consider the two lighthouse cities.

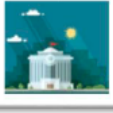



SINFONIA stands for "Smart Initiative of cities Fully cOmitted to iNvest In Advanced large-scaled energy". This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement No 609019



SINFONIA; "Smart INITiative of cities Fully cOmitted to iNvest In Advanced large-scaled energy solutions" has received funding from the European Union's Seventh Programme for research, technological development and demonstration.

WP2 – Task 2.4: Integration of socio-economic aspects.
Questionnaire on co-benefits for key stakeholders

Smart city components	Co-benefits of SINFONIA project	Relevance 1 = not relevant 2 = slightly relevant 3 = moderately relevant 4 = relevant 5 = very relevant	Probability 1 = no chance 2 = remote in the future 3 = likely in the future 4 = happening now 5 = already happened	Importance The 5 most important co-benefits. Give a ranking from 1 st to 5 th position
Smart Governance 	Innovation in processes and decision-making	Choose an item.	Choose an item.	Not among the top 5 co-benefits
	Territorial attractiveness increased	Choose an item.	Choose an item.	Not among the top 5 co-benefits
	Institutional relationship and networks created	Choose an item.	Choose an item.	Not among the top 5 co-benefits
Smart Economy 	Positive changes in local tax revenue	Choose an item.	Choose an item.	Not among the top 5 co-benefits
	Softer loan conditions	Choose an item.	Choose an item.	Not among the top 5 co-benefits
	Local labour market stimulated	Choose an item.	Choose an item.	Not among the top 5 co-benefits
	Local energy supply chain established	Choose an item.	Choose an item.	Not among the top 5 co-benefits
	Energy services developed	Choose an item.	Choose an item.	Not among the top 5 co-benefits
	Innovation in technology development and adoption	Choose an item.	Choose an item.	Not among the top 5 co-benefits
	Professional skills development	Choose an item.	Choose an item.	Not among the top 5 co-benefits

Personal data

Your affiliation	Choose an item.
Your city	Choose an item.

Thank you so much for your kind cooperation!
Please save the file and send it back to adriano.bisello@eurac.edu.



COLLABORATIVE PROJECT; GRANT AGREEMENT NO
609019

WORK PACKAGE:
VERSION:
DATE:

2
0.4
XX.04.2020

ANNEX 6 – DOCUMENT INFORMATION

SINFONIA DELIVERABLE FACT SHEET	
PROJECT START DATE	1 st June 2014
PROJECT DURATION	72 months
PROJECT WEBSITE	http://www.sinfonia-smartcities.eu
DOCUMENT	
DELIVERABLE NUMBER:	D 2.4
DELIVERABLE TITLE:	Integration of socio-economic aspects and analysis of sustainability
DUE DATE OF DELIVERABLE:	M68
ACTUAL SUBMISSION DATE:	M71
EDITORS:	Adriano Bisello, Alyona Zubaryeva
AUTHORS:	Adriano Bisello, Jessica Balest, Gianluca Grilli, Silvia Tomasi, Raffaele Attardi, Alyona Zubaryeva, Daniele Vettorato (EURAC), Tatjana Boczy (UIBK), Rosita Izzo, Gianluca Baldisserri, Francesco Barducci (BOZ), Maren Mayer, Ulrich Klammsteiner (ACC)
REVIEWERS:	Håkan Perslow
PARTICIPATING BENEFICIARIES:	EURAC, UIBK, ACC
WORK PACKAGE NO.:	2
WORK PACKAGE TITLE:	Design and specifications of scalable/replicable refurbished district templates
WORK PACKAGE LEADER:	EURAC
WORK PACKAGE PARTICIPANTS:	SP, MAGIBK, IKB, NHT, UIBK, SAT, BOZ, EURAC, IPES, SEL, ACC, BORAS, LARO, SEV, PAFOS, GIE, PHI, ROSE, ALF, LIE
DISSEMINATION LEVEL:	
CO (CONFIDENTIAL, ONLY FOR MEMBERS OF THE CONSORTIUM INCLUDING THE COMMISSION SERVICES)	
PU (PUBLIC)	X
PP (RESTRICTED TO OTHER PROGRAMME PARTICIPANTS, (INCLUDING THE COMMISSION SERVICES))	



COLLABORATIVE PROJECT; GRANT AGREEMENT NO
609019

WORK PACKAGE:
VERSION:
DATE:

2
0.4
XX.04.2020

RE (RESTRICTED TO A GROUP SPECIFIED BY THE CONSORTIUM INCLUDING THE COMMISSION SERVICES)	
DRAFT/FINAL:	FINAL
NO OF PAGES (INCLUDING COVER):	92
KEYWORDS:	Co-benefits, smart Cities

