REPLICATE	**Project no. 691735** **REPLICATE PROJECT** **Renaissance of Places with Innovative Citizenship And Technology**	This Project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement N° 691735

REPLICATE PROJECT

REnaissance of PLaces with Innovative Citizenship And Technology

Project no. 691735

H2020-SCC-2015 Smart Cities and Communities

Innovation Action (IA)

D9.4 Business opportunities report validation

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1. EXECUTIVE SUMMARY

The main purpose of this document is to assess and validate twenty interventions deployed in the REPLICATE project in the areas of energy efficiency, mobility and ICT infrastructures in the lighthouse cities of San Sebastian – Spain, Florence – Italy, and Bristol – UK.

REPLICATE interventions are assessed from a business analysis methodology point of view, throughout a comprehensive set of tools based on Canvas methodologies. The objective of this methodology is to analyze how companies, cities and organizations create, deliver and capture value for their customers in each intervention. Concretely, authors use the Business Model Canvas (BMC) as a principal tool to analyze companies' business models, as well as different variations of it depending on the ownership of the action. To this end, variations of the BMC such as the City Model Canvas (CMC), the Mission Model Canvas (MMC) or the Organization Model Canvas (OMC) are applied to councils' services and organizations. Furthermore, authors apply other tools such as the Value Proposition Canvas (VPC) and Strategy Canvas to complement the analysis (see section 5.2 for further information about the methodology proposal).

Business analyses consider different types of content regarding the creation, delivery and production of value. They analyze value propositions, customers/beneficiaries, channels, relations, stakeholders, activities, resources, costs/revenues streams and environmental and social impacts. To this end, interventions are assessed from a holistic point of view, through a co-productive approach involving citizens' needs and desires, and the cities' stakeholders – public and private agents – and the impact they have in customers and beneficiaries, as well as cities themselves, in economic, environmental and social aspects.

One of the cornerstones of the analysis is the public-private collaboration: innovative private companies and research institutions are essential for the development and integration of the smart city services, while public administrations at all territorial levels must ensure a maintained support and political buy-in for these projects to guarantee their financial sustainability and future consolidation. Furthermore, the analysis focuses on these partnerships as a way of setting standards in terms of the business models needed to deploy this type of interventions where several and diverse agents are involved.

Besides, these projects are pioneers regarding their replicability and scalability in the smart city services industry, thanks to the business models deployed by the companies and

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institutions involved, as well as for all the know-how acquired through the process of developing and integrating such innovative technologies. Due to the high degree of innovation of these interventions, there is still room for improvement in regard to the processes and methodologies deployed. In this document, the authors propose some key ideas in the form of lessons learnt in order to improve the performance of future replication of these types of interventions. In addition, all interventions are assessed with a focus on their replicability and scalability, as these projects will serve as a baseline reference for their development in other territories.

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2. REPLICATE

The main objective of REPLICATE project is the development and validation in three lighthouse cities (San Sebastián – Spain, Florence – Italy and Bristol – UK) of a comprehensive and sustainable City Business Model to enhance the transition process to a smart city in the areas of the energy efficiency, sustainable mobility and ICT/Infrastructure. This will accelerate the deployment of innovative technologies, organizational and economic solutions to significantly increase resource and energy efficiency improve the sustainability of urban transport and drastically reduce greenhouse gas emissions in urban areas.

REPLICATE project aims to increase the quality of life for citizens across Europe by demonstrating the impact of innovative technologies used to co-create smart city services with citizens and prove the optimal process for replicating successes within cities and across cities.

The Business Models that are being tested through large scale demonstrators at the three cities are approached with an integrated planning through a co-productive vision, involving citizens and cities' stakeholders, providing integrated viable solutions to existing challenges in urban areas and to procure sustainable services. Sustainability of the solutions is fostered in three areas: economic and environmental and finally, fostering transparency in the public management.

In addition, the Model features the replicability of the solutions and their scale up in the entire city and in follower cities, particularly in three follower cities (Essen – Germany, Laussane – Switzerland and Nilüfer-Turkey) that are involved in the project and therefore, have access to know-how and results achieved on the project so they can apply the developed model. At the moment, there are 2 observer cities, Guanzhou (China) and Bogota (Colombia).

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3. INTRODUCTION

3.1 Relation to Other Project Documents

This deliverable presents a business analysis from cities, organizations and industrial partners point of view in order to scale-up and replicate project interventions. The deliverable is related to deliverables D9.2 (Methodology review and methodological framework definition) and D9.3 (Sectorial business analysis / Exploitation potential in the field of energy, ICT, sustainable mobility and other remaining sectors included in REPLICATE).
The methodology used to develop the analysis is based on the business model introduced in the deliverable D9.2 and further explained in this deliverable, section 3 (Deliverable description), subsection 3.2 (Methodology). Authors have made an adaptation of the business model canvas used for industrial partners to analyse also city councils and organizations.
The main conclusions of the business opportunities report validation, which are presented at the end of this deliverable, focus on key aspects to scale-up and replicate project interventions.

3.2 Reference documents

This document is based on the following project level documents:

Table 1: Reference documents

Ref.	Title	Description
REPLICATE Grant Agreement signed 240713.pdf	Grant Agreement	Grant Agreement no. 691735
DoA REPLICATE (691735)	REPLICATE Annex 1 - DoA to the GA	Description of the Action
REPLICATE Consortium Agreement signed December 2015 (7th December version)	Consortium Agreement	REPLICATE project - Consortium Agreement
REPLICATE Strategic Planning and Business Models	D2.2 Report on the Business Models of Lighthouse Cities* D2.4 Report on replication potential of City Business Models	* Description of the City Model Canvas (CMC) ** Replication strategies for lighthouse cities
REPLICATE San Sebastian Pilot	WP3 Reports of the implementations for the pilot (D3.3; D3.8; D3.9; D3.10; D3.11)	Partners deliverables on implementations

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Ref.	Title	Description
REPLICATE Florence Pilot	WP4 Report of the implementations for the pilot (D4.5)	Partners deliverables on implementations
REPLICATE Bristol Pilot	WP5 Reports of the implementations for the pilot (D5.2; D5.5; D5.6; D5.7)	Partners deliverables on implementations
REPLICATE Cross Cutting Activities Analysis and Scale-up Study	D7.3, 7.4 & D7.5 Reports on management models	Description and analysis of intervention in the three Lighthouse Cities
REPLICATE Business Models	D9.2 Methodology review and methodological framework definition	Presentation of the holistic framework developed for analysing business models in smart cities
REPLICATE Business Models	D9.3 Sectorial business analysis	Description and analysis of business environment, market, competition and value chain

3.3 Abbreviations list

Table 2: Abbreviations list

Abbreviation	Full name
BMC	Business Model Canvas
CA	Consortium Agreement
Capex costs	Expenditures in fix assets
CMC	City Model Canvas
DH	District Heating
DoA	Annex I-Description of the Action
EC	European Commission
ESCO	Energy Service Company
EV	Electrical Vehicle
EU	European Union

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Abbreviation	Full name
GA	Grant Agreement
ICT	Information and Communication Technologies
IoT	Internet of Things
H2020	Horizon 2020
LED	Light emitting diode
MMC	Mission Model Canvas
NGO	Non-governmental organization
nZEBs	nearly Zero Energy Buildings
Opex cost	Operating and maintenance expenses
PC	Project Coordinator
PL	Pilot Leader
PMP	Project Management Plan
ROI	Return on Investment
SECAP	Sustainable Energy and Climate Action Plan
SMEs	Small medium-sized enterprises
TBA	Temporary Business Association
TC	Technical Coordinator
WP	Work Package
WPL	Work Package Leader

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4. DELIVERABLE DESCRIPTION

This deliverable is part of task 9.3 *Business opportunity validation,* from WP 9 *Exploitation of results – industrial business plans*.

The document divides into the following sections, each of which addresses the following aspects:

- Section 5: establishes the methodology used to analyse the viability of business models. As already introduced, the methodology is based on a comprehensive set of tools based on Canvas methodology. The objective of this section is to present the business tools to analyse how companies, cities and organizations create, deliver and capture value for their customers in each intervention.

- Section 6: analyses companies, city services and organizations in the field of energy efficiency. This section is divided in two groups of analysis. On one hand, there are the analysis for retrofitting interventions, and on the other the analysis of District Heating interventions. After the analysis of the business model for each organization, authors present a subsection of final remarks for each organization. Furthermore, each group of analysis present a discussion and a proposal of scale-up strategy.

- Section 7: analyses companies, city services and organizations in the field of mobility. After the analysis of the business model for each organization, authors present a subsection of final remarks for each organization.

- Section 8: analysis companies, city services and organization in the field of ICT. After the analysis of the business model for each organization, authors present a subsection of final remarks for each organization. Furthermore, each group of analysis present a discussion and a proposal of scale-up strategy.

- Section 9: identifies and explain main lesson learnt along the business model analysis.

- Section 10: identifies and compares impacts, innovation and scalability of interventions according to the business tools used to analyse business models in sections 6, 7 and 8. Authors have divided this section according to sectors.

- Section 11: presents main conclusions.

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5. METHODOLOGY

5.1 Introduction

One of the main objectives of REPLICATE project is to provide to cities, organizations and industrial partners a description of future business opportunities in order to ensure the replication of the deployed solutions in other places (districts or cities) and beyond the H2020 projects, which are co-financed by the European Commission.
WP9 (Exploitation of Results – Industrial Business Plans) has established a common logic for systematizing the analysis of partners' interventions to exploit results. The sequence of layers used by ESADE to carry out the study respond is presented in figure 1.

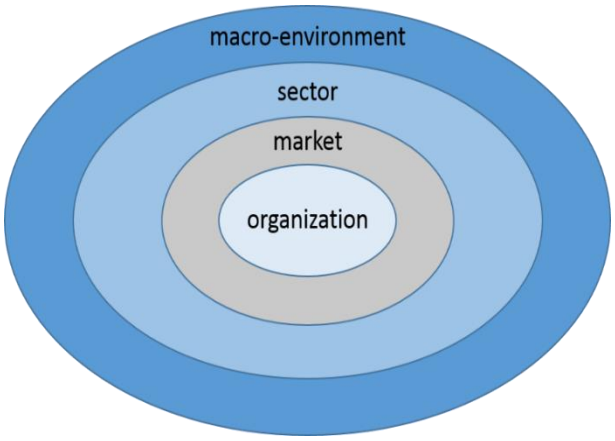

Figure 1.- Layers of business analysis (adapted from Johnson et al. 2016)

According to these layers, ESADE has used different business tools to analyse each organization. As depicted in figure 2, the macro-environment study was carried out with a PESTEL analysis, the competitiveness with Porter Five Forces, and the value chain with the Value Creation Ecosystem (VCE). The reader will be able to find these analyses in deliverable D9.3 (Sectorial business analysis). This deliverable presents the business analysis, which has been developed using different tools such as the Value Proposition Canvas (VPC), the Business Model Canvas (BMC), the City Model Canvas (CMC), the Mission Model Canvas (MMC) and the Strategy Canvas. Furthermore, some common interventions present a scale-up strategy.

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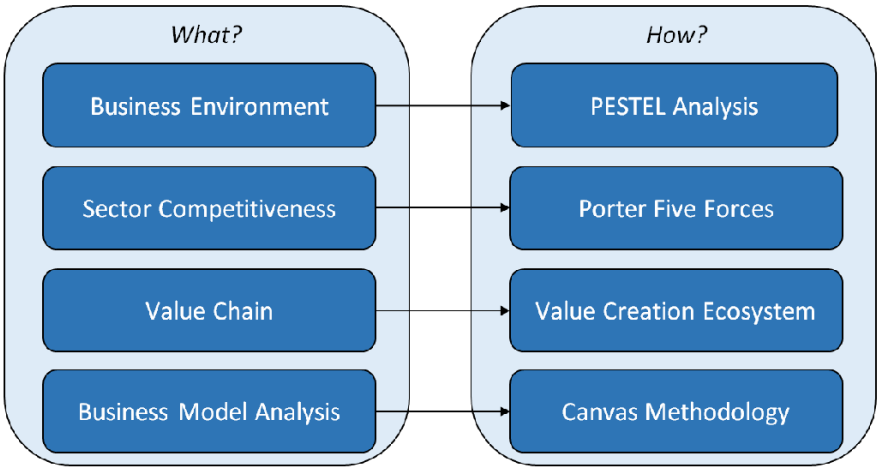

Figure 2.- Methodologies used to carried out the sectorial analysis

With the purpose of giving to the document a practical nature, and thus avoiding a theoretical reflection, ESADE analyzed the following organizations involved in different important interventions of the project:

- Giroa Veolia (San Sebastian – Energy Efficiency)
- Casa Spa (Florence – Energy Efficiency)
- Warm Up Bristol (Bristol – Energy Efficiency)
- Knowle West Media Cent (Bristol – Energy Efficiency)
- Fomento de San Sebastian (San Sebastian – Energy Efficiency)
- Ikusi (San Sebastian – Mobility)
- Bristol City Council (Bristol – Energy Efficiency & Mobility)
- Co-wheels (Bristol – Mobility)
- Esoterix (Bristol – Mobility)
- Sistelec (San Sebastian – ICT)
- Eurohelp (San Sebastian – ICT)
- Euskaltel (San Sebastian – ICT)
- Leycolan (San Sebastian – ICT)
- Silfi (Florence – ICT)
- Mathema (Florence – ICT)
- Thales (Florence – ICT)
- Telecom Italia (Florence – ICT)
- UNIFI (Florence – ICT)
- Enel-Distribuzione (Florence – ICT)

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Along the REPLICATE project, ESADE organized in-depth interviews and seminars with all these partners (see figure 3), which have validated the part of this report related to them.

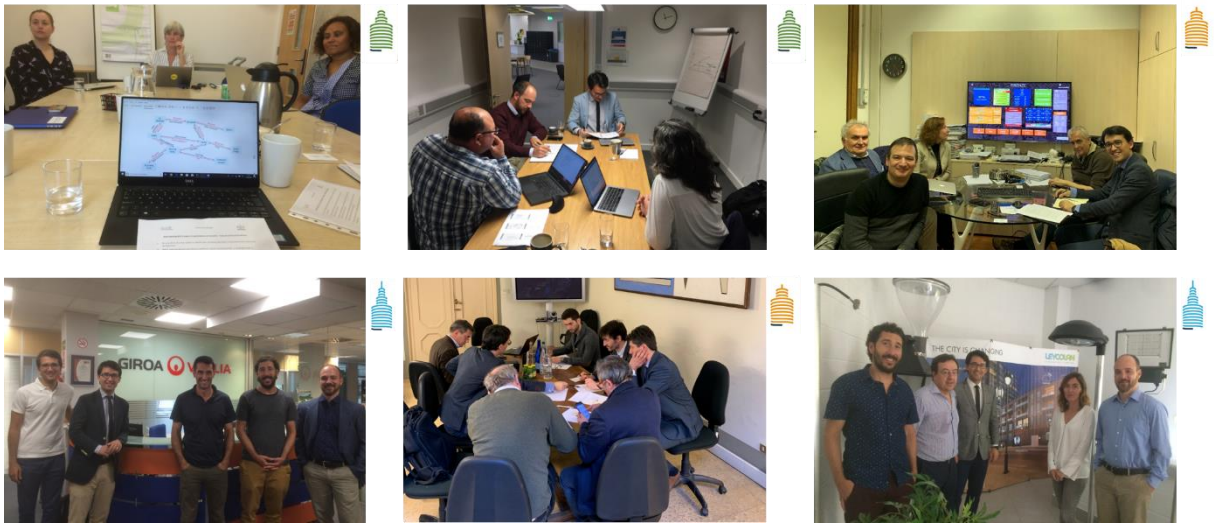

Figure 3.- Examples of seminars and interviews developed with all the organizations as an essential part of this deliverable

5.2 Business tools

In order to analyse the viability of intervention for future scale-up or replication strategies of products and services from REPLICATE interventions, this deliverable has continued the already mentioned common logic analysis (see figure 1) focusing on the organizations' business models.

The common framework for business models is based on the canvas methodology developed by Osterwalter et al. (2009). According to them, a business model is a rationality that explains how a company creates, delivers and captures value. Also, Magretta (2002) states that business models are for the manager the equivalent of the scientific method for researchers, declaring that both begin with a hypothesis that must be validated with a test, and that can be revised if necessary. In that sense, Seelos (2014) explains that the implementation of common frameworks helps in explaining what works and what does not work to create value in each specific business. To this end, ESADE has used the Business Model Canvas (BMC) framework from Osterwalter to analyse industrial partners, but also has adapted this framework to other organizations realities such as those from cities – using the City Model Canvas (CMC) – or those from non-profit organization – using the Mission Model Canvas (MMC). This adaptation of the theoretical framework, according to the organization's ownership and idiosyncrasy, implies different analysis, although these are based on a common framework.

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In order to ensure the quality of the deliverable, ESADE presented the analysis to project partners involved in the deliverable, which validated the results.

5.2.1. Value Proposition Canvas

The Value Proposition Canvas (VPC) is at the centre of each business model. It represents the value that an organization (city council, non-profit organization, private company) offers to customers. The VPC makes explicit how you are creating value for your customers. It helps organizations to design products and services that their customers are presumed to need and to be ready to buy (Osterwalder et al., 2014). The logic is based on a customer approach, who will validate your product or service, which at the end is what really matters about the success of an idea and what makes it viable and sustainable. To this end, the VPC of an intervention must be constructed to respond to customers' supposed needs. The VPC is a dynamic tool that has to be constantly reviewed and validated through hypothesis regarding customers.
As observed in figure 4, the VPC is based on two segments. The first segment (on the right side) corresponds to customers, and the second segment (on the left side) corresponds to the organization. The objective is to create a clear vision of the relation and interconnection between the market and the intervention (solution).
The first segment, the customers map (demand side), identifies three elements from the customers: jobs and tasks, pains, and gains. Customers' jobs are those activities related with the intervention that customers do or want to do. Pains are those costs (barriers, time, challenges, etc.) that customers do not want or tries to avoid with the intervention. And gains are those benefits (results, savings, optimizations, etc.) that customers expect to have with the intervention.

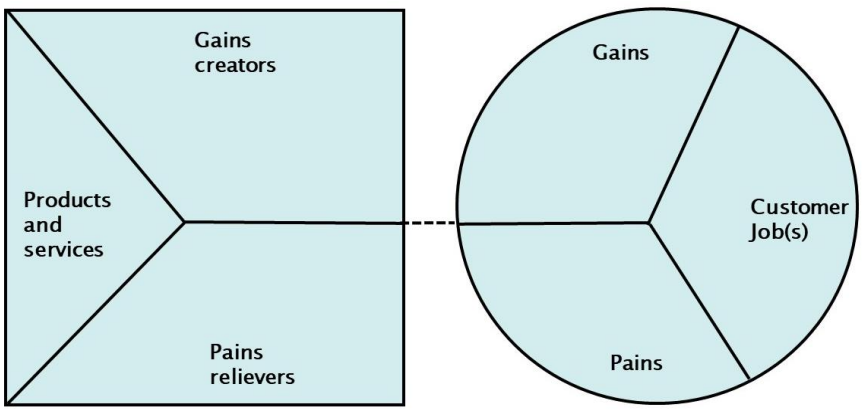

Figure 4.- Value Proposition Canvas

The second segment, the value map (supply side), describes how the proposed business model challenges customers' expectations and the proposed value for the use which is created. The

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second segment identifies also three elements corresponding with customers' elements. Products and Services are those that the organization offers to customers to solve their jobs. Pain relievers are those elements that the company puts forward to solve customers' pains. And Gain creators are those benefits that the company has also to offer according to customers' expected gains.

5.2.2. Business Model Canvas

As already mentioned, according to Osterwalder et al. (2009) a business model explains the rational of how a company creates, delivers and captures value. This definition shows the importance of the business model of an organization. Although its essence has been part of companies since the existence of the free market, this concept has gained relevance in the last 15 years. Nowadays, the business model has been consolidated as a fundamental element of analysis that must be done from a holistic perspective. As pointed out by Zoot and Amit (2010), it is surprising the little attention that the technicians and practitioners have devoted to business models.

Magretta (2002), in one of the first relevant works in this area, states that business models are stories about how companies work and how they usually answer the following questions: Who is the customer? How do we make money? What underlying economic logic explains how we can deliver value to customers at an appropriate cost? Magretta also remarks that a business model is not a part of strategy, understood as a way to obtain a competitive advantage. This is an important difference which is reinforced by Casadesus-Masanell and Ricard (2010), who explain that strategy refers to the choice of how the company interacts with competitors in the market place, while the business models is the logic by which the company creates value for its customers and stakeholders.

The question is how organizations are able to select the logic to proceed. Seelos (2010) explains that the implementation of common frameworks helps in explaining what works and what doesn't work to create value in each specific business. In that sense, Reuver, Bouwman and Haaker (2013) ensure that the Business Model Canvas (BMC), introduced by Osterwalder et al. (2009), is the most prominent and popular tool for practitioners to design business models. The BMC has been applied around the world and it is being used in many and important organizations such as IBM, Deloitte or the Public Works and Government Services of Canada. The creators of the BMC think that the best system to describe and analyze a business model is through nine basic building blocks (figure 5), because they cover the four main areas of a business: customers, offer, infrastructure and financial viability.

The nine blocks and their definitions, according to Osterwalder et al. (2009), are:

1- Customers segments: It defines the different groups of people or organizations an enterprise aims to reach and serve. Every company must decide which segment wants to serve, because each of them has different needs or problems.

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<table>
<tr><td rowspan="2">Key partnerships</td><td>Key activities</td><td rowspan="2">Value Proposition</td><td>Customer relationships</td><td rowspan="2">Customer segments</td></tr>
<tr><td>Key infrastructures and resources</td><td>Channels</td></tr>
<tr><td colspan="2">Budget costs</td><td colspan="3">Revenue streams</td></tr>
</table>

Figure 5.- Business Model Canvas

2- Value Proposition: It describes the bundle of products and services that create value for a specific customer segment. It means what solves the needs or problems that customers have. Some new business models are articulated around new value propositions.
3- Channels: It describes how a company communicates with and reaches its customer segments to deliver a value proposition.
4- Customer relationships: It describes the types of relationships a company establishes with specific customer segments. The relation between a company and its customers can be personal or automated depending on the value proposition and the characteristics of the customer segment.
5- Revenue streams: It represents the cash a company generates from each customer segment. If the value proposition is attractive for customers, they will be willing to pay the price of acquisition.
6- Key infrastructure and resources: It describes the most important assets required to make a business model work. It can be tangible (physical, human, financial…) or intangible (intellectual), but all of them are essential to create, deliver and capture value.
7- Key activities: It describes the most important things or actions that a company must do to make its business model work.
8- Key partnerships: It describes the network of suppliers and partners that make the business model work. There are different types of partnerships, but usually, organizations try to create these alliances that reduce risks or acquire resources.

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9- Cost structure: It describes all costs incurred to operate a business model.

5.2.3. City Model Canvas

According to Timeus, Vinaixa and Pardo-Bosch (2020), the City Model Canvas (CMC) is a framework that city councils can use to articulate how they expect to create and deliver value in an economically, environmentally and socially sustainable way through smart services. The CMC (figure 6) is based on the Business Model Canvas (BMC), replacing several blocks of that canvas for other ones more related to public services, and introducing a triple bottom line, where cities must assess the sustainability of their services. Using it when cities define strategies for their future services, public managers will be capable of assessing from a holistic perspective the net balance of their policies and actions. This tool emphasizes that the transition from a traditional city to a smart one should be based on solving environmental and social problems rather than just addressing economic challenges, which, obviously, also have to be considered. This is important to ensure that smart services actually serve to alleviate a particular need of the population and are not just being implemented to follow a trend or satisfy corporate interests.

<table>
<tr><td colspan="5">Mission Statement:</td></tr>
<tr><td rowspan="2">Key partnerships</td><td>Key activities</td><td rowspan="2">Value Proposition</td><td>Buy-in & support</td><td rowspan="2">Beneficiaries</td></tr>
<tr><td>Key infrastructure and resources</td><td>Deployments</td></tr>
<tr><td colspan="2">Budget costs</td><td colspan="3">Revenue streams</td></tr>
<tr><td colspan="2">Environmental costs</td><td colspan="3">Environmental benefits</td></tr>
<tr><td colspan="2">Social risks</td><td colspan="3">Social benefits</td></tr>
</table>

Figure 6.- City Model Canvas

CMC is composed of fourteen blocks, divided into four main areas: 1) value proposition, which is composed of Mission Statement and Value Proposition; 2) delivering value, which is composed of Beneficiaries and Buy-in & support; 3) producing value, which is composed of Deployment, Key partnerships, Key activities and Key infrastructure & key resources; and 4)

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triple bottom line, which is composed of Budget costs, Revenue streams, Environmental cost, Environmental benefits, Social risks, and Social benefits.

1. Mission statement: It is a short declaration of the overall aim that the city wants to reach through its City Business Model. It questions about: What is the ultimate goal that the city seeks to achieve?
2. Value proposition: It states what benefits are expected from the new smart service. It questions about: What specific benefits are created and what specific problems does the proposed service solve or alleviate?
3. Beneficiaries: It categorizes who is positioned to benefit directly from the value proposition. It questions about: Who will directly benefit from the proposed services?
4. Buy-in & support: It identifies the individuals, groups or entities (such as unions, NGOs or other governmental organizations) whose acceptance of the proposed project is necessary for its successful implementation. It questions about: Whose buy-in is needed in order to deploy the service (legal, policy, procurement, etc.)?
5. Deployment: It presents the actions/projects through which the Municipality will deliver the value preposition. It questions about: How will the city solve the problems of the value proposition specifically?
6. Key partnerships: It enumerates the partners that will enable the city to produce the value, offering best opportunities to access more resources and capabilities. It questions about: Who can help the city deliver the proposed value to the beneficiaries? Who can access key resources that the city council does not have?
7. Key activities: It describes the most important things or actions that the city must do to make its business model work. It questions about: What must the city council do to create and deliver the proposed value?
8. Key infrastructure & key resources: It describes the most important assets required to make a business model work. It can be tangible (physical, human, financial, etc.) or intangible (intellectual), but all of them are essential to create, deliver and capture value. It questions about: What key resources and infrastructures does the city council have to create and deliver the value?
9. Budget costs: It describes all costs incurred to operate a business model. It questions about: What costs will the creation and delivery of the proposed services entail?
10. Revenue streams: It represents all the sources of income that the city generates from its business model. If the value proposition is attractive for beneficiaries, they will be willing to pay the price of acquisition. It questions about: What sources of revenue for the city do the proposed services provide? What other sources of revenue does the city have?

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11. Environmental cost: It identifies the negative impacts induced by the value proposition or those generated during its production and delivering. It questions about: What negative environmental impacts can the proposed services cause?
12. Environmental benefits: It identifies the positive impacts generated or induced by the value proposition. It questions about: What environmental benefits will the proposed services deliver?
13. Social risks. It refers to negative costs that the smart city strategy can have on a city's residents and communities: It questions about: What are the potential social risks that the proposed service entails? Who is most vulnerable as a result?
14. Social benefits: It refers to indirect positive impacts of the smart city strategy implemented through the value proposition. It questions about: What social benefits will the proposed services bring about? For whom will these benefits materialize?

5.2.4. Mission Model Canvas

The Mission Model Canvas (MMC), which is presented in figure 7, is an adapted model from the BMC for those organizations which their principal objective is not to earn money but to create value to solve a particular problem for a set of beneficiaries. The model was developed by Pete Newell, Alexander Osterwalder and Steve Blank, when they observed that the BMC was not able to describe and analyses some types of organizations, such as public organizations or non-profit organizations. The MMC has also been deeply analysed by Mazzucato (2018).

<table>
<tr><td colspan="5">Mission Statement:</td></tr>
<tr><td rowspan="2">Key partnerships</td><td>Key activities</td><td rowspan="2">Value Proposition</td><td>Buy-in & support</td><td rowspan="2">Beneficiaries</td></tr>
<tr><td>Key infrastructure and resources</td><td>Deployments</td></tr>
<tr><td colspan="2">Mission budget (cost)</td><td colspan="3">Mission achievement</td></tr>
</table>

Figure 7.- Mission Model Canvas

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The MMC follows a similar logic of the CMC, where Customer Segments are replaced by Beneficiaries; Channel is replaced by Deployment; and Customer relationships is replaced by Buy-in and Support. However, instead of having a triple bottom line with six blocks – Budget costs, Revenue streams, Environmental cost, Environmental benefits, Social risks, and Social benefits–, it has only two blocks: the Mission budget (cost) and the Mission achievement/impacts.

The Mission achievement is the value that the organization is creating for the sum of all the beneficiaries. It is about the great value. To this end, the Mission achievement reflects the outcomes of the organization, the intended short-term to medium-term results that the organization expects to see in the beneficiaries because of its service and how they will change. On the contrary, the Mission budget reflects the cost structure, the key costs incurred to operate the service (du Toit, 2017).

5.2.5. Strategy Canvas

The Strategy Canvas (figure 8) is a tool developed to obtain better results in comparison with competitors in a concrete sector. The main objective of this strategy is to create a new market space (blue ocean) where competitors do not have relevance. The strategy is oriented to value innovation in order to create new sectors through changes in demand and products and services. According to Chan and Maubourge (2005), companies do not have to make efforts fighting against competitors in saturated markets (red oceans); on the contrary, they should focus on new spaces where to compete (blue oceans). The reason is that these new spaces present a huge potential to grow in a fast and profitable manner.

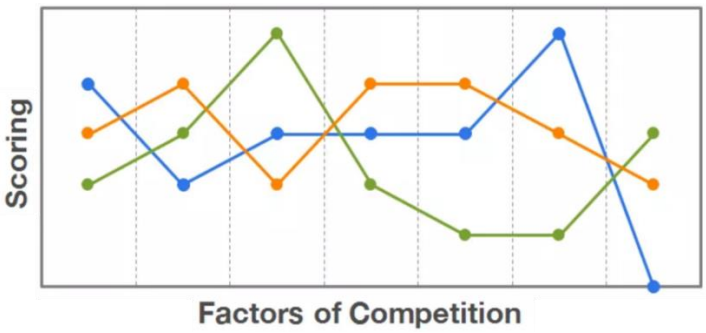

Figure 8.- Strategy Canvas

The strategy explores new ways to create value using different types of questions, such as: Which items should be increased or decreased in the sector? Which items should be created that never have been offered? And which items should be avoided from those that are already offered?

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According to these items, the methodology proposes to compare a company with competitors using different types of items. Furthermore, the methodology can also be used to compare different types of business models – traditional vs. sustainable – in a particular sector.

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6. ENERGY EFFICIENCY

Buildings are one of the most relevant elements of cities and, according to Gynther et al. (2015) and Liang et al. (2018), they use 40% of all energy in developed countries. Furthermore, in frozen scenario in terms of policy and technological developments, total residential heating and cooling energy consumption is not expected to decrease over the coming 30 years (Ürge-Vorsatz et al.,2015). Thus, improving the energy efficiency of buildings should be a critical element for ensuring a sustainable development (Li & Colombier, 2009). Due to the large ratio of existing buildings to new construction, governments, companies, technicians and scientists are aware of the crucial role in this battle that is played by retrofitting existing buildings and constructing District Heating Networks to increase energy efficiency. Next organizations' analysis shows how these organizations develop different business models and strategies to implement energy efficiency interventions in REPLICATE's Lighthouse Cities.

6.1 Giroa Veolia

6.1.1. Company's presentation

Giroa Veolia – *Veolia Servicios Norte* (*Veolia North Services* in spanish) is the main partner from the city of San Sebastian for retrofitting actions under Replicate project framework. Giroa Veolia is part of the Veolia group, a global leader in optimized resource management. With nearly 178,780 employees worldwide, the Group designs and provides water, waste and energy management solutions that contribute to the sustainable development of communities and industries. Through its three complementary business activities, Veolia helps to develop access to resources, preserve available resources, and to replenish them. In 2019, the Veolia group supplied 98 million people with drinking water and 67 million people with wastewater service, produced nearly 45 million megawatt hours of energy and converted 50 million metric tons of waste. Veolia Environment (listed on Paris Euronext: VIE) recorded consolidated revenue of EUR 27.189 billion in 2019 (USD 29.9 billion)[1].

In Spain, Veolia is divided in three geographic zones: *Veolia Serveis Catalunya*, *Veolia Servicios LECAM*, and Giroa Veolia/ *Veolia Servicios Norte*. Giroa Veolia focuses on energy management solutions, thus efficient management of the energy of the facilities and the heat and cooling networks they operate. Likewise, Giroa Veolia is committed to renewable energies, specifically in the management and maintenance of photovoltaic plants, in the management of biomass installations and in efficient cogeneration plants that allow them to significantly reduce

[1] Source: https://www.veolia.com/en/veolia-group/profile

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emissions[2]. To this end, Giroa focuses in what is called active systems, energy installations, trying to search those elements which generates energy, those elements needed to transform and optimize energy, for example from gas to hot water or using excess of heat from one installation to used in another.

Regarding the REPLICATE project, Giroa, acting as an Energy Service Company (ESCO), enacts the retrofitting intervention and energy management of 156 dwellings plus 34 commercial premises (distributed along 10 doorways), totaling 18.350 m^2. The total investment cost is EUR 4,2 million including: façade retrofitting (thermal isolation and window metalwork) and roof and basement adaptation (8 cm. isolation). The intervention also includes the general connection of the buildings to the District Heating (DH) system and all the individual and common installations within the buildings[3].

6.1.2. Customers and value needs

The energy retrofitting industry faces many challenges. An important challenge regards to neighbourhood communities where customers' engagement is crucial. As will be shown along the analysis, the business model for energy retrofitting in communities clearly needs the support from the public sector – public administration – throughout funds. Figure 9 shows the Value Proposition Canvas (VPC) of the intervention and provides a clear vision of the relation and interface between the market and the service.

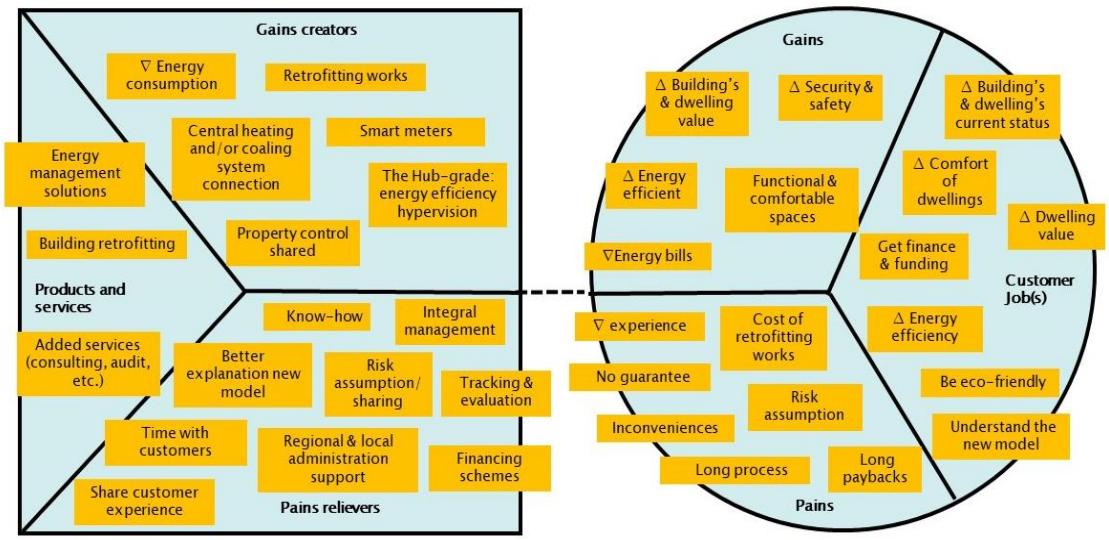

Figure 9.- Value Proposition Canvas of Giroa

[2] Source: https://www.veolia.es/veolia-en-espana

[3] Source: DoA REPLICATE (691735). REPLICATE Annex 1 – DoA to the GA. Description of action: Building Retrofitting. p. 29.

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From the perspective of the customers (right part of figure 9), there are several jobs and tasks when retrofitting for energy efficiency. Obviously, these jobs differ depending on the type of customers' segment. Regarding the REPLICATE project intervention in the city of San Sebastian, customers (neighbourhood community) are rather more worried about their building, dwelling status and comfort related to traditional retrofitting works than energy management solutions from an integral point of view. Ordinarily, these types of communities live in old buildings located in working class neighbourhoods with economic problems to tackle retrofitting. Their need is often linked to retrofitting measures such as covers, roofs, facades… because they are worried about consequences of earthquakes, such as landslides, fissures, leaks…that affects directly to their building and dwelling status as well as its value. To this end, they are just interested in energy management solutions as a second service necessary to get the funding. For them, the energy management service is a window opportunity to get the funding. On the other side, this situation is also a window opportunity for Giroa to introduce the energy management service to this type of customers and to show them its usefulness.

Besides retrofitting and getting finance and funding, owners and tenants from these communities need to understand the new model based on ESCO parameters. This model is hard to understand for communities because it implies concepts such as savings, tracking and evaluation, risk management or property. In general, owners and tenants are more get use to the traditional retrofitting works as well as the traditional energy services. To this end, there is a sense of mistrust regarding the new model based on ESCOs. Customers are used to traditional services where he has just a contract for installation and maintenance.

Regarding pains, aspects that lead to negative emotions of customers, however, those do not have experience in such processes, know that works are expensive and need long processes to do the retrofitting interventions. Furthermore, there is no guarantee in savings and paybacks to recover the investment are usually very long. Jobs and tasks in communities with many owners and tenants require inconvenience to do the interventions, that means: time consumption to search for different energy or retrofitting companies, consult different budgets, get funds, organize community meetings, etc. In general terms, this is a hard task that implies responsibility, management, control and time effort that not many owners or tenants want to handle. These pains are quite linked to the idea of traditional retrofitting works and not to the energy management services from an ESCO business model, which as a new business model has already demonstrate to overcome most of these pains.

As an exchange of these pains, customers expect to increase their building and dwelling value as well as to increase their security and perception of safety and having functional and comfortable spaces to live. For customers, one of the most relevant things is to be energy efficient because leads to a decrease in energy bills. In general, customers prioritize gains such as dwelling value, retrofitted space, and energy bills rather than energy efficiency or being environmentally friendly. Citizens' lack of know-how about energy management services and ESCO business model contribute to it.

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As it is show in the left side of the figure 9, Giroa's main services, which are energy management solutions, building retrofitting and facilities maintenance, etc., clearly tackles customers' needs through many pain relievers and gain creators that are characteristic from an ESCO business model (Brown, 2018).

To this end, pain relievers clearly solve customers' problems. Giroa is a pioneer company in energy management services in the Basque Country with a long track record which renowned know how is a guaranty for customers. Regarding the REPLICATE project intervention, the integral management of all the project – energy services plus retrofitting measures – decreases many pains of customers' jobs and tasks such as lack of experience and inconveniences related to responsibility, management, control or time; Giroa takes care of all aspects when producing and delivering value for customers. Furthermore, Giroa offers different financing schemes which imply different formulas to return the investment, accessibility to soft loans, and funds from regional and local administration. Furthermore, Giroa, as an ESCO company, assumes and shares risk of the interventions investments with its regular customers, but in the case of the REPLICATE pilot the risk of the price keeps in the public sector, while Giroa assumes the risk of maintenance and guarantee of facilities. This is an important fact, which transmits confidence for customers. To manage this risk, Giroa tracks and evaluates energy efficiency in an accurate way to follow all previsions and calculations and manages deviations. To this end, this aspect is crucial for Giroa because as a risk taker and guarantor, its business model depends on energy and bills savings. Finally, to sell their energy management model, Giroa spends a lot of time with customers, dealing with all different customers' experiences, expectations and situations from a community building. To sell its value proposition and get the confidence of customers, Giroa use to share customers' experience as a marketing action, as well as other marketing arguments already mentioned, such as the opportunity to get the fund.

Regarding gain creators, solutions that lead to customers' benefits, Giroa does retrofitting works but its main function is to decrease energy consumption through installing and connecting central heating and/or coaling systems. To control energy parameters, Giroa has the Hub-grade, an energy hypervision control center where they track and evaluate all energy implemented systems through smart meters installed. Finally, Giroa also offers different types of contracts regarding building communities. Among these different types, one is centered in sharing property, which clearly lead the customers' confidence and guarantee because of risk assumption.

6.1.3. Business model

Giroa operates in a very competitive sector, where there are many obstacles that prevent the implementation of building retrofitting interventions by private owners. In this section, authors explain, through the Business Model Canvas (BMC), which is presented in figure 10, how Giroa works on it successfully.

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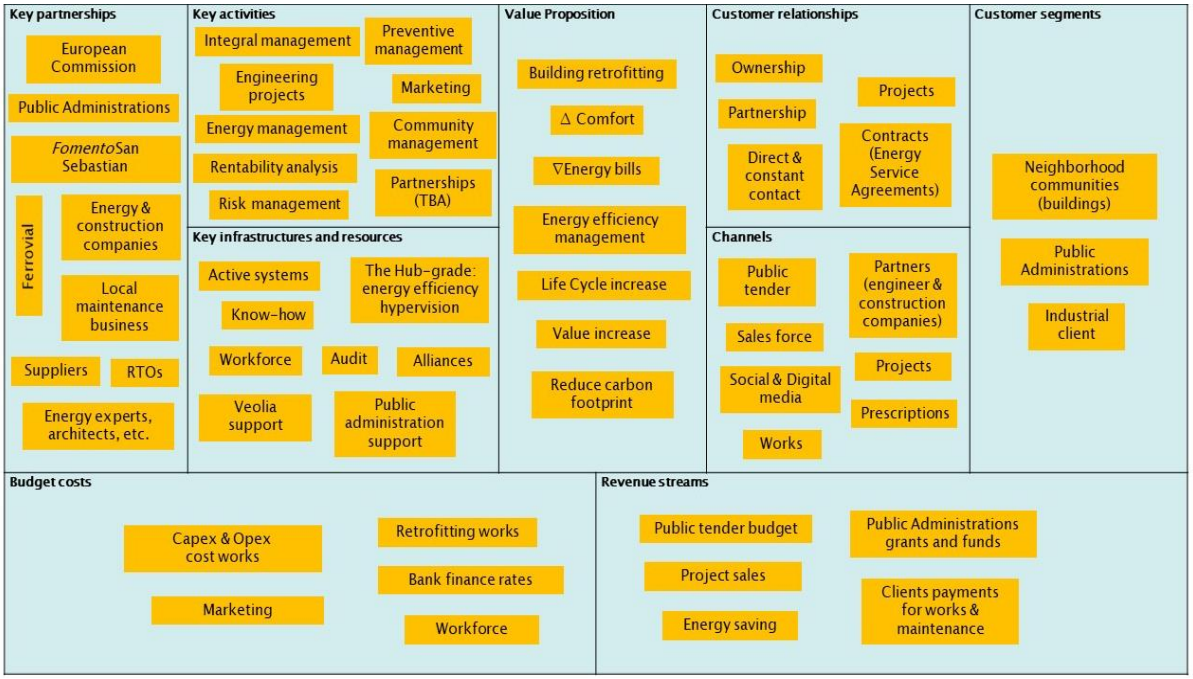

Figure 10.- Business Model Canvas of Giroa

The objective of the intervention is to retrofit 156 dwellings from different building communities and connect their heating and/or coaling systems to the DH. The value proposition of Giroa as a company focuses on energy management solutions with a clear emphasis in reducing energy bills and carbon footprint to contribute to sustainable communities and SECAP objectives. The selling of such value proposition, difficult to understand and to afford for building communities implies also selling buildings' and dwellings' traditional retrofitting works, such as façade retrofitting (thermal isolation and window metalwork) and roof and basement adaptation (isolation) to improve indoor comfort as a mechanism for engagement and cost of opportunity because of the fund. Obviously, all measures increase the value of buildings and dwellings from the neighborhoods.

The principal customer segment for Giroa regarding the REPLICATE project are communities' buildings. As mentioned before, these types of communities live in old buildings located in working class neighbourhoods with different needs to tackle retrofitting works. From the perspective of the company, the engagement of such type of customer is clearly linked to public funds, otherwise the business model does not work at this moment. On the other side, Giroa's customers are also public administration infrastructure (i.e. Hospitals, sport centers, etc.) and private/industrial companies. Private and industrial companies are attractive for Giroa because of their purchase amount but on the other side, these companies have the need for shorter rentabilities and repayment schedules. These types of customers tend to work with closed balance sheets and annual budgets.

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The delivering value of the business model presents different types of customers relations such as contracts, ownership, partnership, projects, or direct and constant sales. For the case of communities as a customer, usually there is an Energy Service Agreement (ESA) where Giroa does the investment, assumes risk and manage installations but makes profit from this initial investment throughout buying and selling energy, saving energy from interventions or increasing life cycle of systems. In some cases, Giroa also becomes an owner or does a Temporary Business Association (TBA) – when need to do a huge investment. TBA is an accepted formula for customers when they do not want to offer a complete control of the service to the company.

Finally, regarding channels to deliver value, Giroa mainly obtains through public tenders presenting their offer through TBAs. Depending on the type of contract, engineering and construction companies present their candidature and uses Giroa for the energetic management. In general, the principle channels are public tenders or prescriptions. This last channel becomes important because show the value of the energy management solutions from customers' perspective.

The producing value of the business model implies multiple and varied stakeholders. The stakeholders structure is classified by those who: i) promote the retrofitting – EU and public administrations, in the case of the REPLICATE project there is the Basque Country regional government as well as the Municipality through Fomento de San Sebastian (FSS); ii) finance/fund the retrofitting – EU, the Basque Country regional government and the Municipality; iii) produce and deliver value – Fomento de San Sebastian (FSS), energy and architects experts, energy and construction companies, or local maintenance businesses and RTOs. FSS has coordinated all retrofitting interventions with the district urban works that were taking place in parallel. At this point, FSS has done a huge effort coordinating and facilitating during the whole process important aspects such as citizen engagement, coordination between departments, getting more funding from the Basque government, administrative tasks, etc. These aspects have been crucial for the success of the retrofitting interventions.

At the end, Giroa works with different type of stakeholders, from suppliers to energy experts. At this point, the task of engineering services is crucial because offers a very detailed information to customers about calculations and parameters. In fact, many public procurement processes came to Giroa through engineering companies that are contracted by public customers.

The business model implies different types of key activities. Obviously, the most important are those that involve the integral management of the value chain, which implies engineering projects, rentability analysis, preventive and risk management, community management and partnerships. Depending on the type and budget of the contract, usually those that involve long term investments which represent a certain grade of risk, Giroa must follow strict business plans and rentability analysis in order to have the acceptance of the company represented by the investment committee. As mentioned before, Giroa usually does the

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investment for customers who are the owners of the installations, and Giroa assumes the management and risk of the investment. Furthermore, Giroa takes care of everything, obviously they do the installation and managing of it, trying to get the most of it in terms of optimization and efficiency which means searching for lower prices of energy as well as increasing life cycle of installations.

Besides these activities, the business model lies on key resources and infrastructures. One of the most important resources they have is the Hub-grade for energy efficiency hypervision. The resource is crucial to follow, control and evaluate all installations throughout a set of parameters that are crucial for Giroa. This is important because Giroa does huge investments in energy solutions and its business model strongly relies in energy savings. All installations have smart meters and alarms which are constantly sending data on these parameters to the Hub. It is important to remark that Giroa plays in a sector where margins are very low, and every installation has to be controlled carefully to avoid deviations. The Hub-grade also represents a sales argument for Giroa. One of the reasons is that customers mistrust the new energy model as they are used to the traditional ones, so Giroa shows this resource to them as a mechanism to convince.

It is very important also to highlight the public administration support. To this end, the regional Basque Country government and the Municipality have push hard towards smart and sustainable environments, offering financing and funding schemes, as well as setting a proper infrastructure for an attractive ecosystem in energy efficiency maters boosting for projects, creating laws and municipal ordinances, fostering public-private collaborations, and making stakeholders follow a same path.

Finally, the business model focuses on the costs/revenues structure. As observed in figure 10, Giroa has different sources of revenue streams: public budget, project sales, energy savings, public administration grants and funds, and clients' payments for works and maintenance. For the case of the REPLICATE intervention, Giroa counts with the project's fund, around EUR 1,335,896,65, and the Basque Country regional government fund, around EUR 2 million. It is important to remark that the regional government's fund is allocated for the 156 dwellings covered by REPLICATE, contributing to the retrofitting and accessibility works funding. Besides these sources of revenue, the business model highlights savings in energy which clearly means savings for households.

From a traditional business market point of view, the revenue streams of Giroa are strong and relies on public administrations – which led by an example and are retrofitting public facilities – and private/industrial clients, although budget costs are high due to initial investments and operations and maintenance costs. Regarding the intervention of the REPLICATE project, revenues are weak because they rely too much on public funds and costs of interventions are high. According to Giroa, it is difficult to engage this type of customer – community buildings – in new energy business models and even worse for the customers' segment who live in old buildings with different problem issues to retrofit.

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Finally, another important problem regarding this type of customer segment, is that the payback of energy solutions is not as fast because does not depend just in energy management measures, rather in retrofitting works such as those mentioned like façades, roofs, etc. We must bear in mind that energy costs in dwellings are not as high comparing with energy cost from public administrations or industrial customers. Furthermore, the recovery implies also traditional retrofitting works from passive interventions as well as interest rates from loans. Nonetheless, dwellings value increases.

6.1.4. Strategy

According to Brown (2018), the business model of Giroa as a company, follows the theoretical business model of an ESCO in the provision of energy and rehabilitation services. As shown in figure 11, there have been selected ten items to compare different theoretical business models. This is an exercise based on the discursive analysis of Giroa and secondary sources from each business model.

As observed, the business models reflect the strategy positioning of a company according to each model. The items have a score of 1 to 5, where 1 means less weight compared to other business models (disadvantage) and 5 greater weight compared to them (greater advantage) when facing the market.

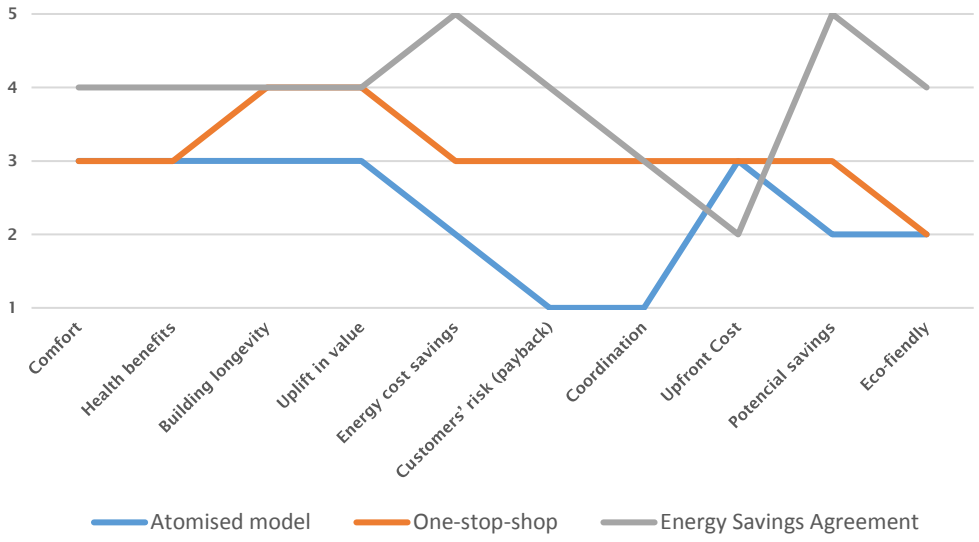

Figure 11.- Strategy Canvas of Giroa

The figure presents three business models, the Atomized market model, the One stop shop, and the Energy Savings Agreement (ESCO model). The Atomized market model is a business model based on energy savings through different measures of action. The main characteristic

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of this model is the fragmentation of the value chain. The services are offered to customers separately. It is a business model focused on the market. Suppliers must use push strategies to reach customers (owners). The management of the model rests with customers, who establish contractual relationships with the suppliers separately. The financing is usually done through a third agent that is not part of the rehabilitation process. Savings are estimated rather than guaranteed.

The One stop shop is also a business model based on energy savings, although it presents a set of comprehensive actions. Like the intermediation model, it uses a point of contact (customer interface) only to offer a complete rehabilitation package. The business strategy is also push, as in the previous model. However, unlike the previous model, the point of contact (or interface) includes financing. In general, this point of contact is assumed by a rehabilitation company. As for the previous model, savings are estimated rather than guaranteed.

While the Energy Savings Agreement (ESA) is a business model that integrates multiple and comprehensive retrofitting measures, integrated value chain, customer interface, like the One stop shop business model, but energy savings are guaranteed by an Energy Savings Performance Contract (ESPC). The ESPC is used as a structure to finance retrofitting. The lender – own ESCOs, financial institutions or investors firms – captures energy savings and charges back to property owners based on historic consumptions (Boza-Kiss et al. 2017).

Giroa business model reflects the logic of an Energy Savings Agreement but falls into the One stop shop regarding the pilot intervention. There are several reasons to explain this situation. As observed in figure 11, the model of Giroa is very strong in many of the items when comparing to the other models. The items clearly reflect a value proposition from the Energy Savings Agreement regarding comfort, health benefits, energy cost savings, potential savings or being eco-friendly, but falls in coordination and upfront costs.

Regarding coordination, the Energy Savings Agreement clearly states the need for a customer interface, a single and trusted point of contact, which integrates the supply chain for retrofitting works and energy management services as well as integrated financing packages to encourage customers. At this point, due to the pilot and the characteristics of customers, the financing schemes regards to the public administration and Giroa does not control them. In this sense, the finance provider acts as in the One stop shop model, represented by the public administration, and it is not integrated in the provision of the ESCO model though a customer interface.

Regarding upfront costs, these are high for customers. The reason, as mentioned, is that energy management services in retrofitting of old buildings are quite linked to traditional retrofitting works. Customers usually do the energy works if these are linked to a fund for traditionally retrofitting works such as façades, roofs, etc. To this end, one of the main key aspects to implement energy management services in this type of buildings means to fund other types of retrofitting jobs. Otherwise, the engagement is quite difficult to get from customers.

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These two items clearly reflect the need to tackle energy efficiency services in old buildings from working class neighbourhoods throughout the push of the public administration and the need to offer funds. Otherwise, the engagement of owners and tenants from these types of buildings does not work. Furthermore, this is the reason why the Energy Savings Agreement provided by an ESCO company, such as Giroa, cannot manage to afford these types of jobs by itself. Giroa, represented by the Energy Saving Agreement in figure 11, can afford energy costs savings, savings, and appropriate paybacks better than the other two models, but this models just works for energy management services, not for retrofitting traditional works. If they must tackle these types of works, then paybacks get higher.

6.1.5. Final remarks

The analysis of the business model of Giroa and the pilot intervention of the REPLICATE project reflects an appropriate manner to solve the problem of old building stock in low-income neighbourhoods in our cities. This means a public-private coordination and cooperation. Giroa, as an ESCO company, assures important items to achieve SECAP objectives through its business model, such as cost savings, guarantees and energy savings, but needs the support of the public administration in terms of funding to get to customers. To this end, the public administration, coordinated at all levels, is key to engage this type of customers through funds, and Giroa, as an ESCO company, is key to control the supply chain of the business model and offer guarantees.
Besides the economic support based on funds from the public administration, there is a huge need to understand the new energy model, as well as to understand how operates its business model. To this end, the public administration must push hard on marketing strategies to let citizens know how functions the model and which are its advantages. This task should be also accompanied with clear and strict policies and regulation among competitors to support this type of market where Giroa operates.

6.2 Casa Spa

6.2.6 Company's presentation

Casa Spa is a public company that projects, creates and manages the public residential buildings legacy in the area of Florence[4]. Furthermore, Casa Spa manages the housing stock

[4] Source: http://www.casaspa.it/default_eng.asp

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of thirty Municipalities of the Florentine LODE; it is a stock of approx. 12,000 real estate units whose main feature is to be the "home" of as many families. The awareness therefore that this type of management must be aware that the final recipient of the service are people and families constituting a reality even composite, has pushed the company to equip itself with suitable tools to pursue the quality of management not separated from sociability. Indeed, the adoption of an Integrated Quality System - Social Responsibility goes in this direction supported by the extensive use of information technology and in synergy with the precious role played by self-management allows them to adapt to the multiple needs of the assignees (and the owner municipalities) the complex set of activities for the management of the housing stock, in which the maintenance aspect is of primary importance[5].

Regarding the REPLICATE project[6], Casa Spa realises the intervention consisting of the retrofitting of two residential social housing buildings (>20,000 m²). The total surface selected (from a total social housing volume of about 184.000 m³ in the district which could be useful also for the replication plan) is about 20.000 with an actual consumption of 2,6 GWht and 500 MWhe.

The materials chosen are able to combine high performances with easy and cost-effective implementation: the requirements entail high standards in terms of insulation, breathability, strength, reflectance and easy installation. After retrofitting, the buildings can expect a 50% reduction in their thermal demand due to the improvements in the thermal properties of the envelope (insulation, elimination of thermal bridges) and due to optimized control strategies that are implemented along with the renovated heating distribution system.

Heating distribution systems inside the flats is equipped with regulation and control. These devices will ensure further optimisation of consumption and comfort, and they work in synergy with the smart info devices.

6.2.7 Customers and value needs

The first business tool to analyse the business model is the Value Proposition Canvas (VPC). Figure 12 shows the VPC of the intervention and provides a clear vision of the relation and lace between the market and the service.

The first segment, the customers map (demand site), as mentioned in chapter 3, identifies the jobs and tasks the customer wants to perform as well as the negative aspects he wants to avoid as well as the positive aspects and benefits the customer wants to gain from the service. At this point, it is important to mention that the Municipality of Florence is the customer of Casa Spa in this business service because the Municipality owns the dwellings and households are the beneficiaries. Although Casa Spa clearly mentions that the final recipient of their

[5] Source: https://www.casaspa.org/internet/informazioni/depliants/Gestione_patrimonio.pdf

[6] Source: DoA REPLICATE (691735). REPLICATE Annex 1 - DoA to the GA. Description of action: Building Retrofitting (FLORENCE - Casa spa, UNIFI, SPES), p. 40.

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service are people and families, it is the Municipality who owns the titularity of the service. To this end, Casa Spa has a figure of public manager for social housing.

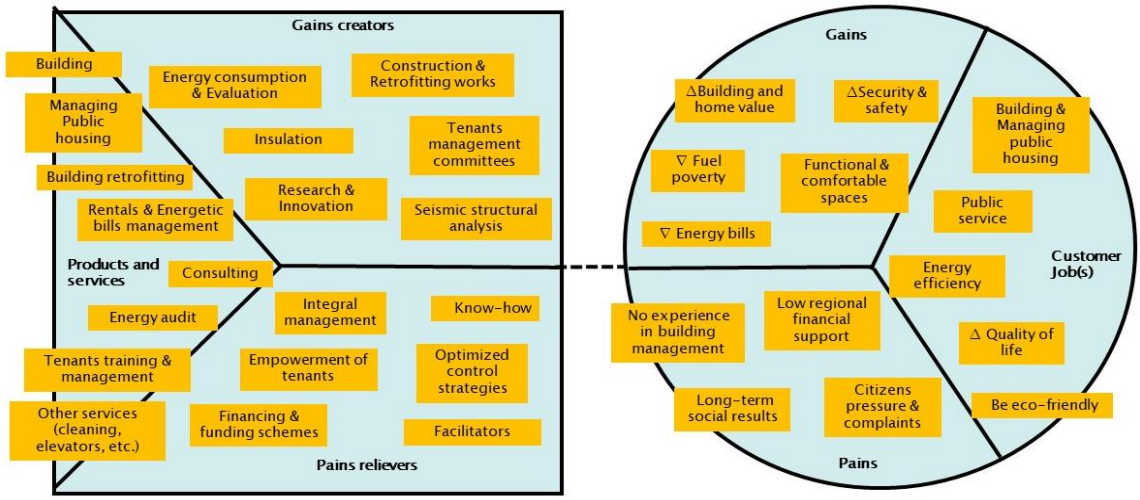

Figure 12.- Value Proposition Canvas of Casa Spa

From the perspective of the Municipality, we find several jobs or tasks. Altogether, these respond to design, set up and manage public policies to offer services which solve citizen's needs. These needs regard to two basic areas: (1) the urbanistic area; and (2) the social area. The first one, responds to build, retrofit and manages the housing stock on a technical sense, where measures of energy efficiency to become eco-friendly are crucial. The second one, respond to the needs of owners, tenants and families who cannot afford market housing rental. Regarding pains, aspects that lead to negative emotions of the customer, these are linked to citizens pressure and complaints, long-term social and environmental results, low regional financial support and know how. In this scene, citizens pressure and complaints are clearly a pain for the Municipality because they need to give an answer to people who needs a home. Therefore, the Municipality relies on a specialized figure such as Casa Spa, with knowledge on building and home management as well as energy efficiency measures to handle it. Moreover, it seems that the Municipality does not have a strong financial support from the regionality and must be itself who finances the service together with some national funds and projects such as the REPLICATE one. Finally, the service, understood as a public service, goes beyond just economic issues, and has to take care of social and environmental issues that normally are difficult to make them visible in short terms.

On the other hand, gains, those expectations and aspects that make easier the customer's tasks, are an increase of the buildings and homes value as well as an increase of security and safety for the Municipality housing stock; and more functional and comfortable spaces, a decrease in energy bills as well as in fuel poverty for owners, tenants and families. At this

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point, gains clearly focus on the customer's expectations from a technical and economical point of view, that is the housing stock, but also clearly reflects the recipients' needs, especially vulnerable families, who have problems of comfort and fuel poverty. Furthermore, the decrease in energy bills helps tenants and families pay the social rents.

The second segment, the value map (supply site), describes how the proposed business model challenges the customer expectations and the proposed value for the use must be created. To this end, as observed on the left side of figure 12, products and services clearly tackles many of the customer jobs and tasks from the Municipality which clearly impacts in households. Regarding the housing stock, Casa Spa manages almost the whole value chain when obtaining the contract. They retrofit and manage the public housing stock, manage rentals and energetic bills, offer trainings, energy audits, working plans with social services, and also include other secondary services such as cleaning services or elevators arrangements to complete a full service attendance for the Municipality. Furthermore, Casa Spa is also building under nZEB characteristics.

Regarding pain relievers, how the offered products and services solve the customer's pains, Casa Spa has an appropriate know how, well validated by the customer, to manage the stock on a technical and social manner and offer energy efficiency measures. As mentioned, they offer an integral management of the value chain that covers all services and uses different facilitators to help tenants in the whole cycle from getting a home, pay rentals and energy bills, be trained on such issues…moreover, they present a strong strategic policy to empower tenants in their own life and self-management issues. On the other site, Casa Spa works on energy issues in different manners, such as introducing isolation measures but also controlling and optimizing strategies for households. Finally, although Casa Spa does not have any financial role, in terms of resources, they obviously adapt they rentals and energy bills to each household in terms of payments periods and getting resources.

Regarding gain creators, solutions that lead to the customer's benefits, as mentioned, Casa Spa does construction and retrofitting works but also decreases energy consumption through evaluation and training to tenants. In this sense, Casa Spa has created the figure of tenants' committees in the buildings they manage as a bottleneck item to manage and control, but also to empower tenants. Also, Casa Spa has a strong input in research and innovation through programmes such as energy saving, new technics for anti-seismic, photovoltaics, energy monitoring and zero energy.

Regarding the REPLICATE project intervention[7], as mentioned, the service consists in the implementation of insulation measures. This means building refurbishment, concretely exterior insulation to minimizing the impact of the worksite on the inhabitants of Via Marche and Via Liguria, and on the surrounding buildings, in particular the impacts of noise and dust

[7] Source: D4.5 Pilot action progress report year 3. H2020-SCC-2015 Smart Cities and Communities Innovation Action (IA). Firenze

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but also summer discomfort. The overall performance of the insulation realized should optimize the foreseen impacts in U-values: façanes/walls 0,324 and roof 0,288.

6.2.8 Business model

The mission statement of Casa Spa is to be more sustainable through energy efficiency measures which tackle environmental and social issues linked to public buildings and social housing. To this end, the second business tool to analyse the business model is the City Model Canvas (CMC). Figure 13 describes the CMC of Casa Spa. As mentioned in chapter 3, the CMC reflects the logic on how the city is creating, producing and delivering public value in a way that is economically viable, social inclusive, and environmentally sustainable (triple bottom line).

As introduced in the analysis of the VPC, the objective of the intervention is to retrofit two residential social housing buildings. The value proposition of Casa Spa focus in building, retrofitting and managing the public housing stock. To this end, Casa Spa has a strong emphasis in an energy efficiency management of the housing stock to tackle fuel poverty of owners, tenants and families. The value proposition clearly focuses in increasing comfort and decreasing energy bills, which means an increase of quality of life and cost savings for households, and concretely for those targets that are considered low-income households. Additionally, the value proposition of the company as well as the concrete intervention from the REPLICATE project, has a clear impact in reducing carbon footprint and work towards SECAP objectives.

The customer segment of Casa Spa is the Municipality of Florence and the beneficiaries are households, but the company also offer its products and services to many other municipalities throughout public and service contracts. Specifically, Casa Spa manages the building and housing heritage of 30 municipalities in the area of Florence, which constitute a total sum of 13,000 dwellings from 1,700 buildings approximately. The Municipality of Florence itself owns around 7,000 dwellings. A part from the Municipality of Florence, there are other cities where Casa Spa offer services such as Ripoli, Barberino di Mugello, Barberino Val d'Elsa, Borgo S.Lorenzo, Calenzano, etc. Despite municipalities, the major recipient from Casa Spa services are owners, tenants and families who live in these dwellings and pay social rents. As mentioned before, an important target of the service are low-income families who cannot afford market rental prices.

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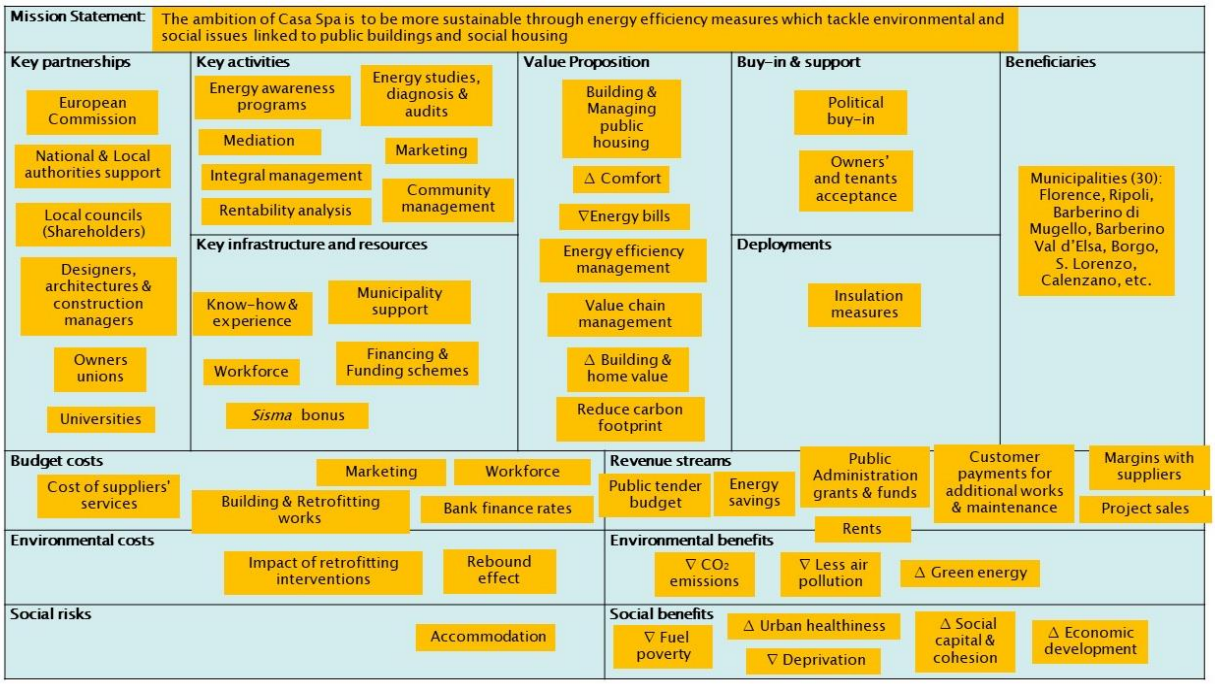

Figure 13.- City Model Canvas of Casa Spa

The delivering value of the business model for the Municipality and households needs the buy-in of the politicians from the Municipality as well as from owners and tenants. The financing of Casa Spa works is key as a revenue stream to accomplish its interventions.

As mentioned before, the deployment the intervention consisting of the retrofitting of two residential social housing buildings through energy efficiency measures which clearly have an impact in energy savings and comfort for households.

Finally, regarding channels to deliver value, Casa Spa obtains contracts through public tenders with all municipalities but uses other channels such as sales force, works, consortiums, prescriptions or its webpage and activity in social media.

The producing value of the business model implies multiple and varied stakeholders. The stakeholder's structure is classified by those who: i) promote the retrofitting – EU and municipalities, in our case the Municipality of Florence; ii) finance/fund the retrofitting – EU, municipalities, the State and rentals from households; iii) produce and deliver value – designers, architects, constructions managers, energy experts, owner unions or universities. This stakeholder's structure means several continuums, such as the public/private regarding the retrofitting and the financial/funding suppliers, and the SMEs/large companies regarding the type of professionals. This situation can be understood as a strength of the model because it tackles the whole picture of actors but must be carefully defined in order to manage precisely such variety of stakeholders.

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The business model implies different types of key activities. Obviously, the most important are those that involve the integral management of the value chain, which implies energy studies, diagnosis and audits, retrofitting works or rentability analysis in terms of energy efficiency. It is also important to mention all those activities related to social engagement, which are key for the function and running of the business. These activities focus on community management and facilitation/mediation processes with owners, tenants and families in other to train them, for example with energy awareness programmes, and encourage them, for example for self-management issues.

Besides these activities, the business model lies on key resources and infrastructures. Obviously, the most important is the public administration support, which covers most of the cost structure of the company and offers bridges to funding from other programmes and advantageous conditions to run and manage the company. Another important resource is the know-how and experience of Casa Spa technicians and work force because they are who design and implement the intervention. Finally, Casa Spa counts with *Sisma* (earthquake) incentives as part of the budget for its work and innovative technics in antiseismic measures. Finally, the sustainability of the business model focuses on the triple bottom line: cost/revenue, environmental costs/benefits, and social risks/benefits.

As observed in figure 13, Casa Spa has different sources of revenue streams: the public tender budget for the service contract with each municipality; public administrations grants, such as EU projects or *Sisma* incentives; project sales; rentals, possible additional payments for extra works and maintenance; and possible margins with suppliers for products and services. For the case of the REPLICATE intervention, insulation measures, Casa Spa has the allocated budget for this purpose coming from to different sources: in one hand, the project fund itself, and in the other 40% of the rentals from households.

Besides these sources of revenue, the business model highlights savings in energy which clearly means savings for households but also savings for the municipal budget allocated to reduce fuel poverty situations. As defined in the value proposition of the business model, the retrofitting intervention impacts in decreasing consumptions and households' energy bills. This fact might affect fuel poverty in a positive way because households will have to pay less for energy. Obviously, this assumption is something that must be evaluated and monitored.

From a traditional business market point of view, the revenue streams of the model and the intervention are weak; they rely too much on funds. For example, 60% of the intervention in budget costs are covered by public funds and just 40% comes from rentals, which some can also depend on municipal budget. In this regard, the business model sustainability depends widely on the public administration economic support.

The business model presents important environmental benefits such as the reduction of emissions that directly influence the urban healthiness through less air pollution and the increase of use of green energy. Regarding environmental costs, could be mentioned a short environmental impact due to some types of retrofitting interventions and a possible rebound

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effect in concrete areas if the dwellings increase its value. On the contrary, we do not believe that this effect could be of much importance because the housing stock in manage and control by Casa Spa and the Municipality as a regulator actor.

Finally, there are important social benefits. The main ones refer to a clearly decrease of fuel poverty targets. The reduction of energy bills and fuel poverty also implies a decrease of deprivation standards from quality of life. We must also highlight the empowerment of households which clearly helps them to gain knowledge about energy efficiency but also could imply an increase of social and capital cohesion among tenants.

6.2.9 Final remarks

The task of the Municipality, through Casa Spa, is especially important. It offers housing to people who cannot afford it, offering rents below the market. From a public point of view, for the Municipality the figure of an operator such as Casa Spa that adds value, helps to optimize resources and to manage the housing stock more efficiently is key. In this sense, it should be remark the role of the Municipally promoting energy efficiency projects in the positive judgment on the results of the Casa Spa management, as also do the rest of the city councils for which Casa Spa works to. It should be noted that urban planning instruments are beginning to give advantages (for example, in econometric terms) from interventions that promote a high degree of energy efficiency, in addition to the social impact that has already been discussed.
From an economic point of view, although part of the model is based on public finance and funding, it is important to highlight its viability. The model is supported by the rents paid by tenants. The average price they pay is EUR 130 per month (regulated by law), a price that is below the private housing market price in Florence, which is around EUR 700 per month. Casa Spa strives to keep its operating costs at 30% of what is paid for rentals. 20% of the total is dedicated to extraordinary maintenance and the rest (50%) to ordinary maintenance and the general operation of the buildings. In this sense, the model is very well adjusted for maintenance, but it lacks resources to make extraordinary investments and to expand its building and housing stock. To do this, external investment must be sought to scale-up and replicate de retrofitting interventions.
Therefore, the Casa Spa model is very attractive, both on a technical, social and environmental level, but a scale-up or replication requires additional investment. Currently, although there is a way to reduce costs through the measures implemented, this is not enough to grow. To this regard, the promotion activity of the model would have to obtain financing through a mixed strategy. On the one hand, it would be interesting to involve the regionality, currently there is only national or municipal funding. The social and environmental benefits, as well as the increase of the economic value from the housing stock, clearly impact regionality as well. On the other hand, it would be interesting to open long-term soft credit lines where the amortization of the same can come through savings, monetized through energy evaluation activities as well as through social impacts such as recovered public budget allocated for fuel

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poverty. And finally, if certain social and environmental returns are assessed, evaluated and monetarized, private investment could be sought through agencies and organizations of social and environmental investors. Complementary, although Casa Spa controls almost the whole value chain, collaboration with ESCO companies could be of interest as has been showed in the discussion.

6.3 Warm up Bristol

6.3.1 Service's presentation

Warm up Bristol[8] is a Bristol Council backed energy retrofitting initiative, launched in October 2014, and designed to help Bristol residents save money on their energy bills and encourage the reduction of carbon emissions through energy efficiency improvements to their homes[9]. The initiative is dedicated to tackling cold homes and reducing fuel poverty.

Bristol contracts works via public procurement exercises in the retrofitting of two hundred and forty residential buildings (20,400m^2) in Ashley, Easton and Lawrence Hill (predominately Easton and Lawrence Hill) Neighborhood Partnership area. Bristol already administers the City-wide Warm Up Bristol retrofitting programme and so the local existing supply chain can be utilized.

For the recruitment of households, Bristol uses the existing Warm up Bristol recruitment campaign with involvement of Knowle West Media Centre (KWMC) to carry out targeted recruitment of two hundred and forty residential participant households clustered in the specified demonstration district. This links into the citizen engagement and involvement actions. The process consists of: survey of properties (Bristol Energy Service); calculating cost of installations (Bristol Energy Service); and KWMC (replicate specific technological products) producing combined collaterals (subject to workshop).

As mentioned, the works execution targets two hundred and forty homes in the district that benefit from retrofitting with a selection of different measures: wall and loft insulations (loft, walls doors and floors); LED lighting; and Solar PV.

The Bristol programme ensures an effective process for quality management of the works carried out and materials used. The REPLICATE project employs rigorous procedures and processes for direct quality control of works execution, linked specifically to materials

[8] The brand of Warm up Bristol is not used anymore after the project intervention. The Council of Bristol operates with Energy Service Bristol. Source: https://www.energyservicebristol.co.uk/energy-saving-measures/

[9] Source: https://www.warmupbristol.co.uk/faqs/

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specification and quality of execution. Records are been collected on a day-by-day basis, including evidence such as photographs and/or videos of the relevant steps of the implementation (i.e. installation of insulation system to avoid thermal bridges, air tightness, etc.)[10].

Figure 14.- Example of a retrofitted house[11]

6.3.2 Customers and value needs

The value proposition of Warm up Bristol clearly fits customers' needs. The reason is that Warm up Bristol represents a public answer to the problem of retrofitting and its principle consequences in terms of social and environmental impacts. In this analysis, customer must be understood as the households – owners and tenants, who come from working class neighborhoods and present many difficulties to retrofit their houses. The first business tool to analyse the business model is the Value Proposition Canvas (VPC). Figure 15 shows the VPC of the intervention from Warm up Bristol and provides a clear vision of the relation and interface between the market and the service.

The first segment, the customers map (demand side), as mentioned in chapter 3, identifies the jobs and tasks customers want to perform as well as the negative aspects they want to avoid as well as the positive aspects and benefits customers want to gain from the service.

From the perspective of customers, as observed on the right side, customer assumptions, there is a clear need to manage and solve clients' necessities, pains and gains of households. The hypothesis for customers, those aspects regarding to problems and needs, has been

[10] DoA REPLICATE (691735). REPLICATE Annex 1 – DoA to the GA. Description of action: Building Retrofitting. p. 56.

[11] Source: https://replicate-project.eu/energy-bristol/

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validated by Warm up Bristol. In fact, the products and services designed and implemented by Warm up Bristol try to tackle customers' problems. As mentioned before, Warm up Bristol born as a respond to objectives' failure of the Green Deal[12].

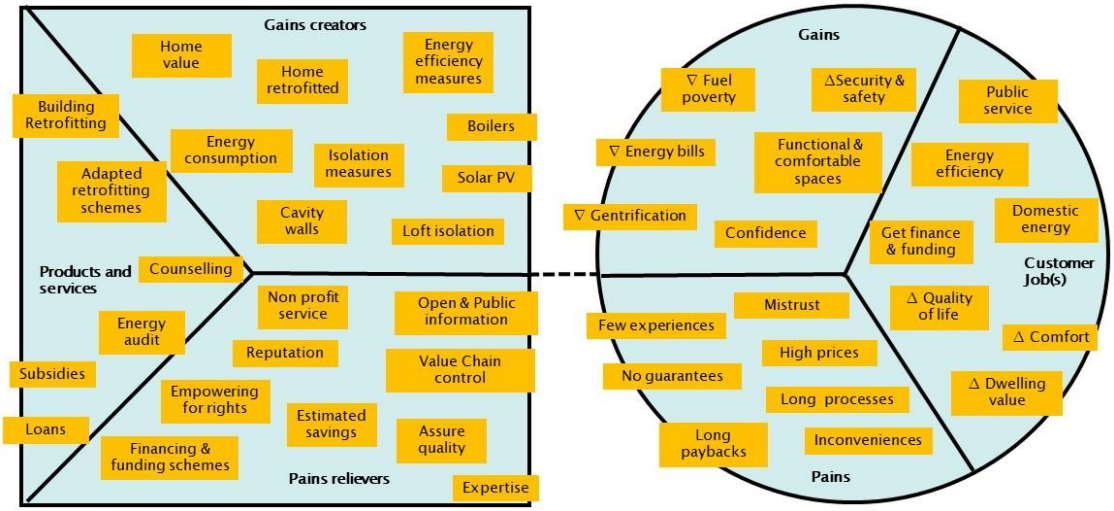

Figure 15.- Value Proposition Canvas of Warm up Bristol

Customers' jobs of the business model represents the reality of retrofitting. The need to retrofit is already validated in many places. There is an environmental issue regarding energy efficiency as many of the housing stock is old, but at the same time the effect of no rehabilitation impacts high in some concrete sectors of population in aspects such as comfort and fuel poverty, which influences negatively in customers' quality of life. To solve such situation, customers' jobs need to solve the problem of domestic energy through different types of retrofitting interventions.

Regarding pains, aspects that lead to negative emotions of customers, these are linked to citizens' experiences both the Green Deal and cost of retrofitting. According to Warm up Bristol, the Green Deal has a wrong political and economic approach[13] which led the interventions to the market as well as many retrofitting works paid and undone. This fact implied a huge mistrust, inconveniences and no guarantees towards and from public services. Furthermore, the typology of the population, many of them linked to low-income households, cannot afford the cost of retrofitting actions without funds.

On the other hand, gains, those expectations and aspects that make easier customers' tasks, are an increase in security and safety matters as well as functional and comfortable spaces. To this end, there is a hope to be able to pay energy bills and "run away" from being fuel

[12] Source : https://energypost.eu/uk-green-deal-failed-needs-replacement/

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poverty dwellings. Of course, from the perspective of citizens who retrofit, they expect to get confidence in those in charge of the retrofitting process.

The second segment, the value map (supply side), describes how the proposed business model challenges customers' expectations and the proposed value for the use has to be created. To this end, as observed on the left side of figure 15, products and services clearly tackles many of customers' jobs and tasks. Regarding the housing stock in all three neighbourhoods, the Bristol Council has taken in house the building retrofitting scheme and interventions throughout Warm up Bristol. This one offers energy audits and counselling through their energy experts and validates interventions through the figure of its programme manager. Furthermore, Warm up Bristol offers retrofitting financial and funding schemes through 0% interest loans and funds regarding some concrete types of interventions.

Regarding pain relievers, solutions that lead to the customers' problems, Warm up Bristol has an appropriate know how (expertise) in its teams, and as a non-profit service (public service), has confidence from customers because offers open and public information, controls the value chain, that means the delivering from contractors in terms of quality, and offers financing and funding schemes. Furthermore, "The Bristol Approach", working with communities through non-profit organization and empowering citizens' rights, clearly constitute a gain creator to get confidence from customers and solve their tasks and pains empowering their rights.

Finally, regarding gain creators, solutions that lead to the customers' benefits, as mentioned, Warm up Bristol does construction and retrofitting works. In this sense, as mentioned at the service's presentation, the intervention focuses on insulation measures, boilers, cavity walls and loft insulation. These interventions lead to a decrease in energy consumption and increase of households' comfort and finally an increase also in the value of homes in some cases.

6.3.3 Business model

The second business tool to analyse the business model is the City Model Canvas (CMC). Figure 16 describes the CMC of Warm up Bristol services. As mentioned in chapter 3, the CMC reflects the logic on how the city is creating, producing and delivering public value in a way that is economically viable, social inclusive, and environmentally sustainable (triple bottom line).

The mission statement of the business model is to be more sustainable and become carbon neutral by 2030 through energy efficiency measures which tackle environmental and social issues linked to poor efficiency housing. The interventions from the REPLICATE project is a clear effort from Bristol to achieve its environmental targets. The achievement of these objectives has a positive impact on increasing energy efficiency, which entails many economic, environmental and social benefits.

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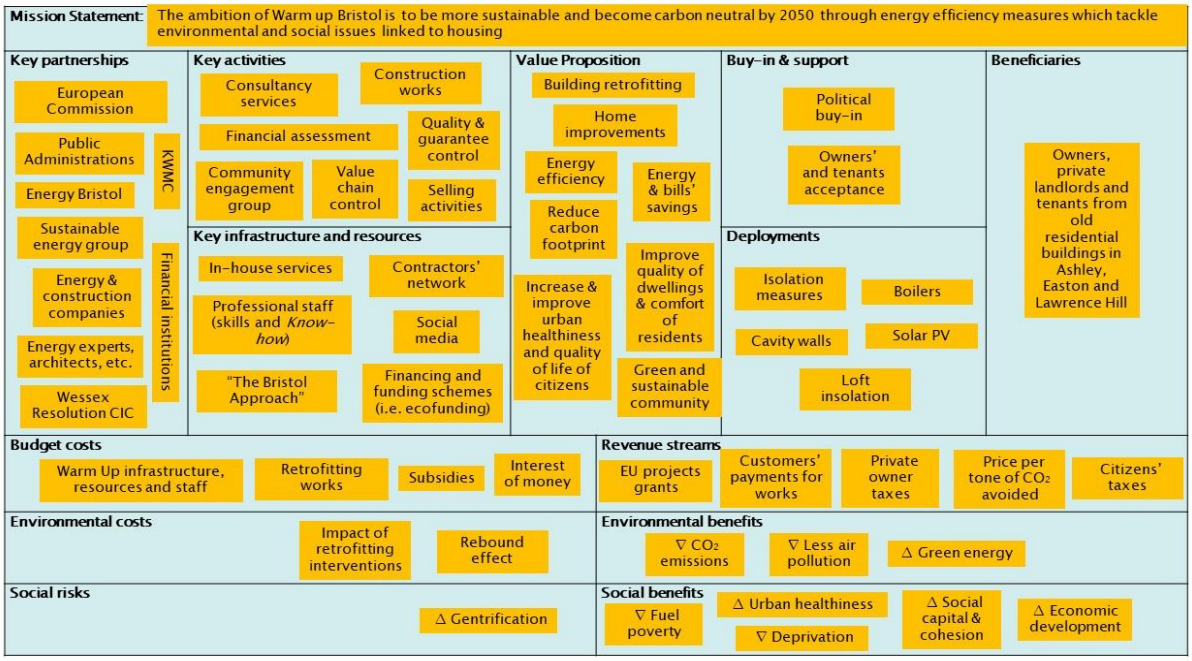

Figure 16.- City Model Canvas of Warm up Bristol

As mentioned for the VPS, the value proposition of the business model is to retrofit owners' and tenants' dwellings in Bristol, in particular the housing stock with concrete deficiencies, offering access, management and facilities to get the job done and improve their homes. The value proposition tackles domestic energy in Bristol neighbourhoods (Ashley, Easton and Lawrence Hill) where many houses are old and not well isolated. This element is crucial to achieve and contribute to the goal of cover reduction by year 2030 (reduction of carbon footprint) through energy efficiency measures. The other important element of the value proposition focuses on dwellings' deprivation, concretely in the reduction of one of its main definitory elements, fuel poverty. Many of the dwellings – not all – due to home characteristics and/or socioeconomic characteristics, are subject to this issue. To this end, all proposed energy efficiency measures improves quality and comfort of residents and so far, increase and impact in urban healthiness and quality of life of citizens.

The direct beneficiaries of the intervention are the owners, private landlords and tenants of two hundred and forty residential buildings in Ashley, Easton and Lawrence Hill (predominately Easton and Lawrence Hill). The majority of the residential building stock was built many years ago, is of low energy efficiency, and thus has comparatively high-energy consumption. As mentioned before, many of the owners and tenants are low-income households. The intervention benefits them in comfort and saving matters, but also in economic valuation of their dwellings. This is an important question because it increases residential assets of low-income households and avoids critical factors such as gentrification.

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The delivering value of the business model for direct and indirect beneficiaries needs the buy-in of the owners, landlords and tenants. As mentioned before, there is a general sense of mistrust regarding the government due to the previous situation regarding Climate Energy, where many customers were left in a difficult situation. Furthermore, the situation is difficult for Warm up Bristol, because there are a lot of different measures to tackle domestic energy, but mainly there is no UK government incentives and people generally do not want or cannot afford to pay for these energy measures. To this end, it is difficult for Warm up Bristol to sell the value proposition of its business model. Despite the mistrust among citizens and the lack of UK government incentives, it is important to mention again that the socioeconomic profile of customers make difficult to handle such energy efficiency cost measures. Furthermore, not all customers are low-income households and so benefit from ECO (Energy Company Obligation) funded measures.

Finally, the delivering value of the business model implies the implementation of the energy efficiency measures. In this case, Warm up Bristol, as will be seen for the producing of value, uses many key activities and resources to implement the measures. The intervention covers many different actions, highly integrated, such as boilers, cavity wall & loft insolation and solar PV. But the election of these measures for the retrofitting package strongly depends on the individual owner's decision and the funding that each measure receives.

The producing value of the business model implies multiple and varied stakeholders. The stakeholder's structure is classified by those who: i) promote the retrofitting – EU, The Bristol Council and Warm up Bristol; ii) finance/fund the retrofitting – EU, Bristol Council, and other institutions such as banks, etc.; iii) produce and deliver value – KWMC, Energy Bristol, the sustainable energy group, energy and construction companies, architecture and energy experts, professionals (individuals and SMEs). This stakeholder's structure means several continuums, such as the public/private regarding the retrofitting and the financial/funding suppliers, and the SMEs/large companies regarding the type of professionals. This situation can be understood as a strength of the model because it tackles the whole picture of actors but must be carefully defined in order to manage precisely such variety of stakeholders.

The business model involves different types of key activities. Principle ones are the consultancy services; construction works; financial assessment; quality and guarantee control; supply chain control; community engagement; and selling activities. As mentioned before, due to the Green Deal situation, nowadays Warm up Bristol concentrates the service in-house. They decided to take the service in house instead of having a managing agency, so they have their own consultancy services, composed of energy experts and architecture, and controls and guarantees constructions works offered by suppliers (energy and construction companies, SMEs, professionals, etc.). To sum up, they control and manage the value chain of the service, which means the producing and delivering of the value proposition of the business model. To this regard, this new scheme, offered by a non-profit organisation, let's say a public institution, clearly brings confidence to customers and value for the city. In fact, the benefit

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for a homeowner when searching for a good provider is that Warm up Bristol follows a strict procurement process in order to have suppliers on board. They make sure that these suppliers can be trusted in terms of job tasks, quality and guarantee offered. On the other hand, this positive aspect turns also on a negative aspect because of bureaucracy processes.

It is important to mention too, all the work that Warm up Bristol is doing to think about something more socially, meaning to bring people together, have more engagement, and work hand by hand with different type of organization such as KWMC (for community engagement and empower citizens' rights) or the Centre for Sustainable Energy (for resources, search for funding, knowledge, new initiatives, etc.). To sum up, the new scheme clearly focuses on a centralised management to produce and delivery, but using a bottom-up approach to involve, represent and tackle citizens' main needs, pains and rights. As mentioned before, the retrofitting intervention for energy efficiency measures in Bristol linked to the REPLICATE projects clearly follows "The Bristol Approach".

Besides these activities, the business model lies on key resources and infrastructures. Obviously, the most important element is the new scheme that the Bristol Council has set up through its brand Warm up Bristol. This scheme, based on "The Bristol Approach" strategy, has in-houses services and procedures to overcome environmental goals but with a strong focus on citizens to offer confidence, quality and guarantee. One of the aspects of the model is its independence regarding market providers. The professional staff is highly qualified and counts with the figure of a project manager, as well as energy experts, for all interventions, who maintains this independence regarding the market of retrofitting. Thanks to this scheme, the brand has a well-known contractors' network. Another important resource is related to finance and funds. Warm up Bristol offers some of the measures for free because of EU funding, but also ECO (Energy Company Obligation) funding for those eligible households' profiles and loans at 0% interest.

Finally, the sustainability of the business model focuses on the triple bottom line: costs/revenues, environmental costs/benefits, and social risks/benefits.

As observed in figure 16, Warm up Bristol has different sources of revenue streams: EU projects grants, in this case the EU grant from the REPLICATE's project (short term); customers' payments for retrofitting works because not all interventions are subsidized; private owners and tenants taxes for building and planning permits; price per tone of CO_2 avoided that can offer the Municipality a grant by the EU; and finally, citizens' public taxes that are allocated by the Municipality in energy efficiency and social policies.

Besides these sources of revenues, we believe that the model should also highlight savings in the municipal budget allocated to reduce the fuel poverty situation of households. As identified in the value proposition of the business model, the retrofitting intervention impacts in reducing consumptions and households' energy bills. This fact might affect fuel poverty in a positive way because households will have to pay less for energy. Obviously, this assumption is something that has to be evaluated and monitored. According to Warm up Bristol, they

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would like to measure this impact as well as others regarding social, health and quality of life, but right now this is just a future plan.

In general terms, the revenue streams of the model are weak. From a market point of view, the business sustainability depends widely on the public administration economic support. The Bristol Council pays for the infrastructure, resources and workforce of Warm up Bristol, covers some of the retrofitting works through subsidies and offers loans at a 0% interest, which means that they are covering the risk.

The environmental impacts are highly positive. The most important environmental impact is the decreasing of CO_2 due to optimization, energy efficiency and production of renewable energies, as well as less air pollution. The decreasing impact will be measured by multiplying tons of CO_2 avoided by price per ton. Regarding the environmental costs, there are i) the impact in energy use during the retrofitting intervention (short term), and ii) the rebound effect (Copiello, 2017). The first one has a short impact that lasts just during the intervention, but the second one, the rebound effect, has to be carefully tackled. The rebound effect produces an increase of energy use; owners/tenants tend to use more energy because they pay less money in energy bills. In order to avoid this effect, the energetic resources' savings must be higher or at least equal to expected savings. Thus, the presence/absence of the rebound effect is crucial for the sustainability of the business model to achieve the environmental objectives, such as the decrease of CO_2, or the reduction in energy consumption and energy bills.

Finally, as observed in figure 16, the social impacts are also quite high. We can highlight the followings ones: i) the decrease of fuel poverty and so the deprivation standards: ii) the increase of urban healthiness due to dwellings comfort; iii) an increase of social capital and cohesion of citizens due to community management activities; and iv) the economic development, measured by jobs and companies created or offering services and their impact in Bristol and concrete neighbourhoods where the intervention takes places.

6.3.4 Final remarks

The City Council of Bristol, thought its Warm up Bristol brand, presents an attractive VPC and CMC proposal for retrofitting in order to save money on households' energy bills and encourage the reduction of carbon emissions through energy efficiency improvements in their homes. Besides environmental impacts, must highlighted the emphasis of the VPC on the quality of life of citizens. In particular, the emphasis on the increase of owners' and tenants' quality of life thought comfort improvement of their dwellings, as well as cost savings for them in energy bills. Comfort and saving are important aspects of the VPC because the scope of the intervention targets low-income households and consequently, fuel poverty problems.

Warm up Bristol offers and ensures an effective process for quality management of the works from a public view. To this end, Bristol has taken the service in-house in other to not led the intervention just to market operators, offering energy audits and counselling through their energy experts, financial and funding schemes through 0% interest loans and funds regarding

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some concrete types of interventions. This centralised management to produce and delivery value is also accompanied by a bottom-up approach – based on "The Bristol Approach" – to involve, represent and tackle citizens' needs, pains and rights. This is a crucial approach because the public value that Bristol is offering incorporates the beneficiaries.

On the contrary, can be concluded that the value proposition and its business model fit in the One stop shop model (Brown, 2018), where there is a customer interface (a point of contact) represented by Warm up Bristol to offer the rehabilitation package accompanied with funding and financial schemes, but saving are estimated rather than guaranteed such in the ESCO model. The business model focuses on energy efficiency measure through multiple measures with an emphasis in energy cost savings, fuel poverty and quality of life, but as already mentioned energy cost savings are estimated rather than guarantee. Monitoring and evaluating activities of the service would contribute to offer a better estimation of the energy cost savings of the whole measures.

From our perspective the engagement of owners and tenants is key in Bristol because this engagement represents the bottleneck for retrofitting residential dwellings. Furthermore, having a customer interface such as Warm up Bristol reinforces the model. But, in order to scale-up the interventions Bristol should considerer growing towards an ESCO model, which offers risk sharing schemes and guarantee savings. On the contrary, this will not have sense if it is not accompanied by public administration financial effort in providing long-term funding to engage low-income property dwellings.

6.4 Knowle West Media Centre

6.4.1 Organization's presentation

Knowle West Media Centre (KWMC) is an arts centre and charity organization based in South Bristol since year 1996[13]. KWMC's mission as an organization is to engage with citizens through art and technology supporting individuals, families, and communities to get the most out of digital technologies. KWMC believes that by enabling people to understand technology better, and to co-design it with other stakeholders such as business, universities and local authorities, technology will be used in a beneficial way for good social outcomes.

Regarding the REPLICATE project, KWMC leads on community management activities in the demonstrator area of the Bristol pilot. This management responds to its extensive experience in community engagement, through which they have developed "The Bristol Approach" and

[13] Source: https://kwmc.org.uk/about/

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co-designed human-centered technology. "The Bristol Approach" is a key methodology in all activities from the organization, how it works with and support others. KWMC is a transversal partner and enabler stakeholder in the community for change.
KWMC also supports the Community Engagement Group led by Bristol Energy Network. The aim of this group is to recruit and support households to participate from a wide demographic to reflect the project area.
There is a particular focus on involving groups who might not traditionally engage with technology projects of these types. An example of these technologies are the frog and Ladybird sensors. At the end, KWMC has been working in the REPLICATE project to develop these approaches, networks, technologies…a whole set of tools on how to engage people and do it in a sustainable manner over a long time period.

6.4.2 Customers and value needs

The value proposition of KWMC fits perfectly with customers (citizens) needs. The reason is that KWMC was created in order to offer an answer to this type of customers or citizens who are frequently not considered in the development of technology. These citizens, who might come from working class neighborhoods and find themselves in a situation of inequality in different aspects that define their quality of life such as job, health, housing, material conditions, environment, etc. In this analysis, this customer must be understood as the beneficiary from different public policies interventions. To this end, KWMC's customer is the City of Bristol who wants to set up and apply a set of different interventions from the REPLICATE project that clearly affects the citizen. As it is shown below, figure 17 shows the Value Proposition Canvas (VPC) of KWMC intervention and provides a clear vision of the relation and interface between the market and the service. In this sense, the market must be understood as the citizens, who represent the main beneficiaries of KWMC services to tackle Bristol's city needs.
The first segment, the customer map (demand side), as mentioned in chapter 3, identifies the jobs and tasks customers want to perform, the negative aspects they want to avoid, and the positive aspects and benefits customers want to gain from the service.
From the perspective of customers, as observed on the right side, customers' jobs, there is a clear need from the City of Bristol to set up a smart city context based on sustainability understood this as economic, social and environmental sustainability. Additionally, this sustainability has to incorporate citizens' needs, opinions and experiences. Furthermore, it must be built from the citizen perspective, in addition to other classical stakeholders such as policy makers, decision makers, technicians or energy experts. This fact implies the task for citizens' engagement. In this scenario, the City needs to put in place different actions in the pilot area of REPLICATE's project. To this end, almost all interventions need the participation of the residents. Furthermore, as mentioned, the City of Bristol needs their participation to understand citizens as an active subject rather than as a passive subject. For this reason, it is

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key to enter, work and learn from residents to offer sustainable solutions. At the end, the City actions need a clear emphasis on energy and technological efficiency to keep developing and growing in a smart city context, which undoubtably must impact the quality of life of citizens as well as being eco-friendly for the city.

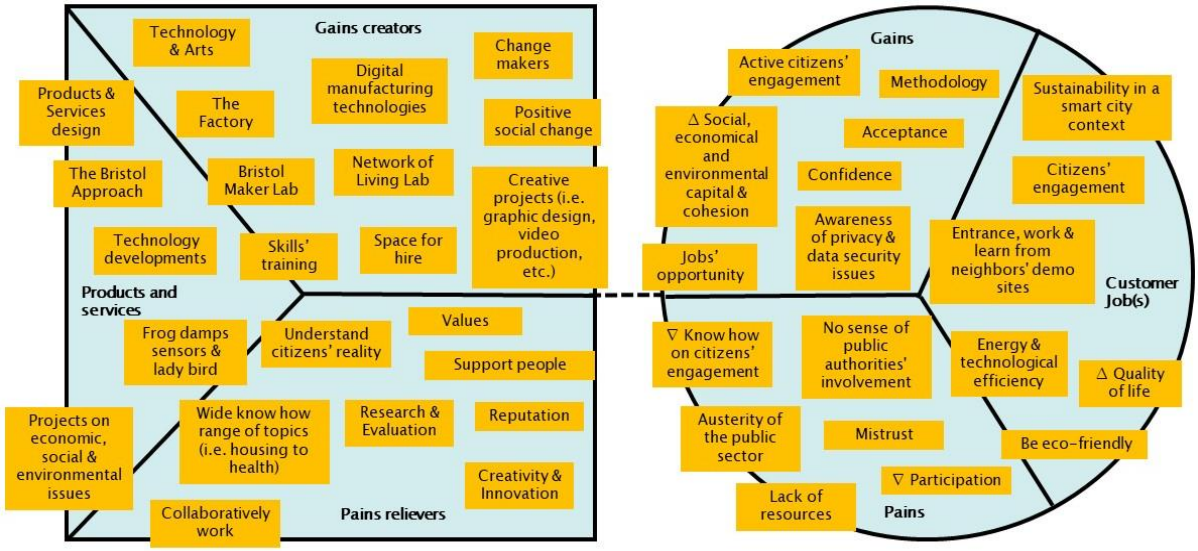

Figure 17.- Value Proposition Canvas of KWMC

Regarding pains, aspects that lead to negative emotions of customers, the main aspects involve a low level of know-how of engaging citizens in their proposed solutions. Furthermore, it is not just about the know-how, it is also about having appropriate resources, suitable skills, and extend experience on the topic. In fact, the City does not have a complete understanding of the "habitus" (Martínez, 2017), concept that is understood as dispositions or schemes of acting, thinking and feeling associated to determined social positions. Even more, it is a matter of social and linguistic codes. In addition to this concrete pain, the public sector has been on an austerity line which implies a lack of resources, particularly on wellbeing resources that clearly affects social and environmental public policies social to tackle inequalities. This situation clearly impacts citizens' mistrust and participation on public bodies.

On the other hand, gains, aspects that led to positive emotions and make easier customers' tasks, there are several opportunities. Obviously, the City of Bristol wants to gain an active citizens' engagement and in order to get that the City needs to gain a methodology, a concrete set of methods, techniques and skills of scientific rigor to be applied systematically during the process of pilot interventions to achieve valid results. This gain should lead to a higher gain that means the testing of pilot interventions to increase social, economic and environmental capital and cohesion in the city. To reach such gain, the City wants the acceptance of citizens

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in such process which implies offer confidence and awareness of privacy and security data issues. Obviously, the City wants an increase of the quality of life of its citizens, which often starts with quality job opportunities.

The second segment, the value map (supply side), describes how the proposed business model challenges customers' expectations and the proposed value for the use has to be created. To this end, as observed on the left side of figure 17, products and services clearly tackles many of customers' jobs and tasks.

KWMC designs many different types of products and services using arts and technologies. Regarding the REPLICATE project, KWMC has developed the Bristol Approach Framework working with two organizations: Ideas for Change[14] and Bristol City Council[15]. This approach is a new way of working that puts communities and their needs at the heart of innovation. Following the conception of the citizen as an active participant, "The Bristol Approach" as a methodology designs and incorporates tools and resources to help group work together to identify and tackle the most pressing issues in the city – from poor air quality to food waste. This framework is being used to aiming for increasing digital inclusiveness in excluded communities. To this end, KWMC addresses the needs of this population when using technology.

Under the Bristol Approach framework, citizen sensing is about empowering people and places to understand and use smart tech and data from sensors to tackle issues they care about, connect with other people who can help, and take positive and practical action[16]. As part of the REPLICATE project, KWMC as well as other stakeholders, collaborate to run two concrete pilot interventions: damp homes[17] and air quality[18].

Regarding the damp homes pilot intervention, a major problem in Bristol because it affects people's health and wellbeing, the pilot brought people across Bristol together to create a new community-led solution to tackling these types of homes, using a mix of sensing technology, community know-how and existing open-source resources. Through co-design workshops, there was created a "damp busting" system with a prototype frog-cased sensor to gather temperature and humidity data in homes affected by damp. The system enables residents to understand the difference between condensation and damp, as well as co-design a prototype.

[14] Source: https://www.ideasforchange.com/en/
[15] Source: https://www.bristol.gov.uk/
[16] Source: www.bristolapproach.org/
[17] Source: www.bristolapproach.org/bristol-approach-projects/damp-homes/
[18] Source: www.bristolapproach.org/bristol-approach-projects/air-quality/

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Figure 18.- Prototypes of the frog sensors[19]

Regarding the air quality pilot interventions, another major problem in Bristol is air pollution that has adverse health effects in people. KWMC worked with communities from the pilot area to develop playful and accessible digital tools to help collect and interpret air quality data in order to take measures and act. Through different types of groups and collaborative working, was created the Ladybird Air Quality mobile sensor, a portable sensor to attach to bicycles, bags or cars to gather NO_2 data on move.

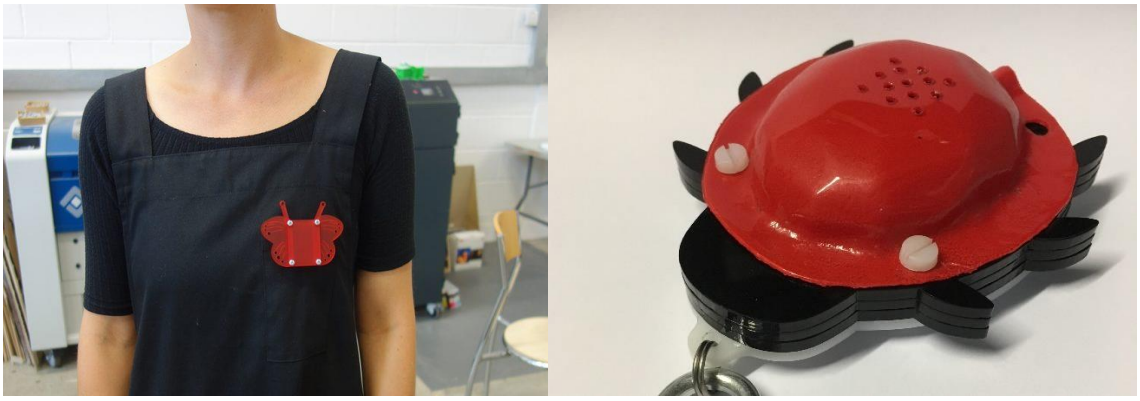

Figure 19.- Prototypes of the Ladybird sensors[20]

To this end, KWMC offers different pain relievers that tackles customers' pains. The main one is the understanding of daily citizens' reality, their conditions of quality of life and how these conditions situates them in high levels of relative poverty, as well as fuel poverty, low levels of economic, social and human capital, or even digital inclusiveness. KWMC has a long track record, experience and reputation in working with people as well as many bottom, horizontal

[19] Source : https://www.bristolapproach.org/bristol-approach-projects/damp-homes/
[20] Source : https://www.bristolapproach.org/bristol-approach-projects/air-quality/

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and transversal groups and organizations. In this respect, KWMC represents a key anchorage for the community. Furthermore, the organization is built under a set of values – equity, collaboration, integrity, resilience and imagination – that clearly frames the needs of citizens, as well as the city. These values constitute the basic element for its bottom-up strategy to improve quality of life of citizens and environmental issues. Besides these pain relievers, the work done in the REPLICATE project – engagement, technology, etc. – shows how collaborative work and research, under a robust engagement methodology, leads to creative and innovative solutions of inclusiveness.

Finally, KWMC has many gain creators, solutions that lead to customers' benefits. Among these gain creators highlighted in figure 17, there is The Factory. This is an innovation space for making, digital fabrication and product design where it is also offered training – courses – and enterprise support to everyone. Both frog and Ladybird technologies were fabricated at The Factory. Also KWMC runs Bristol's Living Lab, a "real-life test and experimentation environment" where citizens, artist, technologies, businesses and public sector organizations can come together to create ideas, tools and technologies to address local challenges, innovative and explore new possibilities. At the end, all these resources, among others, are space to facilitate collaborate work, creativity and innovation which enable KWMC to be a positive social agent and a change maker for the city.

6.4.3 Business model

The second business tool to analyse the business model is the Mission Model Canvas (MMC). Figure 20 describes the MMC of KWMC services. As mentioned in chapter 3, the MMC reflects the logic on how the city is creating, producing and delivering public value in a way that is economically viable, social inclusive, and environmentally sustainable.

The mission statement of the business model is achieved social, environmental and economic regeneration by involving the community in media activity, education and action. The intervention from the REPLICATE project is a clear effort from KWMC to achieve social engagement as well as introducing technologies with a clear environmental impact. In summary, its approach entails many economic, environmental and social benefits.

As mentioned for the VPC, the value proposition of the business model is to engage citizens from Ashley, Easton and Lawrence Hill area of the City of Bristol. This is the task that the Council has entrusted KWMC because they do not have the specific know-how as well as appropriate resources. It is not just about the know-how and resources; it is also about the vast experience and long-term network infrastructure that KWMC already have. To this end, this engagement should be understood as an empowerment of citizens as well as other stakeholders that form the associative and organizational community network. This empowerment implies engaging citizens as well as making them active subjects, change makers, through a process where the individual, group or community acquires a set of

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knowledges, abilities and tools to increase its rights, confidence, capacities and potential towards positive social change.

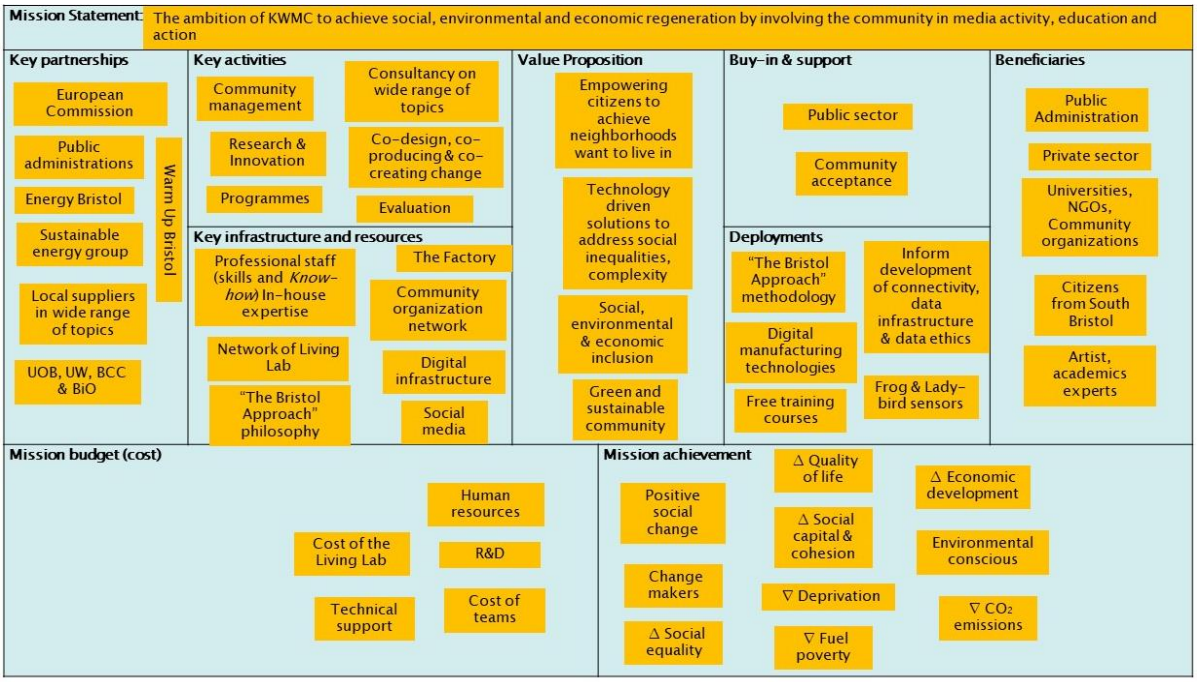

Figure 20.- Organization Model Canvas of KWMC

Furthermore, the process for creating technologies such as the frog and Ladybird sensors, shows a robust methodology – based on "The Bristol Approach" –, where this empowerment is made real and demonstrates how digital technologies can improve quality of life of citizens as well as the city itself. Using a bottom-up approach, "The Bristol Approach" for citizens sensing clearly shows how technology solutions start from the needs of citizens, as well as the environment. Finally, it should be apparent, that KWMC products and services always aim to be inclusive and sustainable.

The direct beneficiaries of the pilots' project are citizens from the intervention's areas as well as all stakeholders. The pilots have many different types of direct beneficiaries, such as home owners or tenants for smart homes, but also other groups involved in the different technological solutions. For example, for the case of the damp homes, there were involved university researchers, businesses, hackers, open data specialists and council representatives for housing, environmental health, building control, etc. And for the case of the air quality, there were also other groups interested in the topic such as cyclists, schoolchildren and their parents, taxi drivers or social housing tenants.

The delivering value of the business model needs two concrete buy-ins'. The first one regards to the public sector and it may be the most important. The reason is that grants and funds

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received by the public sector represent a huge percentage of KWMC incomes in its economic balance[21]. In this sense, the business model of KWMC currently relies too much on these types of income. Furthermore, the shift in public administrations led to different priorities and challenges in delivering programmes such as KWMC ones. In fact, current socio-economic factors (e.g. austerity in the public sector) have a knock-on effect on the charity and arts sectors.

The second one regards to the community acceptance. Obviously, this one should be the most important because if there is not the buy-in, the mission as an organization does not make sense. On the other side, KWMC already have this buy-in because of its long track record and experience working towards the neighbourhoods and its communities. The success from the REPLICATE project must be taken as an indicator of the citizens' valuation and trust in KWMC.

Finally, delivering value of the business model implies the implementation of the pilot measures. The first deployment is the Bristol Approach Framework for citizens engagement. As observed in figure 20, the approach is based on a six-step methodology, which enables different stakeholders to work collaboratively in order to address social and environmental issues such as the ones for damp homes and air quality solutions.

The production of value of the business model implies multiple and varied stakeholders. KWMC has the capacity and facilities to work with a broad range of stakeholders as already mentioned. Obviously, the public administration support at all levels, it is a key stakeholder for promoting this type of solutions and finance and fund them. Its authority and influence often support the way of working and help highlight and address key issues. Also, KWMC is a small team working across arts, creative and cultural industries, young people, volunteers and research and community engagement agents that must be considered as key stakeholders for the organization. Obviously, there is also a wide range of organization from local authorities, housing associations, health networks, universities and tech businesses that play a key role too. KWMC is part of the European Network of Living Labs, are Bristol's Living Lab and have been working with partners in the South West and across the UK to establish new markets.

Regarding the stakeholder's block of the KWMC's MMC, the important thing to underline is that the organization has the capacity to work with specific topic organizations in themes such as housing or health; with transversal topic organizations in themes such as energy efficiency or environment; and with a range of organizations from a bottom-up perspective, from community organizations to local, national and international authority organizations. In this regard, KWMC is not just selling product and services, it is also offering many types of network access that could be of great value for customers. This situation can be understood as a strength of the model because it tackles the whole picture of actors but must be carefully defined in order to manage precisely such variety of stakeholders.

[21] Source: https://issuu.com/knowlewestmedia/docs/kwmc_2019_annualreport

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Figure 21.- The Bristol Approach Framework[22]

It is important to highlight too, that the smart ecosystem of Bristol is unique due to its creative led industries, rich cultural backdrop and diverse cultural communities. Bristol is a fertile environment for tech start-ups, test spaces and new innovative thinking. In 2017, Bristol was named UK's no.1 smart city by UK smart cities index[23]. This fact clearly helps the stakeholder's structure of KWMC and enables many types of contacts, specific knowledge and experience in many different fields. For example, the ecosystem has served smart homes and the citizen sensing pilot projects as a useful way to test solutions as well as stakeholder's ability to work successfully together.

The business model involves different types of key activities. There must be highlighted the community management activities, as well as research, evaluation and consultancy in many different topics affecting the community with the aim to bridge the gap between those thriving and those struggling in the city and increasing their opportunities for skills and employment in Bristol. Also, KWMC has activities for co-designing smart citizen innovation in accessible digital manufacturing facilities and creating cross city networks that support open, scalable, inclusive civic participation.

Regarding innovation, KWMC supports the development of knowledge and new insights for the benefit of communities and city stakeholders with the Council of Bristol, University of Bristol and University of the West of England. Additionally, knowledge transfer between cities such as Barcelona with Ideas for Change helped drive the local development of sensing

[22] Source: http://kwmc.org.uk/projects/bristolapproach/

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technology. Workshops on using "The Bristol Approach" have been used primarily in Bristol, but the methodology, especially in respect to engaging communities, is seen as Best Practice in the region. This can be shown by Public Health England requesting Bristol Approach workshops at a Southwest of England conference on air quality. Working with colleagues at Universities and influencing local policy by supporting people to create the neighbourhoods and city they want through the delivery of digital community test beds (including BIO, Bristol Approach to Citizen Sensing, The Factory.)

Besides these activities, the business model lies on key resources and infrastructures. As already mentioned, "The Bristol Approach" as a working philosophy and based on a set of values is an in-house resource per se, as well as the professional staff know how who among other expertise have contribute to develop this approach. Also the different network that KWMC has built with its partners and clients along many years, with concrete emphasis on the community network. As mentioned, KWMC capacity to access, build and maintain these networks is of great value for clients. Regarding infrastructures, "The Factory" needs to be highlighted, as an innovation space for making, digital fabrication and product design, and the Living Lab, where KWMC offers a "real-life test and experimentation environment" for a wide variety of stakeholders. In fact, the digital manufacturing facility is considered a competitive advantage for the organization, as well as its networks, years of community engagement experience and know-how expertise.

As observed in figure 20, KWMC has different types of costs. The most significant ones are related to the team and R&D technical support. Obviously, the workforce is the more important one, but also the cost of the Living Lab maintenance. The problem, as stated before, is that the business model relies too much on public funds. This is not a problem per se if this source of revenue maintains constantly, but flows into a problem when these funds are not constant in long time. To this regard, from a traditional business market point of view, the revenue streams of the model are weak; the business model sustainability depends widely on the public administration economic support.

The environmental impacts are highly positive. The most important environmental impact is the decreasing of CO_2 because of pilots but also the contribution as well as the change made for environmental conscious.

Finally, as observed in figure 20, the social impacts are many. The most important one could be the better standards of social cohesion and improvement of quality of life, which are at last key aspects of the mission statement of KWMC. At the end, KWMC is working to increase social equality. Also, KWMC actions decreases fuel poverty and technological deprivation and contributes to the economic development in communities. Regarding the REPLICATE project, its forecasts are meet, especially those focused in community engagement, which means social empowerment and cohesion.

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6.4.4 Final remarks

The value proposition of KWMC is increasingly attractive as city stakeholders acknowledge the failings of technology to address social inequalities as well as the complexities surrounding for example trust and acceptance of technology. In fact, one of the key competitive advantages of KWMC is this knowledge about what is really going on in communities regarding the relation between technology and citizens and how this knowledge in acquired through a well-tested approach such as "The Bristol Approach". Furthermore, KWMC networks are of great value, at local, national and international level, for a variety of topics. This value is important for accomplishing KWMC's products and services, but also as a value per se to be sold in the market. The possible clients' portfolio would pay for such value as many are already doing so. From our perspective – safeguarding distances –, KWMC has to identify those aspects from the value chain that are key to create, produce and deliver its value proposition, which entails a great public value. These aspects have to concentrate the majority of economic and human resources to ensure sustainability of the model in concrete products and services that imply a higher return. In this sense, as already mentioned, from a traditional business market point of view, the business model relies too much on the public administration support. This source of revenue is not a problem per se if there is a long-term relationship, but entails a certain risk because shifts in Administration led to different priorities and challenges in delivering programmes.

To this end, according to KWMC, there is the need to clearly market its services such as The Bristol Approach, and the technology products such as environmental sensors, to private companies as well as continuing with public administrations, organizations and universities. In this sense, there should be a clear identification of the portfolio and identify the customer for each product and service. It is important to know who would be most likely to buy each product and service. Although KWMC approach the competition in a win-win relation, as stakeholders which can work collaboratively for a common purpose, it would be useful to carry out research on the competition who offer similar products and services and study their strategies, business models and relationships and channels to reach the customer. With this research, KWMC can define the right relations and channels to get to the customer. In this regard, we believe that the selling argument for every product and service to every customer should be based in a clear definition using a tool or similar to the VPC develop in this analysis which implies the definition of the business model as well. Although there has been presented a general analysis using the VPC and the MMC, these tools would also be useful for analysing each of KWMC's products and services.

From a non-profit organization perspective, we believe that research and evaluation of the impact of products and services are key in selling proposals, especially with public administrations. In this sense, a methodology based on the return of the investment should incorporate economic, social and environmental impacts to the cost/revenue's streams. Nowadays, many public procurement processes incorporate such specific demand. The impact

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of KWMC work, as well as products and services offered, has many interesting social and environmental items – already explained – that could reduce paybacks from the customer because imply gains such as savings in a variety of issues. Many intangible aspects can be monetized in order to incorporate them to the selling proposal applying methodologies[23] such as SROIs (Social Return On Investment), SIA (Global Social Venture Competition), SEAT (Socio-Economic Assessment Toolbox) or TSI (Total Societal Impact). These are methodologies which captures the economic, social and environmental impact value of the organization.

6.5 Retrofitting discussion and scale-up strategy

Cities play a key role in fighting against climate change, decreasing greenhouse gas emissions and improving energy efficiency (Ahvenniemi et al., 2017). As observed from all business model analysis, Municipalities, as well as the different levels of public sector territory (supranational, national, regional or local), are key stakeholders in this type of projects. San Sebastian, Florence and Bristol use different types of strategies to tackle the need of retrofitting actions for environmental and social issues in the REPLICATE project. San Sebastian promotes through Fomento San Sebastian (FSS) retrofitting actions and energy management solutions in private buildings through private companies, in this particular case Giroa; Florence uses a public company, Casa Spa, to manage its public social housing stock; while Bristol has decided to tackle the problem in house throughout Warm up Bristol and KWMC's engagement framework. To this end, solutions regarding energy efficiency and retrofitting works of old housing stock, clearly needs to be addressed from a public policy strategy.

Furthermore, beyond environmental issues, municipalities must solve many social issues related to these types of dwellings. As we have observed, the principle beneficiaries of all interventions are households affected by fuel poverty, socioeconomic inequality, and relative poverty. To this end, buildings and dwellings are one of the most relevant elements of cities and they could be understood as the center of human activity and contribute to the welfare of the population (Pearce, 2017). In fact, buildings and dwellings are high greenhouse gas emitters and energy consumers. Figure 22 shows CO2 emissions and energy consumption by sector for year 2017. As we can appreciate, the building's sector presents 39% of total CO2 and consumes 42% of total energy (sum of operation, materials and construction). In comparison, it is the sector with highest percentages for both issues.

[23] Source: https://www.crecimientoinclusivo.org/blog/metodologias-medicion-del-retorno-social-de-inversiones/

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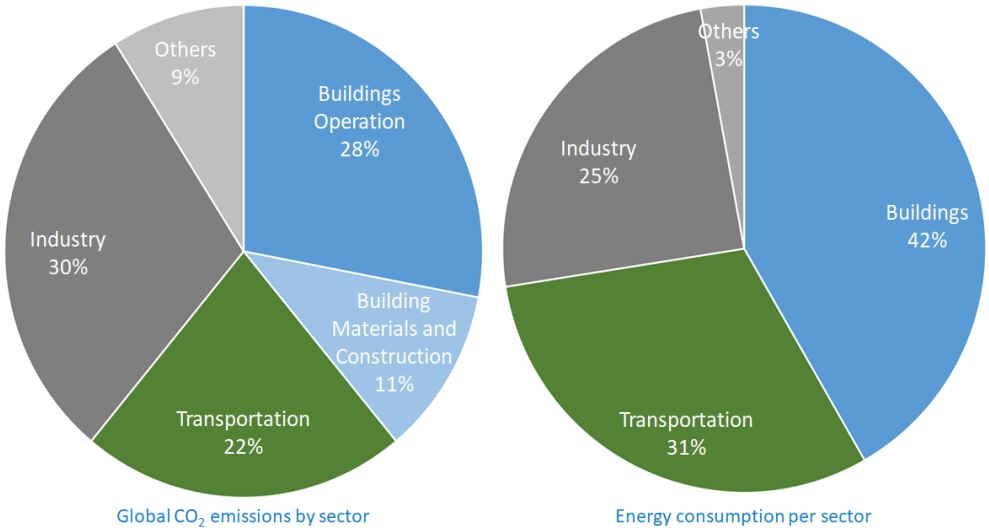

Figure 22.- CO_2 emissions (UN Environment, 2017) and energy consumption (Eurostat, 2017)

These issues clearly show the need to improve energy efficiency to reduce emissions. This is a key aspect because retrofitting interventions such as those done in the REPLICATE project imply many positive impacts. Among these, the authors highlight access to new energy sources and reduced dependency on energy from others; improvement of air quality, indoor comfort and quality of life; minimization of global warming; reduction in operational and maintenance costs; and increased social well-being, especially for low-income households.

In order to accomplish European and national directives to get to the SECAP objectives, the crucial aspect from all business models relies in the cost/revenue elements. Obviously, the delivering value of the business models requires the buy-in of politicians, as well as coordinatization and common goals from different types of territory political levels; also the producing value, requires strong public private structures and collaboration between them; but the crucial aspect relies on the cost/revenue elements. As mentioned in the analysis, all three business models rely on public funding to solve energy efficiency and retrofitting works in this type of dwellings. Giroa, as a private company, cannot afford or assume the risk of the investment for energy solutions because of the type of customer segment and the novelty of its business model. Community buildings do not understand energy efficiency models and often are get used to traditional and passive retrofitting works. Its business model is just taking it into account as an opportunity window to get the fund. Casa Spa is constructing interesting nZEBs initiatives in new building, but its business model regarding social housing retrofitting depends on municipal budget as well as household rents, which are under market conditions. Finally, Bristol relies also on municipal budget and public funds from different stakeholders. At this point, although benefits of building and dwellings retrofitting in

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environmental and social issues are clearly highlighted by many actors, the risk of the investment can only be assumed by public bodies.

The EU is trying to overcome obstacles that prevent the implementation of energy efficiency and retrofitting measures in buildings and dwellings. As mentioned, these obstacles refer to economic dimensions, but also technical and social dimensions related to retrofitting. Regarding the economic dimension, as mentioned, the barriers are the high up-front costs, transaction costs, cost efficiency criteria, risk sharing, public financing, private investment, and paybacks, among others (Menegaki, 2012; Fredericks et al., 2015; Hargreaves et al., 2017; and Regnier et al., 2018). As for the technical dimension, the main obstacles include the complexity of large-scale renovations, lack of concrete integrated definitions, and lack of experience in the industry (Moschetti & Bratebo, 2016; Streicher et al., 2017; and Regnier et al., 2018). In terms of the social dimension, and especially regarding owners, the main concerns are lack of information and awareness of energy issues, absence of clear financing and funding schemes, and the overlap of public and private retrofitting programs (Economidou & Bertoldi, 2014; Fredericks et al., 2015; Weber et al., 2015; and Lesic et al., 2018). Given these challenges, municipalities have to play a crucial role, at least in an initial phase, in the deployment of projects of this type by reducing the risks and uncertainties and by acting as leaders, regulators, facilitators, operators (owners) and customers.

Beyond cities pilot projects, the main objective of lighthouse cities is to define a clear strategy to surmount many of the obstacles existing today that prevent the take-up of energy efficiency measures in buildings and dwellings. The results obtained along this analysis have been key to identifying the principal aspects/activities of building retrofitting strategy, which could be divided into two main phases. The first of these is for the intervention to be clearly led and developed by cities' governments, and the second entails the strong collaboration of their citizens. Figure 23 presents the set of activities and its timeline sequence.

In the first phase:

1- Municipalities should offer a clear and efficient customer interface that takes responsibility for the entire retrofitting project, facilitating the owners' daily management from the beginning of the project through its completion.
2- The City Council should launch information and training campaigns with the objective of explaining to citizens what benefits and risks these projects present. In addition, the municipality should inform them about the opportunities (economic and technical resources) offered by public administrations.
3- Municipalities and other public administrations should promote through specific regulatory frameworks and fiscal initiatives the Energy Performance Contract (EPC), applied by Energy Saving Companies (ESCOs), where savings are guaranteed. In this contract, the lender captures energy savings and credits them back to property owners based on historic consumption levels (Boza-Kiss et al., 2017).

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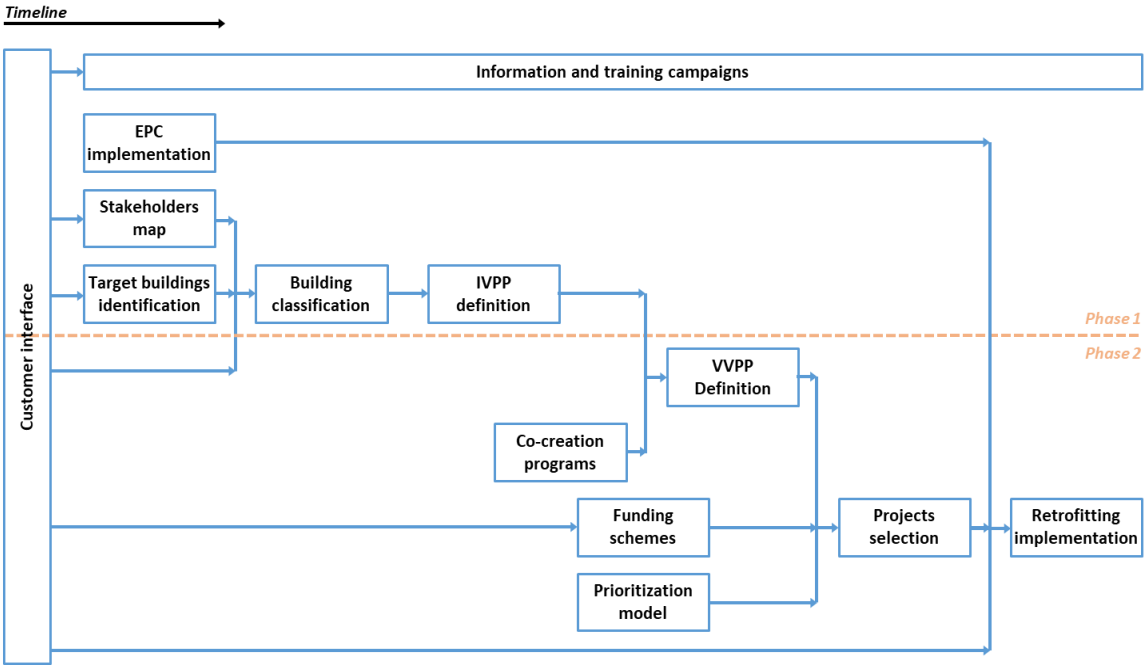

Figure 23.- Retrofitting scale-up general strategy

4- Municipalities should create a precise stakeholders map, identifying all the actors that could participate in retrofitting projects. This list should classify experts, companies, research and technology organizations, social agents, and other public administrations such as regional or state governments.
5- Municipalities should identify those building that are potential targets for retrofitting interventions developing a general diagnosis. Cities' governments should have a broad knowledge of the state of their housing stock.
6- As an essential part of activity 5, municipalities should categorize each building according its owners' socioeconomic status and its architectural (structural) features. These two factors will be key to defining possible interventions.
7- Finally, municipalities and retrofitting experts should define for each potential target building an Ideal Value Proposition Project (IVPP).

In the second phase:

8- Municipalities should develop different co-creation programs for involving citizens in cities' strategy definition. These programs are understood as an intimate form of cooperation and can significantly increase citizens' satisfaction.
9- Considering the IVPP, and thanks to co-creation programs, owners, municipalities, and construction companies, working in a public-private-people partnership framework,

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should define a Viable Value Proposition Project (VVPP) which owners trust and feel comfortable with.

10- Once the different VVPP are defined, municipalities should develop a decision-making methodology for prioritizing and selecting those that they consider strategic for the development of a sustainable city in term of social inclusion, environmental protection and economic viability.

11- Municipalities should offer financing and funding schemes for owners, according to their limited resources and capacities. These schemes are key to de-risk investments and to engage those owners who are willing to retrofit their apartments but lack the resources to do so; concretely this refers to low-income households that cannot afford high up-front costs and long payback periods, or housing associations that offer affordable rental prices.

12- Final project selection and deployment.

6.6 District Heating – Fomento de San Sebastian

donostiasustapena
fomentosansebastián
DESARROLLO ECONÓMICO DE SAN SEBASTIÁN

6.6.1 Company's presentation

Fomento San Sebastian (FSS) is a local public society dedicated to the economic and social development and promotion of the city of San Sebastian / Donostia (Spain), through innovation, knowledge generation and transformation, networking, and project fostering and management, all under sustainability criteria.

Fomento San Sebastian was created more than a century ago for the construction and management of cultural facilities and hotels, and today is the Town Hall instrument for sustainable economic development of San Sebastian. The plenary session of Donostia / San Sebastian decided in 2004 to transfer all the rights and obligations of the Direction of economic development, Employment and Commerce of Donostia/ San Sebastian to the Society Fomento de San Sebastian. The legal structure of the company permits a more dynamic performance compared with other municipal departments.

FSS is the public society of Donostia / San Sebastian dealing with the economic and sectorial innovation development of the city. FSS is leading and driving the transformation of the city's socio-economic model, promoting the development of emerging sectors through the consolidation of the local clustering model. FSS has set-up the Smart Cluster integrating different entities covering the entire value chain: Research Corporations, Training Centers, Associations, Financial and Sectorial Institutions and local Companies in the smart field. It aims to find synergies that allow members to be an active part of the evolution and progress

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in the materialization of the city's smart strategy. The fields of renewable energies, energy efficiency and ICT stand out among others. In this way, FSS supports these business sectors in its transformation, through a cohesive organization that works through economically sustainable projects and capitalizes and transfers the knowledge generated.

FSS is leading the Donostia Smart City strategic project of the city for the promotion of social, economic and environmental sustainability, coordinating the public and private entities in its deployment.

The city of Donostia/San Sebastian, coordinated by FSS, has deployed projects and initiatives (some of them co funded by the European Commission) related to the transformation into a Smart City.

FSS offers aids and services. Regarding aids, FSS financially supports newly established companies, companies that belong to sectors such as commerce and hospitality, as well as entities that are developing innovative initiatives. It offers aid through different calls, for example, for hiring young people, talent workforce, or for the creation and/or consolidation of new business and companies. And regarding services, it supports the city's companies in their growth and consolidation through personalized and comprehensive consultancy; helps and training services to unemployed people, especially those in vulnerable situations; and accompanies people who are committed to starting new businesses in the city[24].

In relation to the REPLICATE project, the pilot in San Sebastian focuses on the District Heating (DH) providing a heat distribution system for domestic hot water and heating generated in a centralized location through an insulated pipe system for the new Txomin Enea residential area in Donostia - San Sebastian. The heat is obtained by burning biomass and with the support of two gas boilers. The district heating scheme has been dimensioned to meet the needs of new 1,500 homes of the district, including the connection of 156 conditioned homes[25] under Replicate project.

FSS proposes an innovative business and management model to carry out DH in the city of San Sebastian. The DH, publicly owned, is based on an efficient management of public resources through a public-private partnership in which the Municipality is the public and the temporary business association (TBA) UTE TXOMIN-ENEA is the private. The UTE TXOMIN-ENEA is 50% constituted by Ferrovial *S.A* and Tecnocontrol Servicios *S.A.*

To this end, the San Sebastian model for developing and implementing DH is an example of innovation in public management. In addition, the model establishes a win-win relationship with which all the parties involved having an economic benefit, as well as other key aspects such as the social and environmental benefits of a smart project focused on energy efficiency. To a certain extent, although there is some experience at the international level, public

[24] Source: https://ayudas.fomentosansebastian.eus/es/ayudas-y-servicios/servicios

[25] Source: D3.3 Report on DH construction including the maintenance program. REPLICATE project. H2020-SCC-2015 Smart Cities and Communities Innovation Action (IA). 31/01/2019

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ownership and the public-private management model carried out in San Sebastian constitute a paradigm shift in energy provision. The business model and its service provision, as we will explain, are of great value. As depicted from figure 24, the market size for DH systems in Spain is incipient. Although there has been an increase of DH system implantations since year 2013, the growth has slowed down in recent years.

As a consequence, the potential target for DH systems implementations in Spain is huge. As observed from figure 25, 10% of buildings have central heating[26] and 5,340 buildings are already connected to DHs (ADHAC, 2019). To this end, there is a potential target of 945,000 buildings that represents the market size for possible interventions.

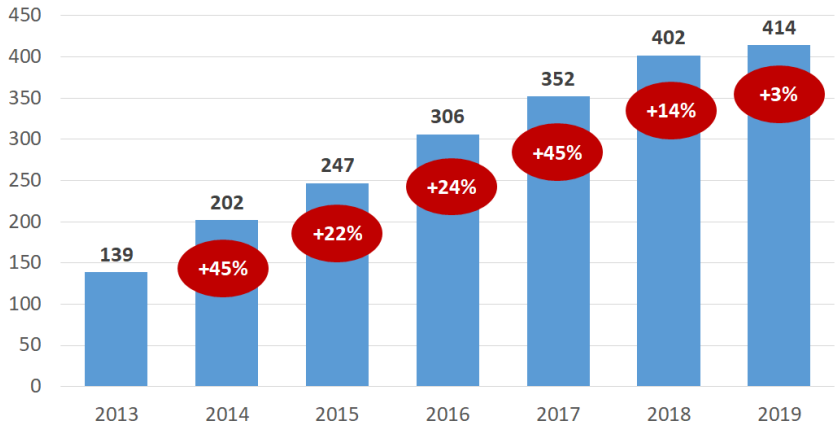

Figure 24.- Census of DH&C systems in Spain (ADHAC, 2019)

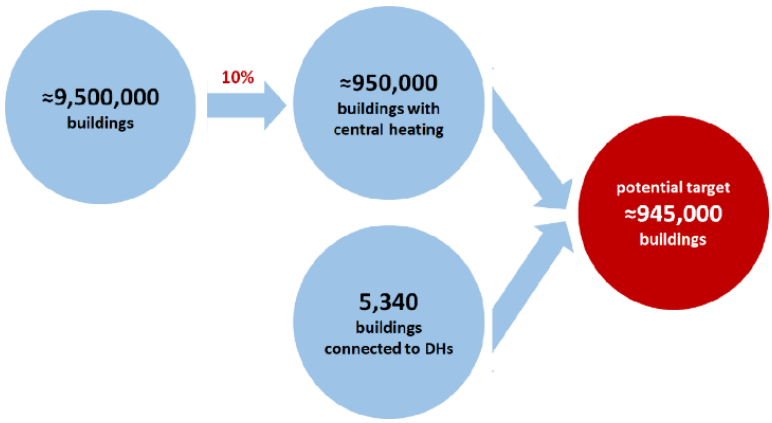

Figure 25.- DH&C market size

[26] Source: www.hogarsense.es/calefaccion/calefaccion-central

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6.6.2 Customers and value needs

As introduced, the public DH of the city of San Sebastian represents a paradigm shift, both due to its public ownership and the proposed management model. One of the key aspects for the success of this model, in addition to other aspects that we will also highlight, is the public interest with which FSS works as an economic development society for the Municipality. We will see how this public interest is a clear anchor for FSS in order to propose an attractive, efficient and economically viable proposal for the city and consequently, for the citizens of San Sebastian. In fact, the figure of FSS – as an economic development society – in a city like San Sebastian is a key factor in replicating this type of project in other cities.

As observed below (figure 26), FSS's Value Proposition Canvas (VPC) offers a clear and adequate relationship between customer and service needs in the smart cities business area. The relationship shows needs from the City Council and consequently citizens (right side) and services from FSS (left side).

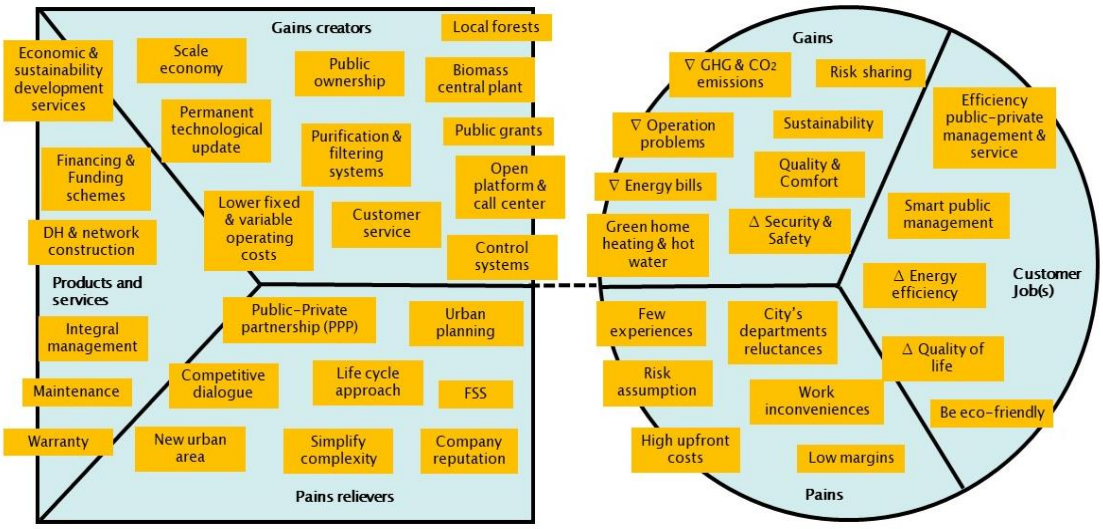

Figure 26.- Value Proposition Canvas of FSS

From the customers' point of view (right part of figure 26), there are different jobs and tasks related to the need to offer and manage a public DH. One of the key aspects for the public client is to offer an efficient public service for the citizen in a smart city context through adequate, viable and profitable management. The Municipality has the need to be energy sustainable. Traditional heat networks involve high energy expenditure, both for the City Council and for citizens with a clear environmental and social impact. At the end the job is to develop and implement the DH.

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Specifically, for the DH project, there is also few experiences in Spain. The REPLICATE pilot represents the first experience of DH from the public point of view in the Basque Country. For this reason, one of its main problems is the technical and economic knowledge to develop and implement DH, especially at an economic level, since the Municipality must make an initial investment that entails a series of risks. One of these risks are margins. Margins are low, which means that the payback period for the Administration is high. Finally, the Municipality clearly needs to optimize its energy resources to move towards an energy-sustainable city.

In this sense, the customer wants a public DH that is sustainable, not only from the point of view of its environmental impact such as the decrease in emissions, but also from the point of view of its economic sustainability. Therefore, it wants a sustainable management model, in which risks are shared and that it offers guarantees regarding prices, quality and the maintain of the service in the long term. The customer, as a public agent, at the end offers green home heating and hot water, which increases security and safety matters, decreases energy bills, and implies a decrease also in operation problems.

Regarding products and services, as introduced, FSS is the economic development society of the Municipality of San Sebastian and offers different types of aids and services, such as subsidies for hiring, advice and consultancy for entrepreneurs and companies, training, etc. Regarding the pilot from REPLICATE project, FSS offers the construction of the DH and connection to buildings, which implies a company such as the UTE TXOMIN-ENEA to develop the business activity. Also, does an integral management that includes the maintenance as well as a warranty for example in quality.

The value proposition of FSS has a series of pain relievers to solve the client's pains. One of the most important aspects regarding the Municipality is the public leadership. FSS, as the municipality's development society, manages both the internal and external complexity involved in carrying out a publicly owned DH. To develop the pilot, FSS had to manage many problems and obstacles, such as initial discrepancies and conflicts between departments internally, or the development of a public-private partnership model externally.

In addition to managing complexity, the public-private collaboration model, based on an exploitation concession, is carried out through a competitive tender using a competitive dialogue process in which companies make their technical and economic proposals. In general, this is not an attractive model for industrial partners, but the FSS feasibility analyzes made it possible to establish interesting criteria and conditions for private companies, as well as public resources, dedication, and commitment from the public side. Furthermore, as UTE TXOMIN-ENEA argues, FSS exercises leadership and dedication, aspects that are key to entering in this type of projects. These aspects are key because these types of tenders tend to be long and involve many variations. The companies that present themselves end up tired of the process and do not know if the invested resources will be fruitful. In general, without resources or dedication on the part of the public sector, these types of projects are not usually carried out.

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It is also important to note that the innovative proposal of the management model is attractive for public-private collaboration. In general, this model and its characteristics is attractive for private companies because of having an initial joint investment and exploitation contract, with a reasonable return and a model in which risks are shared. The private company is committed to this type of model if the public client is willing and demonstrates it through this leadership, resources and dedication.

From the point of view of the gain creators, economic, technical and management aspects stand out. At an economic level, FSS - represented by a temporary consortium - has investment from both the City Council and the industrial partner with which the DH is managed. In addition, it has the subsidies of the City Council itself and the REPLICATE project. At a technical level, it has the network and a heat plant, the equipment, and the storage and extraction systems among others. And from a management point of view, there is an open platform to promote awareness between users and show them their habits, a call center and consequently a complete and adequate service to the owner. In summary, there is an economy of scale that helps to reduce fixed costs and operating variables. In addition, the fact of having a very powerful company such as UTE TXOMIN-ENEA implies that there is a permanent technological guarantee based on innovation. The fact of having an industrial plant and that the combustion is not done in the individual buildings themselves, it is evident that it helps to reduce certain risks in each building, to reduce noise, and increasing comfort to citizens. Purification elements are installed to help reduce emissions. In addition, public ownership is maintained, therefore there is a guarantor of a public service and offers confidence to the user.

6.6.3 Business model

Nowadays there are different DH initiatives that are publicly owned and are managed through an efficient and profitable public-private partnership model[27]. The FSS model is a clear example of public efficiency and represents a paradigm shift with respect to the traditional models of contracting and consequently of the exploitation of a public service. As it will be shown, FSS and UTE TXOMIN-ENEA constitute a joint venture with conditions, criteria and requirements that benefits both parties, as well as benefits the public client, in this case the Municipality and consequently the citizen.

The mission statement of the business model is to reduce the city greenhouse gas emissions from buildings improving their energy efficiency and promoting green energies. The DH intervention from the REPLICATE project is a clear effort from San Sebastian to achieve environmental targets. The achievement of these objectives has a positive impact on increasing urban healthiness, which entails many economic, environmental and social benefits.

[27] Source: https://energy-cities.eu/best-practice/hot-news-a-local-district-heating-company-established/ & https://www.eseficiencia.es/2018/10/26/silleda-inaugura-primera-red-calor-biomasa-publico-privada-galicia

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In this section, authors explain through the Business Model Canvas (BMC), which is presented in figure 27, how FFS carries out its value proposition to develop and implement DH through an innovative managing and business model.

The VPC analysis helps identify the key aspects of the FSS value proposition. As mentioned, FSS takes responsibility and management of DH in San Sebastian, which is publicly owned. This offers to the beneficiaries a reduction in energy cost. Green energy is produced by burning biomass. Building efficiency is improved by not having individual boilers. Emissions are reduced, as well as risks by having the central outside the buildings. In addition, as there is a specialized company that carries out the integral management of the entire DH, from the central to the connection networks, maintenance costs are greatly reduced. It must also be noted that there is an increase in living space in the buildings because there are no central boilers. In general, the value proposition contributes to a better image of the area in which it is located, in addition to offering a new sustainable development. In fact, the sale of the new home constructions was carried out in record time. In addition, this sales aspect also helps to ensure demand, which represent a key aspect of the model in order to involve the private company in the joint venture.

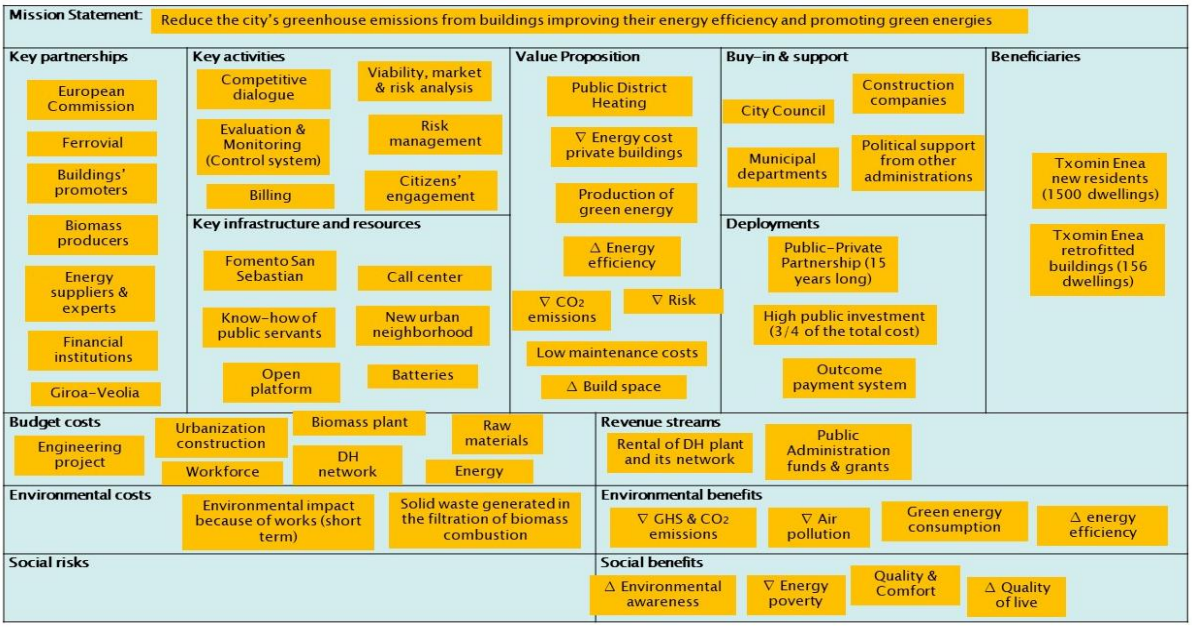

Figure 27.- City Business Model of FSS

The beneficiary of FSS is the City Council itself. Although FSS is an economic development society of the City Council itself, receives the commission and responsibility for managing the DH. Furthermore, the project pilot has beneficiaries who represent the customers of the San

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Sebastian City Council. To this end, as mentioned in the introduction, the pilot focuses on new residents and homeowners in the Txomin Enea residential area in Donostia – San Sebastian. Homeowners perceive clear energy savings on their utility bill, as well as funds for retrofitting and environmental and social benefits for them and its neighborhood.

Regarding the buy-in and support, there must be a clear political will. In addition, to carry out the competitive dialogue, the support of the construction companies is needed. It is also necessary that the municipal departments, through the technicians, get involved, help and believe in the project. And finally, the support of other administrations is also needed, such as the Basque government, which can help both with legislation and with funds.

The deployment of the intervention focuses in three elements. In the first place, as mentioned, through a public-private partnership that lasts for 15 years, which guarantees that the private company can recover the investment made for the execution of the works. The development and implementation of a public-private management and exploitation model is key. Through a competitive selection competition, FSS signs and agreement with the UTE TXOMIN- ENEA (join-venture among Ferrovial and Tecnocontrol). The creation of the temporary consortium itself is a factor for success and a competitive advantage. This experience, as well as the contracting conditions, allow efficient and profitable management and operation with clear cost savings and significant social and environmental benefits. Furthermore, FSS recuperates full decision-making and control after these 15 years. Another important element is that there is a large contribution of public funding. Finally, the payment system is made through outcome, that is, by energy delivered, not by outputs.

The production of value involves different activities. Stands out all activities related to the development of the management model. Since 2010, the Municipality has asked FSS to intervene in the development, management and control of the DH. Once the business model was designed and developed, the next key activity, as mentioned for the deployment, was to develop and execute the competitive tender and therefore, the evaluation of proposals and final selection of the industrial partner. In addition to these activities, FFS did a feasibility study, carrying out, among others, demand and risk analysis. These aspects are key to involving an industrial partner in DH. The main reason is that FSS had to ensure the demand and therefore ensure the sale in the proposal, in addition to offering an attractive investment recovery period, otherwise the contest would not be attractive for the private company. There is a public commitment to renewable energy and the launch of the DH has made the deployment of a gas network in the new urbanization unnecessary. And regarding the return on investment, the calculations made estimated a return on investment of 15 years for the industrial partner, and a return of 30 years for the City Council. Finally, there are other important activities such as evaluation and monitoring to control the public service, customers engagement and billing.

In addition to these activities, the business model involves different resources and infrastructures. The support of the Municipality of San Sebastian is key. Along with the

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financial support in the initial investment of the DH, as well as the subsidies to residents for the rehabilitation of their homes, the Municipality represents an enabling political power and has the figure of FSS who can lead the project. In this sense, the City Council through FSS made a municipal push by providing a technical structure as well as a political decision to implement the DH so that it would remain as a long-term initiative. It is also important to note that the Municipality, through FSS, ensured attractive conditions for the entry of an industrial partner, such as ensuring demand and therefore sale. It is important to highlight the know-how of public servants to promote the DH model and implementation. Another important resource is the call center, without this resource it is difficult to manage users' needs and demands.

In addition to the Municipality support, the REPLICATE project constitutes a grant from the EU that has a great value, both economically and politically. Although the DH approach predates the REPLICATE project, the fact of being part of a European project represents an important push for the Municipality to move forward with the initial proposal to develop and implement the public DH.

Regarding the production of value from the business model, stakeholders are key to the development of DH. As mentioned, the public sector, made up of the EU and public administrations, are drivers of public DH. They play an important role in promoting actions, pilots, R&D projects, as well as offering investment, financing, and grants. In the specific case of San Sebastian, the public-private collaboration among FSS and the UTE TXOMIN-ENEA has been key.

One of the greatest difficulties of a project of this type is the guarantee of long-term supply. In other words, there must be a biomass supplier next to the temporary consortium for the same years that it provides the service. The reason is that many suppliers do not want to sign contracts beyond four years. Therefore, a supplier that is committed throughout all the years that the service lasts allows offering more guarantees for the maintenance of the project. Obviously, there are other stakeholders such as building promoters, energy experts and ESCO companies.

Finally, the sustainability of the business model focuses on the triple bottom line: cost/revenue, environmental costs/benefits, and social risks/benefits.

Regarding costs, the investment was shared between the public and private parties. The City Council invested two thirds and UTE TXOMIN-ENEA one third, with payback periods of thirty and fifteen years, respectively. The total cost of the entire project is 3.3 million, two thirds assumed by the Municipality and a third by UTE TXOMIN-ENEA. The Municipality, through FSS, pays the total cost of the construction of the facility. UTE TXOMIN-ENEA carries out the operation and exploitation of the installation and, as a service, offers FSS the delivery of heat in the buildings. Given that the infrastructure and facilities are publicly owned and operated by UTE TXOMIN-ENEA, FSS collects a rent from the UTE, through an advance payment that represents a third of the investment. Regarding the costs of the DH operation, one of the most significant costs is the raw material, the energy. 50% of the operating costs are represented

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by the energy supply. Within the energy cost, biomass represents 70% and electricity and gas 30%. In addition to the cost of energy supply (50%), the rest of the cost is made up of personnel (25%) and materials, subcontractors, canon, etc. (25%). The canon (rent) is paid at the beginning of the project but is considered in the annual exploitation.

The sources of revenue are two. From one side, there are grants, for example, those coming from the EU. And from the other, there are rental paid at time zero by UTE TXOMIN-ENEA. The advantage of this type of revenue is that the ownership is public which implies a guarantee of public general interest.

The business model presents important environmental costs and benefits. Regarding costs, there is the impact of the construction in a short time period, and the impact of solid waste generated by the biomass combustion because of filtration. On the contrary, there are many environmental impacts such as the decrease of GHG and CO_2 emissions, less pollution, green energy consumption, and the increase of energy efficiency in buildings.

Finally, there are important social benefits. Obviously, there is an increase of the environmental awareness of citizens, there could be a reduction in energy poverty, and increases quality and comfort of owners and tenants which affects their quality of life.

6.6.4 Strategy

For the analysis of the strategy, the comparison has been between a building with a central boiler system and another connected to a DH. The items that are analyzed are the initial costs, maintenance costs, associated risks, comfort at noise level, viability of space, the scale factor that may be needed, a visual impact that a type of action like this may have, the savings that can be generated, the simplicity of the structural solution, the times of the action, and finally both the impact of the civil works and the environmental impacts from each type of action.

In this sense, next figure 28 presents a comparison through the Strategy Canvas tool between the individual and DH models. This is an exercise based on the analysis of data collected throughout the REPLICATE project and secondary data, which reflects points of similarity and difference between models.

In general, as depicted from the figure, the DH items have greater advantages rather than the individual model.

It is true that the initial costs of the DH may be higher. The reason is that part of the central plan must be carried on to the network connection, as well as the costs of the network connection itself. On the other hand, the maintenance costs are clearly lower, as well as the associated risks, the comfort or the viability of spaces.

The scale factor does harm the DH if there is not a very large volume of dwellings that are connected. Therefore, it is important to guarantee a minimum of users connected to the DH. In this sense, new real estate developments offer a greater guarantee compared to rehabilitation and retrofitting developments.

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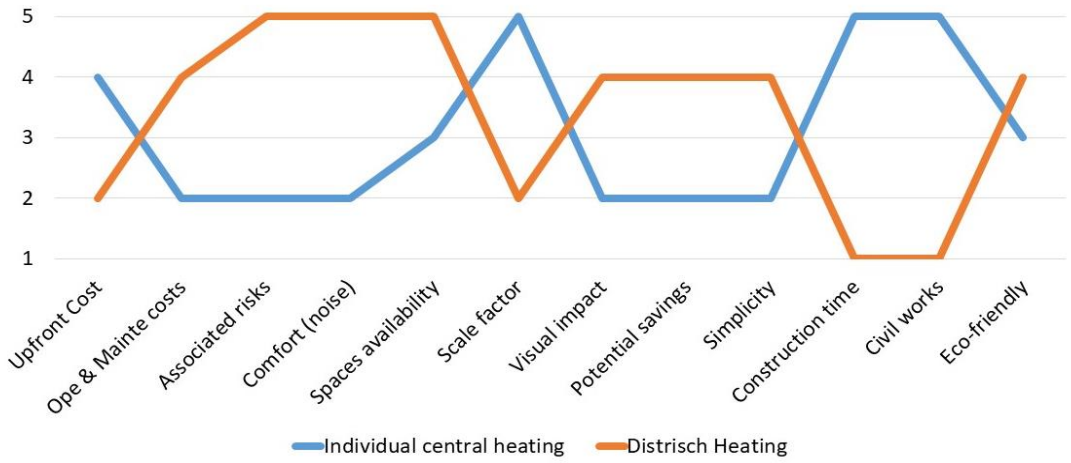

Figure 28.- Strategy Canvas of FSS

In terms of visual impact, the fact of not having a boiler in the building plays in favor of the DH, as well as the potential savings and simplicity which brings DH. On the other hand, construction time and civil works are items that penalize the DH because there must be urban plans that guarantee a central for example that will generate that heat, and also it is necessary to ensure the connections. Civil works are also complicated. Finally, it is more sustainable and efficient to have a DH than an individual one regarding eco-friendly aspects.

6.6.5 Final remarks

We are facing a type of intervention that has very important environmental advantages and impacts. Therefore, must be promoted. But it is very important to differentiate between the areas where urban development has not begun, from those where rehabilitation and retrofitting must be carried out. Obviously, it is much more difficult to do the performances in the second areas. Probably, considering the volume, new areas are more profitable than the the others. But the reality of cities shows that we are on scenarios towards rehabilitating than towards new construction. Therefore, it would be important to do a good urban planning thinking about the rehabilitation, reserve spaces for the plants and think how to generate the network of conduction and the connection with the different buildings.

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6.7 District Heating – Bristol City Council

6.7.1 Service's presentation

Bristol City Council[28] (BCC), understood as the Municipality, is the Local Authority of the city of Bristol. Bristol is a unitary authority, having the powers of a non-metropolitan county and district council combined. The council is unusual in the United Kingdom local government system in that its executive function is controlled by a directly elected mayor. Bristol was European Green Capital 2015. The Bristol Futures team within Bristol has successfully delivered technology and innovation EU projects over the past 10 years in a range of calls including FP7, CIP, eTen and eParticipate. Bristol can effectively spread and demonstrate the outcomes from this project locally, regionally and nationally within the UK, and internationally through its platform as European Green Capital 2015. Bristol City Council has made a clear offer for innovators to see Bristol as a testbed for exploring new ideas that can be proved in Bristol before being scaled more broadly. This concept of the city as a shared and open laboratory for developing new more efficient ways of doing things informs and drives smart city innovation in Bristol. Bristol has attracted around £15m investment from UK Government for digital infrastructure and Smart City activities. Bristol City Council leads and coordinates the Bristol demonstration pilot. Moreover, Bristol participates actively in energy efficient buildings, district heating, smart grids, mobility, ICT Smart Platform, Smart Business Models, cross cutting activities in the three different areas (Energy Efficiency, Sustainable Mobility and ICT/Infrastructure), Replication, Exploitation and Monitoring[29].

Regarding the REPLICATE project, the Bristol City Council provides lower carbon and more efficient heat to the existing and new district heating systems by linking the operational Heat Network connecting 13 social housing blocks with the new network that it is powered by Combined Heat and Power Engine. Each system has peak and reserve back up gas boilers but by linking the two energy centres the whole system will better utilise the low carbon heat from the Biomass and the CHP providing more efficient and cheaper heat across the network. The project also includes upgrades to existing and new additional metering and control units on

[28] Source: www.bristol.gov.uk

[29] Source : DoA REPLICATE (691735). REPLICATE Annex 1 – DoA to the GA. Bristol City Council – Bristol. Legal entity and main tasks. p. 235.

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the existing network, in order to upgrade the old equipment to be integrated into a smart network in the future[30].

Figure 29.- District Heating from Bristol City Council[31]

The REPLICATE project is just one project among many that the Municipality is delivering related to energy efficiency. Bristol has been developing many capital delivery programmes to find clean energy projects to invest either to generate energy, to save energy and generate carbon savings according to Council's target. Some of these projects relate to solar projects based on PV panels, smart interventions like batteries, and of course energy efficiency.
Building on all that they have achieved, Bristol needs to up the pace of delivery to help meet its 2030 target. Through the City Leap Prospectus, the city is seeking long-term partners to work with us to achieve our shared goals and build a resilient city where no one is left behind. City Leap is a series of energy and infrastructure investment opportunities that represent a big step towards a cleaner, greener Bristol. This will not only create a healthier and fairer city for all our residents, but also allows us to share our success. It will help to create jobs, maintain our economic competitiveness, de-carbonise the city, build strong partnerships and empower people to take their future into their own hands[32].

6.7.2 Customers and value needs

The value proposition of the Bristol Council seems to fit with customers' needs, although the REPLICATE project forms part of an initial, exploring and testing initiative to set up a city strategy regarding low carbon heat provision for the future years. As it is shown below, figure 30 shows the Value Proposition Canvas (VPC) of the Municipality's district heating intervention

[30] Source: D5.2. Connection of a 13 block (700 flats) district heating network to a gas CHP energy centre. Bristol City Council. REPLICATE project. H2020-SCC-2015 Smart Cities and Communities Innovation Action (IA). 31/07/2019
[31] Source: https://replicate-project.eu/energy-bristol/
[32] Source: www.energyservicebristol.co.uk/cityleap/

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and provides a clear vision of the relationship between the market and the service. In this case, the market has to be understood as the building owners, business, social housing tenants and citizens in general, who benefit from Bristol's service to help tackle their needs. It is important to highlight that this intervention set up is the basis to scale up the connections for different types of customers and establishes procedures that can be replicated throughout Bristol's heat network.

The first segment, the customer map (demand side), as mentioned in chapter 3, identifies the jobs and tasks customers want to perform, the negative aspects to be avoided; and the positive aspects and benefits customers want to gain from the service.

From the perspective of customers, as observed on the right side, customers' jobs, there is a clear need to be provided with low carbon heat at an affordable price which means cheap heat and maintained comfort levels. Some tenants can be in a situation of energy poverty and need to be protected against future rising gas prices. Besides being energy efficient in its housing blocks tackling affordable energy prices can reduce fuel poverty and improve household's quality of life.

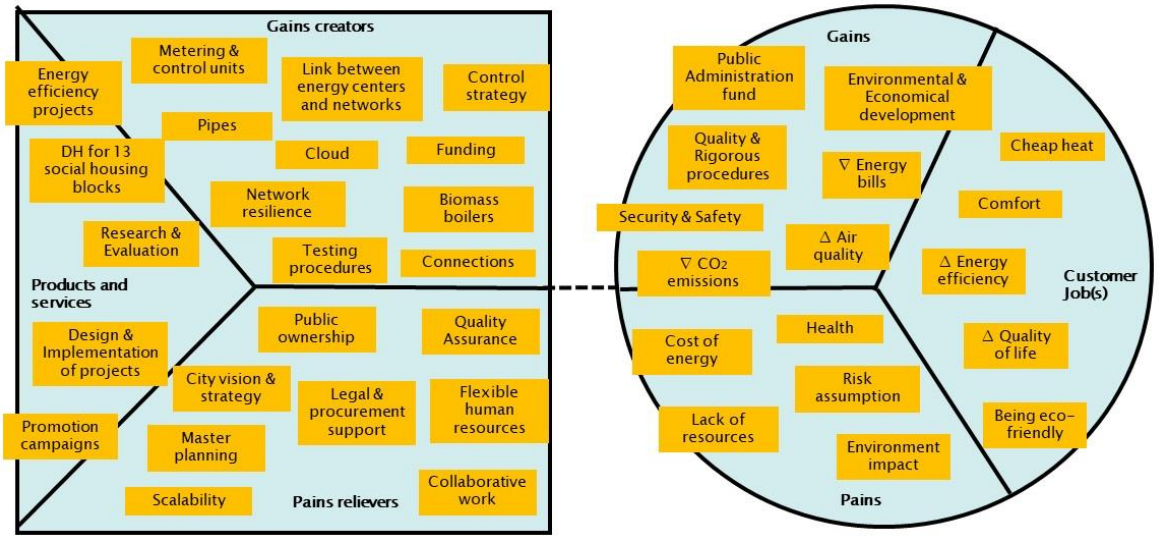

Figure 30.- Value Proposition Canvas of BCC

Regarding pains, aspects that lead to negative emotions of customers, the main aspects regards to the cost of energy. The reason is that prices can be high and some customers are in a situation of a fuel poverty that has impacts on economic costs, and also can have health impacts for customers, for example in terms of level of comfort in the home and choosing between adequate heating and food for example. From this point of view, a potential pain for customers may be that they don't have resources needed for energy efficient retrofitting works in older buildings required to avoid building leaks. The investment cost is high in order to

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achieve economic, social and environmental benefits. Furthermore, tackling this situation by individually would mean a large economic outlay and risk. District heating costs also need to compete with currently low gas prices when developing low carbon sources of heat.

It is important to highlight that the intervention is covered by the Bristol City Council from EU REPLICATE project's grants as well as UK government funding. Also, customers expect that the impact of the intervention regarding the decrease of the energy bills and the increase of environmental aspects such as air quality using more sustainable sources or CO_2 emissions, will be realised with standards of quality and rigor, as well as security and safety matters needed to have high quality as well as safe installations and implementation of the works.

The second segment, the value map (supply side), describes how the proposed business model challenges customers' expectations and the proposed value for the use that has to be created. To this end, as observed on the left side of figure 30, products and services clearly tackles many of the routes required for the end users' needs.

The Municipality as already introduced, carries out many projects regarding energy efficiency. These types of projects imply many different services, such as the capacity to attract funds and grants from public administrations, do research and evaluation of interventions and design and implement these projects. Regarding the REPLICATE intervention, as mentioned in the institution presentation, the Council delivers DH to 13 social housing blocks.

To this end, pain relievers clearly solve customers' problem. The DH is publicly owned and responds to a city vision and strategy for a scaling DH. It is well funded and considers environmental and social pains from customers. To this end, from a public institution point of view, the Council is offering a great public value for customers, as well as the city itself that does not just correspond to profitability objectives. The strategy is based on a well-defined master plan which goes beyond the social housing tenants and presents long-term objectives and goals. Furthermore, the Council bases the intervention on different quality and rigour processes, activities and supports - such as legal and procurement, quality assurance, etc. that offers confidence to the whole intervention and to customers.

From the point of view of the gain creators, economic, technical and management aspects stand out to respond to customers' gains. Regarding the economic point of view, as already mentioned, the intervention is well funded. Regarding technical aspects, the installation of the network extension is possible because it uses the biomass boiler more effectively and replaces standard gas boilers with a more efficient CHP engine on the network. The Council installed a 150DN pipe with associated cabling and controls within the new energy centre that allows the heat network to grow further and allows connection to other nearby buildings. The intervention also enables development of connections to wider energy demand management work in the district; including where applicable ICT architecture designs and possible systems

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integrations[33]. Regarding the management model, the Council has a control strategy to improve monitoring, remote access and control improvement. The data collected is used by a cloud-based prediction and optimisation system to advice on optimum use of technologies and network conditions[34]. Technical and management aspects are further explained in D5.2.

6.7.3 Business model

The mission statement of the business model is to reduce the city greenhouse gas emissions and increase the urban prosperity and wellbeing. The charging station intervention for EV from the REPLICATE project is a clear effort from Bristol to achieve environmental targets. The achievement of these objectives has a positive impact on increasing urban healthiness, which entails many economic, environmental and social benefits.

The second business tool to analyse the business model is the City Model Canvas (CMC). Figure 31 describes the CMC of the Municipality service. As mentioned in chapter 3, the CMC reflects the logic on how the city is creating, producing and delivering public value in a way that is economically viable, social inclusive, and environmentally sustainable (triple bottom line).

As mentioned for the VPC, the value proposition of the business model is that the heat network can provide low carbon, affordable heat to the customer and can help to alleviate fuel poverty. In summary, it is about public value and considering citizens' needs as well as environmental impact for the city itself. The purpose of DH intervention is to provide lower carbon and more efficient heat by linking together the operational Heat Network connecting 13 social housing blocks with a new network powered by a Combined Heat and Power Engine. By linking the two energy centres, the whole system better utilises the low carbon heat from providing more efficient and cheaper heat across the network. Furthermore, the intervention is setting the DH strategy in the city and prepares herself for the transition towards a smart city. At the end, the value proposition puts emphasizes on offering a quality public service.

The direct beneficiaries of the intervention are social housing tenants from the blocks (700 flats), but the intervention clearly tackles all citizens who benefit from the environmental impact of such an intervention in aspects such as the lower overall carbon factor of the network in the following years, by displacing the gas boilers on the current network. Furthermore, the replicability and scalability potential of the intervention based on the systems control strategy with open protocols to be easily integrated into Building Management Systems or other platforms such as Bristol's connectivity test networks will allow many types of new customers.

[33] Source: D5.2. Connection of a 13 block (700 flats) district heating network to a gas CHP energy centre. Bristol City Council. REPLICATE project. H2020-SCC-2015 Smart Cities and Communities Innovation Action (IA). 31/07/2019. p. 7.

[34] Source: D5.2. Connection of a 13 block (700 flats) district heating network to a gas CHP energy centre. Bristol City Council. REPLICATE project. H2020-SCC-2015 Smart Cities and Communities Innovation Action (IA). 31/07/2019. p. 34.

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The delivering value of the pilot requires different buy-ins'. The intervention has already the public administration buy-in. Internally, politicians (Mayor and Councillors) have supported the project, but also other departments such as highways, housing, major projects, planning or buildings, as well as other public sector bodies. In addition to this aspect, the intervention needs the buy-in of social housing tenants. The fact is that the Council's VPS clearly tackles customers' jobs, pains and gain creators, thanks to an early engagement strategy and funding sources. Also, the intervention has benefited from flexible and collaborative work between in-house departments. This is a key aspect from the business model because the collaboration, communication and data sharing among departments is not always easy to put in effect.

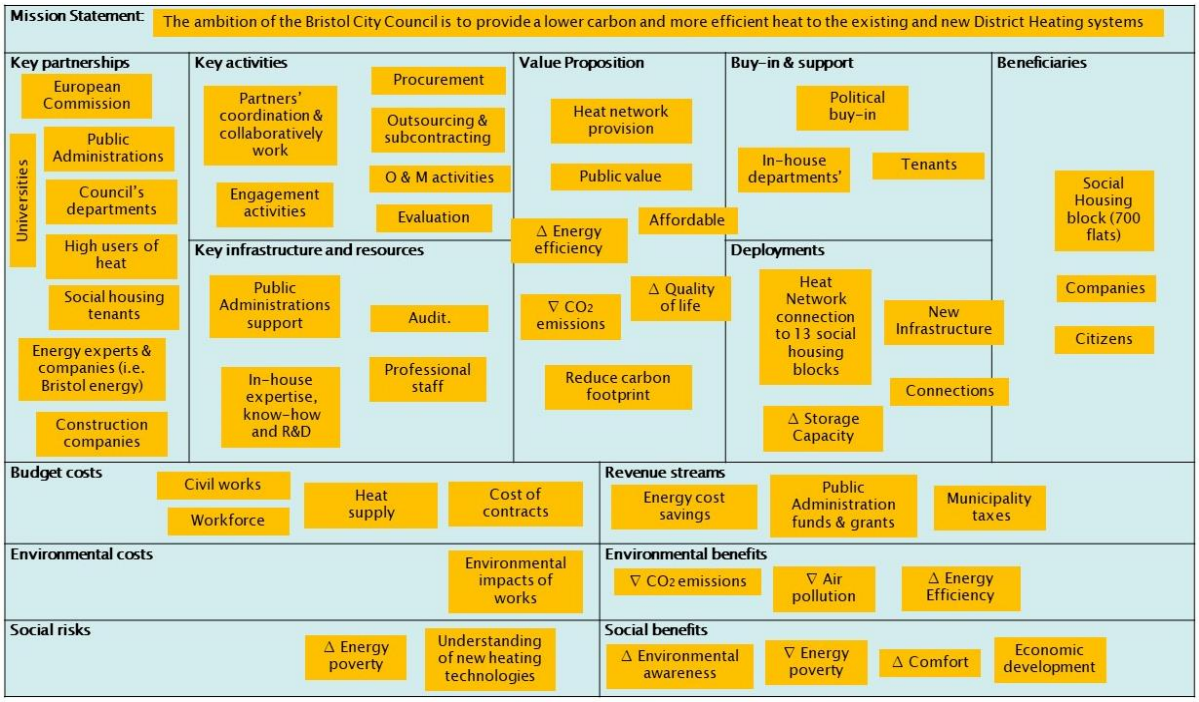

Figure 31.- City Model Canvas of BCC

The delivering value of the business model implies linking the operational Heat Network connecting 13 social housing blocks with the new network that it is powered by Combined Heat and Power Engine.

The producing value of the business model implies different stakeholders. The stakeholder's structure is classified by those who: i) promote the DH – EU, UK government and the Bristol Council; ii) finance/fund the DH – EU, UK government, the Bristol Council; iii) produce and deliver value – developers of buildings, universities, public sector bodies located in the city (Central Government and NHS), South Gloucestershire Council, high users of heat, social housing tenants, experts and companies which integrate connections. Also, developers'

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buildings companies and their contractors are key stakeholders, as well as possible target clients, to design sustainable buildings which support DH solutions.

The producing value involves different activities. One of the crucial activities is the partners' coordination and collaboratively work to set up the strategy and consequently its Master Plan. Also, procurement standards and subcontracting parameters to supply providers are key activities for the intervention. Works and services are procured for the connection between the energy centre (Temple Street) and a separate nearby District Heating system (Redcliffe). At the end, promotion focused on stakeholders' engagement, designing processes, physical works and the overall operation and maintenance works are key activities for the interventions. Additional to the technical deployments, stands out all activities related to the development of the management model.

Besides these activities, the business model relies on key resources and infrastructures. A key resource is public administration support in different items such as public procurement, contracting and legal advice with clients' supply contracts, highways, property or engineering designing. In general, it is easy to talk among/with other departments and get information, and expert advice. In this sense, the institution is quite flexible regarding human resources for collaborative work. These aspects are important for a public organization and add value to it and of course for the pilot project. Furthermore, the Council have really good consultants' skills in-house for the heat feasibility and understanding of the industry despite it is an emerging market in Bristol and in the UK.

Finally, the sustainability of the business model focuses on the triple bottom line: cost/revenue, environmental costs/benefits, and social risks/benefits.

The sources of revenue streams come from public administration funds and grants from different actors such as the EU REPLICATE grant and the UK government. Obviously, the Council uses local taxes to overcome some of the fixed costs related to in-house human resources, but must be highlighted that connection charges and heat sales are crucial incomes for the business model. Furthermore, the energy cost savings for the customer, the city itself and consequently the Council should be highlighted too. Economic savings, as well as environmental ones are of great importance to the next few years regarding municipal budget. Regarding budget cost, significant ones are related to civil works and engineering requirements from the intervention, although civil ones are crucial.

The business model presents important environmental benefits. The impact in the decrease of CO_2 emissions for the new solution is estimated at 52,239 tonnes/year. In terms of decarbonization processes, the decrease in emissions and air pollution improvements positively impacts in city's air quality, which is a priority for Bristol.

Finally, there are important social benefits. In terms of the customer and citizens in general, there is a big element about trying to stabilize the cost of energy and provide affordable energy processes to sell it to them. Regarding the social housing blocks, this action clearly tries to tackle energy poverty. The situation of energy poverty is poor in some districts of Bristol, such

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as those where the pilot is taking place. These districts and areas around the city centre are affected by air quality issues that effects neighbour's comfort, health and quality of life. It must also be highlighted that the economic development from the Council supports private companies and SMEs who benefit from contracting and construction phases of the project. On the contrary, must be highlighted the increase of fuel poverty as a social risk because of the competition with low wholesale gas and capital cost of low carbon technologies. Furthermore, understanding of new heating technologies could be a risk also. There is not a lot of decent information about heat networks and even a poor name for district heating from poorly designed built and operated systems in eastern Europe and elsewhere in the second half of 20th century.

6.7.4 Final remarks

The task the Council is carrying out crucial to set up the conditions to create an attractive DH market. As for the case of the EV charging stations, the emerging DH market situates the Council in a good position to ensure the roll out of the heat network for coming years. To overcome this objective, there are important barriers, such as long-term funding from different public administration, raising quality standards in the industry from contractors – good management is key –, stakeholders' engagement, and offering the right skill for the supply chain.

One of the key aspects is that the currently amount of investment required means that public aids are required to build out the network. UK government funding, as well as projects like REPLICATE, are essential for the development of this type of energy efficiency projects where returns on investment are estimated in the medium and long term. Furthermore, these types of projects help to raise the awareness of the network as well as engaging customers and offering quite a wide range of beneficial impacts for the city. To this regard, public investment is a priority. Additionally, there are external factors that could generate a higher impact on the industry and should be consider. These aspects regard to the prices of gas and electricity that affect the ability to procedure and sell heat at affordable and comparable prices to using individual gas boilers; political policy from central government regarding hydraulic fracturing for gas and renewables; make heat network more attractive to developer and users because electricity grid id dropping; raise industry standards; and offer positive media campaigns.

It must be highlighted that the commitment from Bristol is exemplar. Bristol City Council is leading by example in the action against climate change and has committed to Bristol becoming a carbon neutral city by the year 2030. The council's award-winning Energy Service is a driving force behind this activity, delivering projects that benefit the social, economic and environmental health of the city and partners across the region. Bristol has gained international recognition as a leading energy city (European Green Capital 2015), as well as

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being the GLOMO Smart City 2018 and it is always keen to share its experiences and knowledge with other cities[35].

6.8 District Heating discussion and scale-up strategy

DH systems and networks are a key element in cities. In fact, heating and cooling in buildings and industry accounts for half of the EU's energy consumption. Regarding EU households, heating and hot water alone account for 79% of total final energy use and 75% of heating and cooling is still generated from fossil fuels while only 19% is generated from renewable energy[36]. To this end, efficient district energy systems in cities play a crucial role in the energy transition towards a low-carbon economy (Galindo et al. 2016). Lighthouses (LHC) from the REPLICATE project are a clear example of how these cities are assuming this role with great environmental and social impacts for the buildings and consequently households who benefit from the intervention. In fact, buildings and dwellings are among the most important energy consumers and greenhouse gas emitters (Jiang et al., 2013; Russell-Smith et al., 2015; and Zhou et al., 2016). Thus, improving energy efficiency of buildings should be a critical element of combating climate change (International Energy Agency, 2006; and Li & Colombier, 2009) and implementing energy efficiency measures and carbon emission mitigation through energy efficiency projects is associated with multiple benefits (Li & Colombier, 2009; and Nilashi et al., 2015).

As observed from all business model analysis, Municipalities, as well as the different levels of public sector territory (supranational, national, regional or local), are key stakeholders in this type of projects which are well-implemented presenting high quality procedures, efficient and low-carbon heat supply to its buildings' interventions. San Sebastian and Bristol present different strategies to tackle the need of DH actions for economic, environmental and social issues in the REPLICATE project. San Sebastian carries out the project using an innovative business and management model based on an efficient management of public resources through a public-private partnership in which both parties, public and private, Fomento de San Sebastian and UTE TXOMIN-ENEA respectively, receive benefits. And Bristol promotes the project within the Bristol City Council through its own Energy Service department offering a strategy to encourage the market based on planning policy, and investment in the required infrastructure.

Although the EU, LHC and stakeholders' partners are doing a great effort funding and implementing these interventions throughout different strategies, DH present a low percentage in market share compared to other heating systems in Europe. As depicted from

[35] Source: https://www.energyservicebristol.co.uk/

[36] Source: https://ec.europa.eu/energy/topics/energy-efficiency/heating-and-cooling_en

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figure 32, the market share for DH is just 7%, while gas is still presenting the highest share with a 43%.

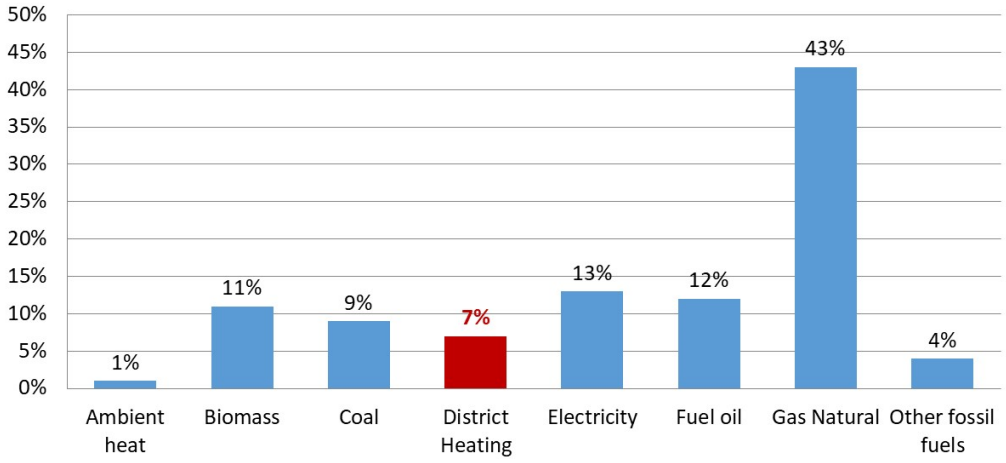

Figure 32.- Heating systems' market share in Europe (Adapted European Commission, 2016)

Regarding the LHCs countries, figure 33 presents the DH market size from different EU countries. As we can observe, Italy (1,9%), England (0,8%) and Spain (0,0%) present very low or even non-existent market sizes for residential supply while the EU average is 24,5%.
Although these percentages regarding market share and heat supply are quite negative, it seems that the REPLICATE interventions are being successful and present a high potential to scale up and replicate.

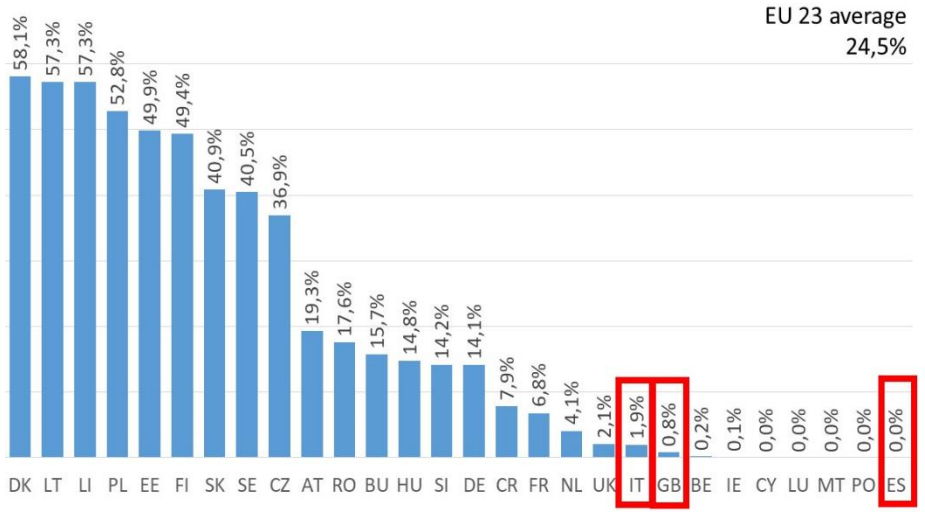

Figure 33.- % of residential heat supply from DH in EU countries (Sayegh et al., 2018)

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We would like to highlight different strengths and weaknesses from both models which present interesting ideas. Besides both models' benefits in terms of economic, environmental and social impacts, the production and delivering of the public value is done in different ways. Obviously, the public ownership of the intervention for both models is a strength and fixes conditions and procedures quality standards to future interventions. Both models offer a public tender in order to realize concrete activities. San Sebastian uses a competitive dialogue as a selection methodology which has bring a strong public-private partnership based on a win-win solution both for the public and private side, who strongly collaborate in an equal position. On the contrary, Bristol also offers a procurement process to contract with the private sector but quality standards and procedures seem to be guided from a public perspective. Obviously, this is not a weakness of the model, but analysis shows that future initiatives should follow a public-private partnership where interventions risks are shared. We also believe that this partnership can represent a window opportunity to scale up the market.

Complementary, Bristol's business model seems to be very inclusive, empathizing heavily in citizens' and social aspects. To this end, we believe that the construction of the value proposition clearly obeys a bottom up approach based on the "Bristol Approach" which seems to impregnate all Bristol's interventions. Furthermore, having an organization such as KWMC on board is a key success factor. The reason is that as in the retrofitting actions, the engagement of households and communities for DH is also a bottleneck of this type of interventions. On the contrary, San Sebastian also does a huge engagement task, but should considerer the idea to involve community organizations with a similar mission statement and scope such as the one from KWMC in engagement activities for decision making and implementation.

Besides this aspect, we would like to highlight the public administration economic support at different levels for the success of the interventions. Public administration bodies must offer this funding to accomplish the transition towards smart heating networks in cities, which is also key to engage households.

Beyond cities pilot projects, the main objective of LHC is to define a clear strategy to surmount many of the obstacles existing today that prevent the take-up of DH. The results obtained along this analysis have been key to identifying the principal aspects/activities of a general scale-up strategy. Figure 34 presents the set of activities for this strategy proposal.

1- Municipalities should have or constitute an interdepartmental public body which brings together public needs and become a driven force to overcome a DH project. This seems quite obvious, but the reality of many municipalities shows that there is a lack of these types of bodies and decision making, tensions or dialogues among departments are often prolonged.

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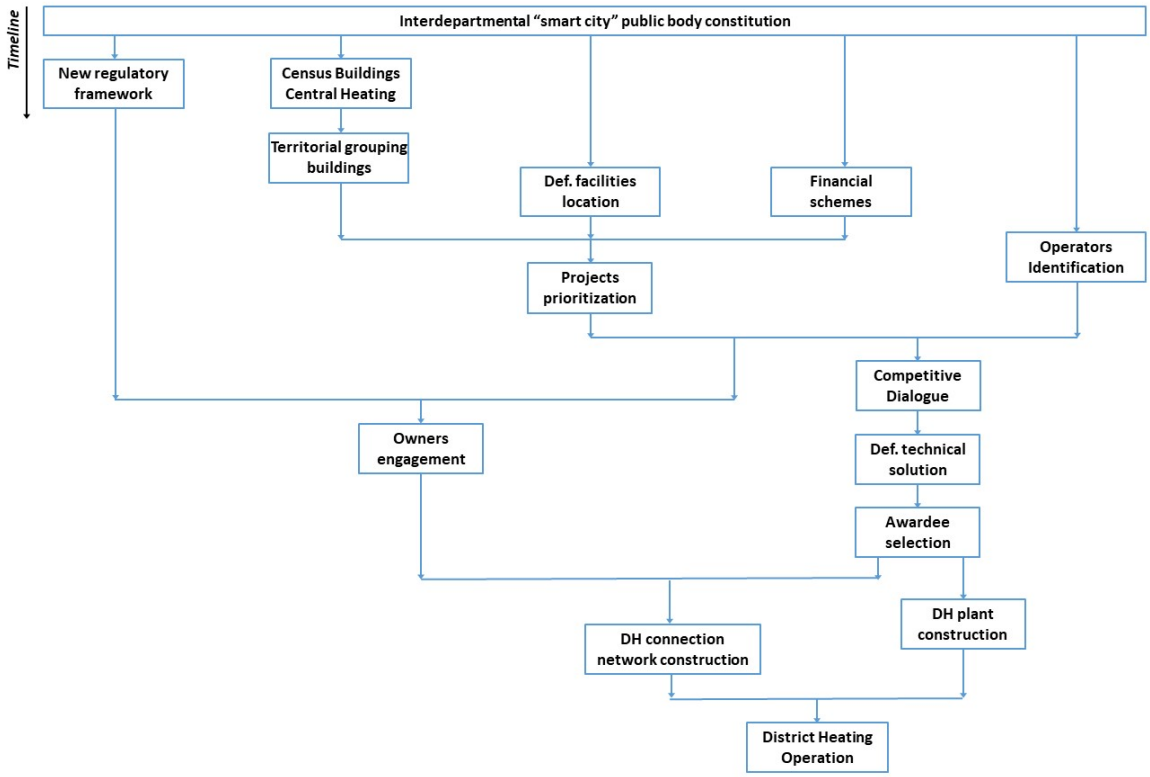

Figure 34.- District Heating scale-up general strategy

2- Hereon, municipalities should create an adequate regulatory framework for the promotion of this interventions, on the contrary there is the risk that excessive use of gas continues being promoted.
3- In parallel, they should elaborate a buildings' census which have central heating. The reason is that these buildings can potentially be adapted and connected to DH.
4- Once this census is created, would be very important to make a territorial grouping building along the city to see what types of buildings could be grouped and served by the same DH network.
5- In parallel, there should be urban plans where the locations of these facilities can be defined, which would involve the central plants, besides the financing schemes that would be necessary to overcome the interventions when they take place.
6- Another important activity is to make an identification of the different operators that that at any given moment can carry out the construction, and the operation and maintenance of the DH.
7- Once we have the territorial grouping of building and heating centrals, as well as a clear idea on the financing schemes, we can do a projects' prioritisation to decide where to start.

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8- Having this prioritization, the project we will like to do, and the operators, we propose to initiate a public procurement process based on a competitive dialogue to start building the DH together.
9- In parallel, once Municipalities know the type of project they want to carry out, ubications, and regulatory frameworks, they should do the owners and tenants engagement from different buildings that should be connected to the DH.
10- Once municipalities have done the competitive dialogue, a definition of the technical solution that is considered ideal can be made. After task, make a tender, selection and award of the company(ies) and start the DH plant construction.
11- Once we have the owners and tenant's engagement, the company(ies) awarded, and has start the DH plant construction, the connections from different buildings to the DH network can be made.
12- Finally, once municipalities have the plant as well as the connections, the operation of the DH can be deployed.

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7. MOBILITY

EVs, Charging Stations' Infrastructure and new mobility solutions are an essential part of a smarter and more sustainable future of cities because of their high impact to reduce the city's greenhouse gases and CO_2 emissions, and pollution (PM). Mobility sector was responsible for 28% of global final energy consumption in 2016, and 90% of transport energy use depends on oils products (International Energy Agency, 2017). The electrification of the mobility sector, using clean/green energies to produce such electricity, represents a key aspect to alleviate the climate change (Yong et al. 2015). Electricity offers the possibility to substitute oil with a wide diversity of primary energy sources. This could ensure security of energy supply and a broad use of renewable and carbon-free energy sources in the transport sector, which could help the European Union targets on greenhouse gases emissions reduction[37]. Next organizations' analysis shows how these organizations develop different business models and strategies to implement energy efficiency interventions in REPLICATE's Lighthouse Cities.

7.1 Ikusi

7.1.1 Company's presentation

Ikusi is a Basque Country company that leads market niches in a continuously changing and evolving scenario, where foresight and flexibility are fundamental driving forces in businesses and organizations. Throughout more than 45 years of activity, they have managed to develop a profound knowledge and specialization in their clients' business fields and sectors. This is a key factor in helping them to understand company needs in this new scenario, in which they have supported them in their digital disruption and operational efficiency processes. Its business knowledge is reflected in applied technological innovation that seeks to simplify the complex, giving rise to competitive advantages for their clients which enables their ongoing improvement[38].

From 2010, Ikusi got into the Velatia's business group[39]. Velatia is a familiar, industrial, and technological group composed by companies which offer advanced technological solutions in the areas of smart cities. They are in the electrical grids, helping the deployment of smart grids. Accompany their clients in their digital transformation process. And they also contribute

[37] Source: https://ec.europa.eu/transport/themes/urban/vehicles/road/electric_en
[38] Source: https://www.ikusi.com/en/about-ikusi
[39] Source: https://www.velatia.com/es/

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to sectors such as aeronautics, energy services, electromechanical engineering, or prefabricated houses[40]. The Group is composed by thirteen companies, where Ormazabal and Ikusi are the biggest ones, with 2,000 and 900 employees, respectively. The rest are niche companies that also provide support to Ormazabal and Ikusi.

Ikusi is structured in three business areas: (1) Multimedia, which represents the origin of the company and nowadays focuses on transmission, distribution, and emission of digital contents in classical infrastructures such as neighbourhood communities, hotels, hospitals, etc. This area is centered in product design, research and development, fabrication and distribution through own offices or own installers. (2) Data network, which is implanted in Latin America and has it business in Mexico. This area is linked to the process of internalization made years ago by Ikusi where it bought two companies focused on data network. Ikusi is thinking to bring this area to Spain, but there is a high competence, and the market is quite saturated. Also, there are some barriers to bring the area to Spain because everything is already set up in Mexico and it works very well. And (3) Projects' Integration, which operates in Spain and has it headquarters in San Sebastian. Fundamentally, this area offers complete solutions for their customers. Ikusi offers engineering, supply, installation, implementation, start up, warranty, maintenance, service support…anything that can helps the customer to solve its problems or demands.

Regarding the REPLICATE project, Ikusi develops the mobility urban platform of San Sebastian. The mobility platform is part of the smart city strategy of the city. The Municipally develops a smart city project, integrating power and sustainability systems, monitoring the energy balance in different municipal buildings, integrating mobility systems, and collaborating actively in technology-based business start-up programs. The mobility platform captures, analyses and integrates information from multiple sources and displays monitoring, optimization and prediction processes to understand the global status of the city and thus perform detailed monitoring of the parameters of improvement and performance that are defined for each case[41].

7.1.2 Customers and value needs

The ICT industry has become one of the most important economic sectors globally. Although many of the traditional products and services from ICT – nowadays considered as commodities – operates in a mature market, the project integration area business related to data and information is growing. Figure 35 shows the Value Proposition Canvas (VPC) of the intervention and provides a clear vision of the relation and lace between the market and the service.

[40] Source: https://www.velatia.com/es/que-es-velatia/

[41] Source: D3.8 Report on the use of the ITS. Ikusi. REPLICATE project. H2020-SCC-2015 Smart Cities and Communities Innovation Action (IA). 31/01/2019

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From the perspective of the customer (right part of figure 35), there are different jobs and tasks when facing smart city solutions such as the case of mobility in the city of San Sebastian. Regarding the public customer – municipalities, regions, etc. – this need to offer efficient public and management services for citizens in the context of a smart city. Urban managers need a solid base information that allows them taking most accurate actions in their public policy fields with the aim of offering the best services to the citizens[42]. In summary, this urban management should improve citizens quality of live by increasing energy efficiency and being more eco-friendly as a city. In general terms, no matter whether the type of client is, this needs an accurate solution to optimize its policies or businesses.

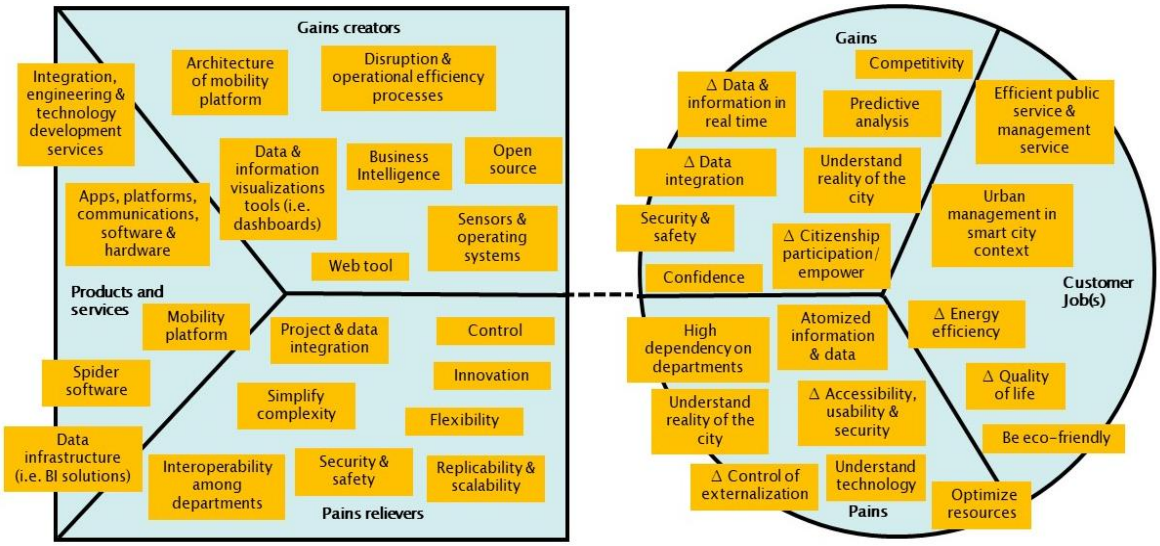

Figure 35.- Value Proposition Canvas of Ikusi

Regarding pains, aspects that lead to negative emotions of the customer, there are different aspects. Both public and private customers, need to solve their pains regarding atomized data and information to optimize their resources and become more efficient and competitive in the market where they operate. For the case of the public customer, there is a high need to understand the reality of his city through structured data and information in many different topics related to mobility to offer adequate responses to citizens, but in many occasions this represent a problem due to the fact that public bodies present a high dependency among departments as well as problems regarding accessibility, usability and security of data and

[42] Source: D3.8 Report on the use of the ITS. Ikusi. REPLICATE project. H2020-SCC-2015 Smart Cities and Communities Innovation Action (IA). 31/01/2019

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information. The fact is that there is data and information that could serve to multiple departments, but nowadays these data and information are not shared among them.
Regarding these pains, the customer is waiting for different gains, that are presented by the value proposition of Ikusi. As mentioned above, the customer wants to optimize solutions for its public policies or businesses, which means understanding the reality where they operate and being more competitive in the market where they operate. For the case of the public customer such as the city of San Sebastian, they want to have integrated data in real time to offer better solutions, understand what is happening regarding mobility in his city as well as increasing citizenship participation and empowering them. As mentioned for the case of pains, data and information from a concrete issue use to be atomized and frequently depend just in one department. The fact is that understanding the mobility environment of a city, implies multiple sources of data and information from different departments. Otherwise, results impossible to have the whole picture of an issue such as mobility as well as developing appropriate public policies or actions.
As it is show in the left side of the figure 35, Ikusi's main products and services, are related to the integration, engineering and technology development through applications, platforms, or other systems in a wide range of fields. As mentioned before, working under the integration of projects as a business area, Ikusi offers complete solutions to customers' problems or demands. Regarding the REPLICATE project, the mobility platform operates with the Spider software[43].
To this end, pains relievers clearly solve customers' problems. One of the main pains relievers for them is project and data integration, which clearly helps them to simplify complexity. As mentioned above, data and information are not shared. Ikusi tries to solve this barrier by using integration because the market is growing in this sense. As an example, the idea is that many of the data from the mobility department can be used by the environment as well as housing departments. To this end, interoperability among departments is a huge problem that Ikusi clearly solves, for example in the case of the mobility platform from the REPLICATE project as a pilot project for the city of San Sebastian. Ikusi also offers flexibility, understood as product brand flexibility, which means that the company can offer solutions using third brand software for the customer is he ask for. To this end, Ikusi is not subject to its own product when offering a solution although it is more profitable for them to offer their own products. But the customer approach is quite flexible. If the customer wants a third software brand, Ikusi introduce it in its solution. It is an ad hoc product using technology from a third party or a competitor.
Ikusi uses different gain creators, solutions that lead to customers' benefits, such as constructing the whole architecture of the mobility platform using business intelligence, open source and sensors and operating systems among others. The key aspect is that they create efficiency processes that offer data and information in a simple manner through different

[43] Source: https://www.urbansolutions.es/es

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visualization tools such as a website or dashboards. Regarding the REPLICATE project, the Municipality can have an historic, real, and even predictive pictures about the mobility situation in the city of San Sebastian. Also, the Spider's software used for the mobility platform can help municipalities to control their processes of externalization. Usually, each platform or contracted service to a third party for the performance of a public service offers reports to the customer, but do not share the data captured. In return, Ikusi's does not have the data because these data are from the customer. In this sense, the great value of a mobility platform based in the Spider's product is that the customer has the data and exploit and work with them independently of the supplier. The idea is that the customer has the data and can work with them without having to wait for supplier's analysis, which often are closed reports. Furthermore, this it is not only about having control on suppliers, it is also about evaluating these suppliers, as well as having data and information to take other type of decisions.

7.1.3 Business model

The relation and lace between the market and the service seems quite logic and clear. Ikusi offers a product and a service that fits perfectly with customers' demand. To this end, the second business tool to analyse the business model is the Business Model Canvas (BMC). Figure 36 describes the BMC of Ikusi. As mentioned in chapter 3, the BMC reflects the logic on how the company is capturing, producing and delivering value.

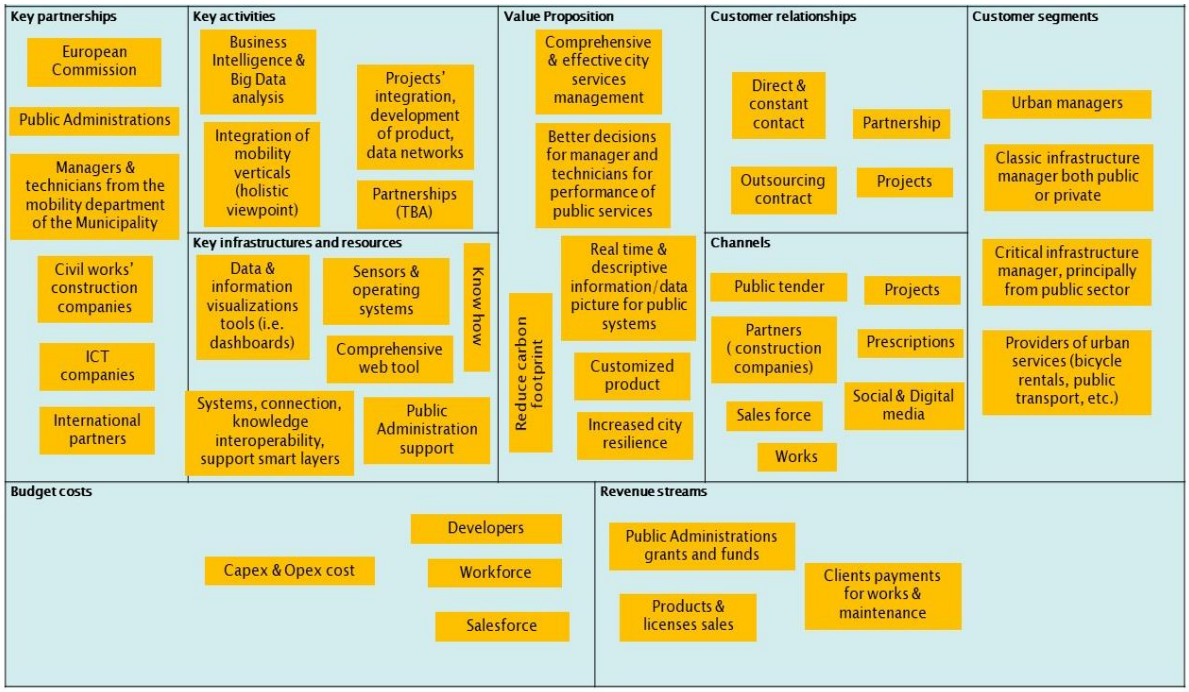

Figure 36.- Business Model Canvas of Ikusi

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As introduced in the analysis of the VPC, the objective of the intervention is to create a mobility urban platform. The value proposition of Ikusi focuses in offering a comprehensive and effective city service management for mobility issues. This comprehension allows politicians, managers, and technicians to understand the situation of such topic and all related issues that affect it. In concrete, the value proposition of the platform offers to the Municipality answers providing useful information for the performance of its services (What has happened? Where is the problem? What actions are required?)[44]. In summary, better decisions in real time could be taken to increase confidence and consensus in decision-making and in offering best services to citizens as well as urbans services providers.

For the case of the mobility urban platform, which is based on the Spider's software, the value proposition also offers two important aspects. Firstly, Spider is developed using open source. Many of the products from the competence are developed in a closed format, but Spider is developed in open source. This fact means that those developers who have knowledge about this technology can make their own developments on Spider. And secondly, Spider has been developed many years ago, which implies many updates, and its performance has been well tested. The software has a well-known track record by many types of customers.

The customers from Ikusi are urban managers, owners of public and private infrastructure and providers of urban services such as bicycle rentals, public transport, etc. In summary, the principle customer segment for Ikusi is the classical infrastructure's client, both public or private, who owns or manage infrastructures such as harbours, airports, roads, highways, trains, etc. Then Ikusi also has critical infrastructure's customer, where the public administration concentrates demand of products and services; this is the case for example for the Basque Country or the Catalonia regional governments for their security and safety departments, regional police, etc. In general, this type of customer is public and most projects go through a public tender. Regarding the REPLICATE project, the intervention and solution allow politicians, managers and technicians of the mobility department of the Municipality optimizing urban mobility services. Also, providers of urban services as well as the ICT sector and local companies can gain from the service through new businesses that can be created on the basis of the mobility platform.

The delivering value of the business model presents different types of customer relations such as direct and constant contacts, outsourcing contracts, partnerships and projects. In general, Ikusi uses two different types of relations to get to the customer. The first one is a direct and personal approximation to the client, where they call them, set a meeting, and explain about Ikusis' products and services. For the case of the smartcity area, Ikusi calls municipalities and explains its products and services such as Spider, applications and platforms using business

[44] Source: D3.8 Report on the use of the ITS. Ikusi. REPLICATE project. H2020-SCC-2015 Smart Cities and Communities Innovation Action (IA). 31/01/2019

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intelligent, big data and visualization tools. The second one regards to innovation. If the customer is thinking about innovation projects, Ikusi tells him to collaborate through partnerships or consortiums. For Ikusi, these types of collaboration based on innovation projects offers them the possibility to develop technology and they can open a door to set up a pilot project for the customer. These types of collaboration are of great value because allows Ikusi to understand its market.

Finally, regarding channels to deliver value, Ikusi main channel is public tender. As mentioned before, both for classical or critical infrastructure, one of the main customers of Ikusi is public administration (local, regional, national or supranational). In this sense, Ikusi obtains public contracts presenting its offer through Temporary Business Associations (TBAs). Depending on the type of offer, Giroa can covers the whole contract and presents its candidature or can do TBAs, mainly with construction companies (infrastructure companies). Everything depends on the type of contract, but Ikusi always does the ICT aspect. The offer can present separate tenders where Ikusi presents its candidature by itself or the offer can present a whole tender where Ikusi offer its services – ICT – to the construction company who is presenting itself to the tender. To this end, Ikusi's customer is the construction company and not the public administration.

The producing value of the business model implies multiple and varied stakeholders. The stakeholder's structure is classified by those who: i) promote the mobility urban platform – EU and public administrations, in the case of the REPLICATE project the Municipality; ii) finance/fund the action – EU and the Municipality; iii) produce and deliver value – the Municipality, managers and technicians, construction companies, ICT companies and international partners. Regarding stakeholders, it is important to remark the position of Velatia corporation. Velatia has set the smart city business as a priority for the group. For Velatia, smartcity represents a strategic business and the smart city concept as a business must impregnate the whole organization.

The business model implies different types of key activities. The main one can be called as "evangelism", understood as a metaphor for the marketing and commercial activity. As mentioned for the case of customer relations, Ikusi has a constant and direct contact with possible customers to sell its products and services as well as to set possible pilot projects. Also, as it is shown in figure 36, business intelligence and big data analysis are key to develop proper solutions for the customer. Moreover, Ikusi always tries to integrate verticals data and information sources from customers to offer a comprehensive and holistic vision of their businesses. Another important activity, already mentioned for the case of relations and channels, are Temporary Business Associations (TBAs) as well as project collaborations.

Besides these activities, the business model lies on key resources and infrastructures. Obviously, sensors and operation systems are key to get and gather the data and information that serve the customer. Nonetheless, Ikusi highlights the idea of simplifying complexity using data and information visualization tools and comprehensive web tools. Also, Ikusi presents an

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important know-how in the sector with a long track record that has already been tested by many clients. Finally, it is very important to mention the role of the public administration support to the company by believing in the smart city concept and getting Ikusi on board in projects such as REPLICATE. At the end, public administration is a great prescriber for Ikusi.
Finally, the business model focuses on the costs/revenues structure. As observed in figure 36, Ikusi has different sources of revenue streams: public tender budget, grants and funds; products, services and license sales; and clients' payments for works and maintenance. On the side of the revenue streams, it is more important to sell the service than the product license. It is difficult for Ikusi to sell products' capex. In this sense, selling licenses depends on the interest that Ikusi has on the client. Sometimes there is no cost for the license to the customer and in others times there is just a low cost. Regarding cost revenues, most important costs are related to the development of its workforce, this means applications by hours/person. At the end, engineering and developing workforce is expensive.

7.1.4 Strategy

The business strategy of Ikusi regarding the business of project integration and smart city follows two strategies for the public customer and its size. The first strategy implies the market of big cities, where Ikusi tries to get in through TBAs developing ICT verticals. These markets are quite monopolized by two big Spanish companies, Telefónica and Indra. Playing against these companies is quite difficult. Moreover, many public customers such as municipalities or regions often place their trust on them. The second strategy implies small and middle cities, between 5,000 and 500,000 inhabitants, which have at least a smart city strategy. Also, these types of customers have similar problems and needs as big clients, but it is easy to get the contract from them as well as working with them because its daily management is less complex in comparison with big customers.

As shown in figure 37, authors have place eight items to compare Ikusi and the competence. This is an exercise based on the discursive analysis of Ikusi and secondary sources. As observed, the items reflect the strategy positioning of Ikusi. The items have a score of 1 to 5, where 1 means less weight compared to other competitors (disadvantage) and 5 greater weight compared to them (greater advantage) when facing the market.

The first item is the price. In general, Ikusi tries to offer its Spider product and solution below similar products or solutions from the competitors. The reason, following the second strategy, is that Ikusi tries to focus on small and middle size customers, which usually work with low public budgets in comparison with big size clients. Also, as mentioned before, Ikusi has an adaptable pricing strategy depending on the type of the customer. To this end, depending on the specific interest on a customer and his needs, Ikusi can play for example with licenses fees.
The second item regards to the first strategy. As introduced, Ikusi tries to get in big markets trough TBAs developing ICT verticals. In general, Ikusi flee from a direct competition with big

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companies because success is limited and represents a huge effort and many resources to present its candidature. Also, the capacity and volume of Ikusi to get such contracts are not comparable with competitors' size such as Telefónica or Indra. In this sense, Ikusi's capacity and volume influences his market penetration with big clients.

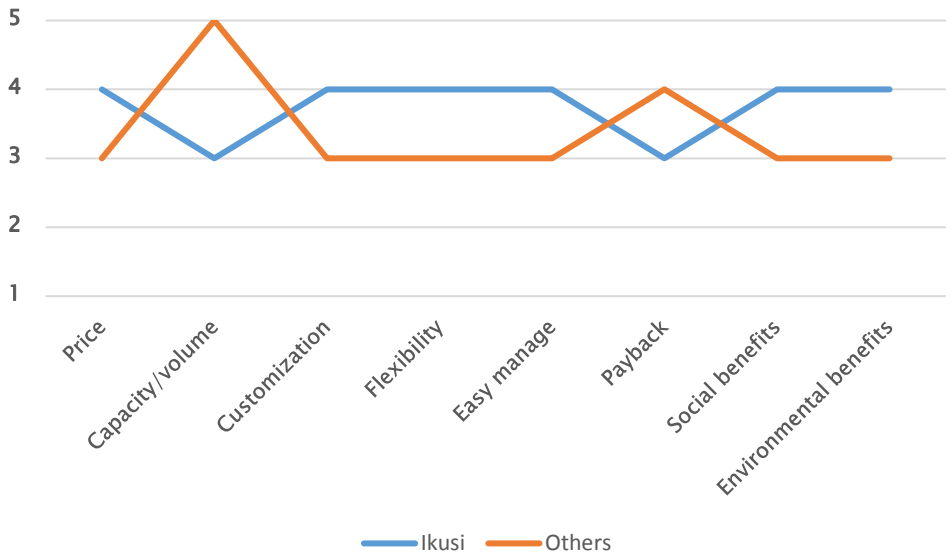

Figure 37.- Strategy Canvas of Ikusi

Ikusi differs from its competition because of its customization. The product and services are adapted to the customer depending on its needs. Also, the customer has the possibility to choose and select how he wants to see data and information through different visualization tools such as dashboards. In this sense, although the Spider software has already a base format, this can be adjusted regarding customers' needs. In fact, this customization helps Ikusi to offer an easy management of the platform and different resources for the customer. To this end, Ikusi perfectly understands that users of its product and extended services are not experts in ICT technologies management, so the management and consultancy of data and information for the customer has to be easy understandable and manageable.

Ikusi also offers higher flexibility in comparison with competitors, understood as product brand flexibility, which means that the company can offer solutions using third brand software to the customers. To this end, Ikusi is not subject to its own product when offering a smart solution although it is more profitable to offer its own products. But if the customer wants a third software brand, Ikusi introduce it in its solution. It is an ad hoc product using technology from a third party or a competitor. In this sense, Ikusi works with the whole spectrum offering own or third solution to its customer.

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There is an interesting and key item for the client, where Ikusi may be below the competition, this is the risk that the customer assumes in terms of payback. The question is that Ikusi's holistic approach based on customization and personalized services cannot compete with close product proposals from competitors' catalogues. In fact, its low capacity and volume comparing with competitors can be a disadvantage in this sense.
Finally, there are environmental and social items. Such as many of the Basque companies analyzed in the frame of the REPLICATE project, the policy of customization and proximity to the customer allows Ikusi to differentiate itself from the competition in environmental and social aspects. The reason is that Ikusi can adapt its value proposition very well to the customers' demands because has grown and works on the territory.

7.1.5 Final remarks

One of the key aspects of Ikusi is the commercialization of its Spider software. In this sense, we believe that there are some key aspects that can help to do so and therefore, focus on the marketing strategy.
There are two aspects to highlight within a possible marketing strategy. On the one hand, a customer-oriented strategy and on the other hand, a competition-oriented strategy. The customer-oriented strategy goes through integrating customers' needs in the development of products and services, while the competitor-oriented strategy goes through the analysis of the competitors as a guide to differentiate itself and sell the value proposition. In general, ICT companies are more oriented towards the second strategy. On the contrary, we believe that it is important to make a mix, but above all to make the first one prevails when doing promotion and selling.
A tool such as the VPC or similar can be of great help to approach the first strategy and develop a business model to create, capture and deliver value. In this sense, we believe that Ikusi, through the work carried out in the REPLICATE project pilot, has done so by offering a comprehensive and effective service that focuses on the customers' jobs, pains, and pain relievers. From our point of view, this is a clear competitive advantage for the company. The accompaniment that they have done with the customer and stakeholders' collaboration is of great value. In addition, a customer-based strategy can have more impact on the business in the medium and long term and strengthen relationships with the customer, who could represent a great prescriber channel or even repeat purchase.

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7.2 Transport Infrastructure – Bristol City Council

7.2.1 Service's presentation

Bristol City Council[45], understood as the Municipality, is the Local Authority of the city of Bristol. Bristol is a unitary authority, having the powers of a non-metropolitan county and district council combined. The council is unusual in the United Kingdom local government system in that its executive function is controlled by a directly elected mayor. Bristol was European Green Capital 2015. The Bristol Futures team within Bristol has successfully delivered technology and innovation EU projects over the past 10 years in a range of calls including FP7, CIP, eTen and eParticipate. Bristol can effectively spread and demonstrate the outcomes from this project locally, regionally and nationally within the UK, and internationally through its platform as European Green Capital 2015. Bristol City Council has made a clear offer for innovators to see Bristol as a testbed for exploring new ideas that can be proved in Bristol before being scaled up more broadly. This concept of the city as a shared and open laboratory for developing new more efficient ways of doing things informs and drives smart city innovation in Bristol. Bristol has attracted around £15m investment from UK Government for digital infrastructure and Smart City activities. Bristol City Council leads and coordinates the Bristol demonstration pilot. Moreover, Bristol participates actively in energy efficient buildings, district heating, smart grids, mobility, ICT Smart Platform, Smart Business Models, cross cutting activities in the three different areas (Energy Efficiency, Sustainable Mobility and ICT/Infrastructure), Replication, Exploitation and Monitoring[46].

Regarding the REPLICATE project, Bristol City Council has deployed 34 new charging points from which 11 are on street charge points and 23 off street[47]. In relation to street charging points, the Municipality works with Co-wheels[48], a project partner who are a national car club operator run as a social enterprise. Co-wheels has the license agreement with Bristol City

[45] Source: www.bristol.gov.uk

[46] Source : DoA REPLICATE (691735). REPLICATE Annex 1 – DoA to the GA. Bristol City Council – Bristol. Legal entity and main tasks. p. 235.

[47] Source: D5.7. Transport Infrastructure Adaptation Including EV Charge Point Installation. Bristol City Council. REPLICATE project. H2020-SCC-2015 Smart Cities and Communities Innovation Action (IA). 31/07/2018

[48] Source: https://www.co-wheels.org.uk/bristol

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Council for the projects' on street charging points. In relation to off street charging points, these are based in park cars from or near shopping centers, supermarkets, etc. and are public for any Electrical Vehicle (EV) owner to use.

Figure 38.- Example of a street parking place from Co-wheels[49]

The REPLICATE project is just one project among many that Bristol City Council is carrying out related to energy efficiency in mobility solutions. Bristol has been developing many capital delivery programmes to find clean energy projects to invest either to generate energy, to save energy and generate carbon savings according to Council's target of becoming carbon neutral by 2030. Some of these projects relate to solar projects based on PV panels, smart interventions like battery storage, and of course energy efficiency.

7.2.2 Customers and value needs

The value proposition of Bristol City Council seems to fit with customers' needs, although the REPLICATE project forms part of an initial, exploring and testing initiative to set up a city strategy regarding EVs for future years. The Municipality is already in a good position to accelerate the transition because operates the city's highways and owns a lot of land to set up charging points' infrastructure. So, when it comes to charging infrastructure, Bristol City Council's 'customers' are the EV private owners and car club members who share EV's. These are the ones who benefit from new charge points deployed in the city for its own use, as well as citizens who indirectly take advantage from the reduction of greenhouse gas emissions and the increase of urban healthiness. As it is shown below, figure 39 represents the Value

[49] Source: https://www.trendhunter.com/trends/cowheels

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Proposition Canvas (VPC) of the Municipality intervention and provides a clear vision of the relation and lace between the market and the service. This way, the market has to be understood as the EV owners, car club members and citizens, who take advantage of Bristol's service to tackle their needs.

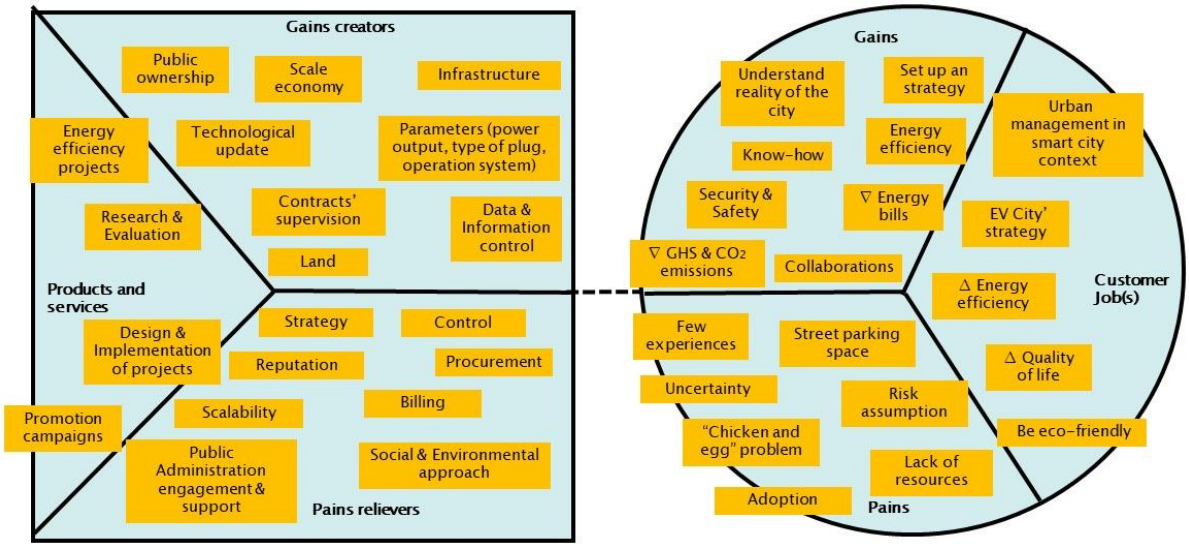

Figure 39.- Value Proposition Canvas of BCC

The first figure, the customer map (demand side), as mentioned in chapter 3, identifies the jobs and tasks customers want to perform, the negative aspects they want to avoid, and the positive aspects and benefits customers want to gain from the service.

From the perspective of customers, as shown on the right graphic which represents customers' jobs, we can see that there is a clear need to receive an efficient public service regarding the EV. Customers mention that there is a lack of charging points around the city. Street parking spaces which allow users to charge their vehicles are limited in number and some of these are just reserved for car club vehicles. Parking an EV in the street – except for car club members which have a designated bay for it- is quite complex as it is not easy to find parking spaces and conventional car owners usually reclaim these places for their vehicles. This way, the Municipality is testing through the project pilot to set up a strategy in the city for EVs. At the moment, the ecosystem for EVs in Bristol is quite incipient but there is a clear push strategy from the city as well from the UK government towards this transition. Obviously, the transition benefits from energy efficiency, which undoubtably must impact the quality of life of the citizen as well as being eco-friendly for the city.

Regarding the pains, this is, the aspects that lead to negative emotions of customers, the main feature relates to the experience, uncertainty and adoption. As mentioned, Bristol is an incipient market right now with few charging points and a lack of private companies operating

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in it. There are technical barriers such as batteries, charging points' power capacity, etc. that Bristol is working on, as well as social barriers like parking spaces, buy-in, etc. The price of EVs is also a deterrent at the moment. Not everyone can afford an EV and there is still a lack of incentives for purchase. The reason is that those incentives have to be thought-out carefully to avoid discrimination among those who can afford an EV and those who cannot. In general, as a classic element from the mobility market regarding EVs, there is the "chicken and egg" problem. People ask themselves why to buy an EV if there are not enough charge points and local authorities or private companies say they do not want to install more because they need more cars.

On the other hand, regarding the gains which represent the aspects that led to positive emotions and make easier customers' tasks, it is important to highlight the effort that Bristol City Council is doing on setting up the strategy for the transition. To this extent, the Municipality is working in many collaboration projects with internal departments, such as the highways as well as external organizations like Co-wheels, to lay down the principles. This is clearly benefits customers who want a clear functionality and organizations for EVs in Bristol who aim for energy efficiency as well as decrease of emissions. Obviously, this type of customers who has an environmental awareness, although it is important to highlight economic aspects such as the decrease in energy bills. Furthermore, the fact that the Council is leading the process offers important parameters such as security and safety aspects, legal aspects, etc. that contribute to customer confidence.

The second segment, the value map (supply side), describes how the proposed business model challenges customers' expectations and the proposed value for the use has to be created. To this end, as observed on the left side of the figure 39, products and services clearly tackle many of the customers' jobs and tasks.

Bristol City Council is already carrying out many projects related to energy efficiency and has the capacity to attract funds and grants from public administrations, as well as private investment in concrete topics such as community energy in order to design, implement and evaluate these. Regarding the REPLICATE project, the important fact is that the Municipality is testing the fundamentals and designing in addition to implementing the architecture for delivering charging station infrastructure.

To this end, pain relievers clearly solve customers' problem. As mentioned before, the Municipality is leading the strategy which offer confidence to customers in terms of control, reputation and concrete activities like procurement and billing. The Council controls the whole process. Figure 40[50], shows the stage in design and commissioning process for EV charge

[50] Source: D5.7. Transport Infrastructure Adaptation Including EV Charge Point Installation. Bristol City Council. REPLICATE project. H2020-SCC-2015 Smart Cities and Communities Innovation Action (IA). 31/07/2018. p. 16

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point and identify many of the pains and gain creators from the VPC. These aspects are further explained in D5.7.

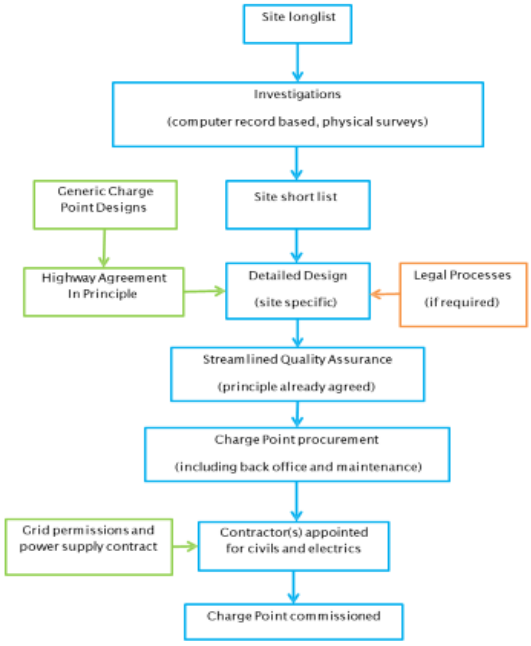

Figure 40.- Diagram stages in design and commissioning process for EV charge point

7.2.3 Business model

The mission statement of the business model is to reduce the city's greenhouse gas emissions, become environmentally-friendly and increase the urban healthiness. The charging station intervention for EV from the REPLICATE project is a clear effort from Bristol to achieve environmental targets and contribute to become carbon neutral by 2030. The achievement of these objectives has a positive impact on increasing urban healthiness, which entails many economic, environmental and social benefits.

The second business tool to analyse the business model is the City Model Canvas (CMC). The figure 41 describes the CMC of the Municipality. As mentioned in chapter 3, the CMC reflects the logic on how the city is creating, producing and delivering public value in a way that is economically viable, social inclusive, and environmentally sustainable (triple bottom line).

The value proposition of the business model is to promote and enable the use of EVs facilitating charging stations infrastructure. The pilot will be a key test to take decisions-based on optimal strategies.

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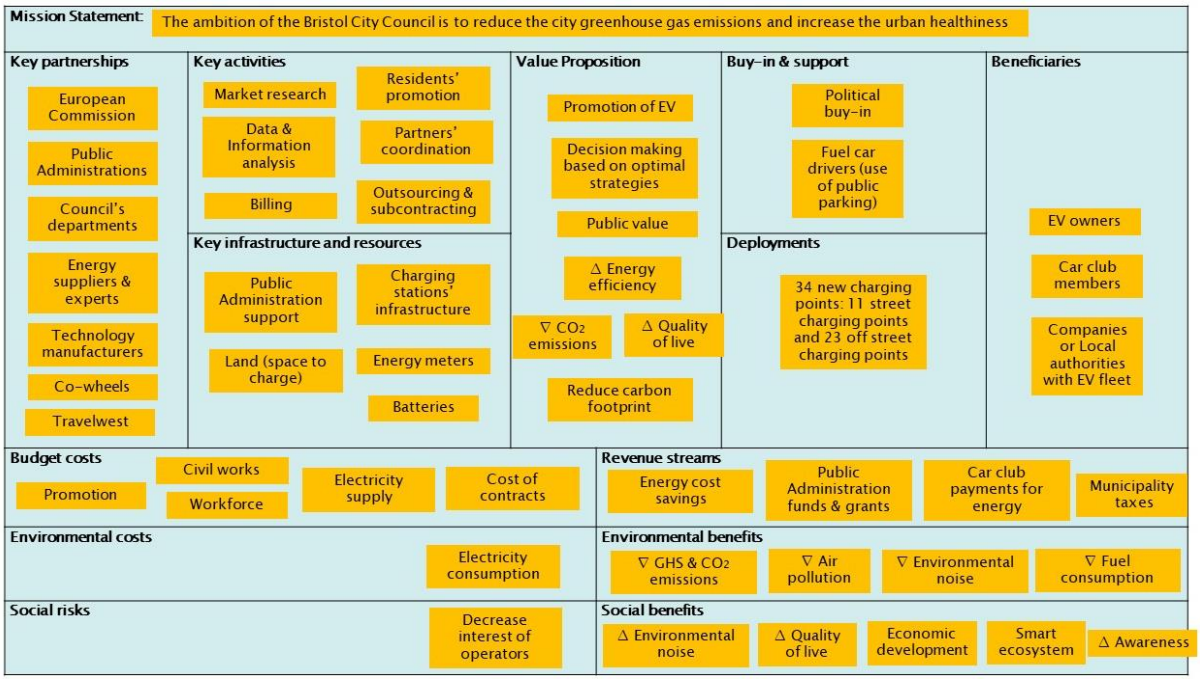

Figure 41.- City Model Canvas of BCC

As mentioned for the VPC, the value proposition of the business model wants to promote the use of EVs from a public value perspective, although the focus of the intervention is to explore and test the EV situation in order to define a concrete future strategy. The value proposition also focuses on the improves of the energy efficiency – reducing energy consumption from fossil fuels – through a decrease in CO_2 emissions and increase quality of life of Bristol's citizens.

The direct beneficiaries of the pilot project are private EV owners, citizens who own an electric car. Part of these owners are Co-wheels car club members who benefit from new charge points on streets. These car club members take advantage from spaces to park and charge their vehicles in a more efficient way. Companies and Local Authorities who have an electric vehicle fleet also make the most out of these as don't have to incur into additional costs for charging them. Obviously, considering the mission statement, the business model has indirect beneficiaries, such as citizens who will benefit from the reduction of greenhouse gas emissions and an improvement of better air quality. Also, the business model brings along other environmental and social advantages, which are beneficial for citizens and the city of Bristol itself.

Delivering value of the pilot, needs political and traditional car owners buy-in. The intervention itself has already got the interest of local councillors as well as party members as the Municipality is setting up the EV strategy for the upcoming years. Furthermore, the REPLICATE project has been working closely to the Go Ultra Lowest West project. This project is funded

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by the UK government and run by Bristol City Council which provides a range of information and infrastructure to facilitate the uptake of EV, as well as additional funding for the local authority. On the other side, fuel car owners can also be considered as blockers, because there might be a reduction of public space to park their vehicles. Car clubs such as the project partner Co-wheels have designated street parking spaces marked with white lines. Searching for new bays in the street is currently an issue for the Council as it would mean less parking spaces for private vehicle owners.

Delivering value of the business model implies the implementation of the charging points. Bristol City Council has deployed 34 new charging points from which 11 are on street charge points and 23 off street.

Producing value of the business model implies different stakeholders. The stakeholder's structure is classified by those who: i) promote the retrofitting – EU, UK government, the Bristol Council and Bristol's Energy Service; ii) finance/fund the retrofitting – EU, UK government, the Bristol Council and Bristol's Energy Service; iii) produce and deliver value – Bristol's Energy Service or Co-wheels.

Producing value involves different activities such as identifying sites to park which is an important activity. As part of the REPLICATE project, Co-wheels manage a different number of sites in the street of Bristol. They already had designed white lines in the street which say "Car club" and EV members can book online and pay for the service. The Municipality works with car clubs including Co-wheels in identifying new suitable sights to install charging points. The Municipality has also made quite a substantial effort talking with residents to set up places for charging spaces and promoting the adoption of EVs. To this end, there has been an initial stage for market research to understand the charging points demand. The Municipality also owns the data and information for the use of charging points and also the energy supply bills which the car clubs like Co-wheels use to charge their vehicles. Besides partners' coordination, with Co-wheels or Knowle West Media Center (KWMC) for different activities as well as other Council department such as highways, the Municipality has different types of contracts with partners. Although they are the owners of the infrastructure, they have an initial contract for installing the charging points and do the maintenance, as well as a follow up contract for managing data required to operate the charging stations.

Besides these activities, the business model relies on key resources and infrastructures. Resources must be highlighted the support from public administration, both national and local, as well as the EU project grant. As previously mentioned, the UK government is encouraging the transition from traditional fuel vehicles towards EVs and for instance in areas like transport, Bristol receives funding through the Go Ultra Lowest West project. The Municipality can borrow zero cost money or at low interest from the UK government for energy efficiency projects. It does also worth mentioning that Bristol bases its strategy on a bottom-up approach, which is reflected in the Bristol Approach developed in the project's framework

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and carried out by the local NGO KWMC. To this end, Bristol always consider all stakeholders involved in the energy efficiency and mobility topics.

Regarding infrastructure, Bristol City Council owns the charging points. Some charging points have got 7kWh power but most of these deliver 22Kw and cars can be charged from flat battery in about two hours. The charging point have already installed an energy meter so BCC knows how much power is coming up through the ground and then charging points can measure how much energy is delivered to the EV. Another important aspect is that the Council owns the space where Co-wheels operates through a license.

Finally, sustainability of the business model focuses on the triple bottom line: cost/revenue, environmental costs/benefits, and social risks/benefits.

The sources of revenue streams come from the UK Government programme Go Ultra Low; EU REPLICATE project grant; payment for the cost of energy when EV owners, fees car club members charge to their users; and taxes. Budget costs of the business model are related to the civil works, charging points themselves, electricity supply and cost of contracts' outsourcing.

The business model presents important environmental benefits such as the reduction of emissions (CO_2, PM, NO_x, etc.) that influence directly Bristol's quality of life; reduction of fossil fuel consumption due to an increase of EVs; and the decrease of environmental noise, which also affects daily life of citizens. Regarding environmental costs, the increase of the number of EVs is directly linked to the consumption of electricity, which also have an environmental impact according to the source of electrical power.

Finally, there are important social benefits. The main ones are quality of life and the improvement of citizens' wellbeing. Obviously, the pilot contributes to the smart ecosystem development and scaling-up the solution could imply an economic development for the city in terms of job creation, attraction of companies and start-ups, investors, etc. On the whole, it seems as the use of EVs and the promotion that Bristol is carrying out must increase also the environmental awareness of citizens. Regarding social risks, there could be a lack of interest about Bristol market from private companies like operators, SMEs, CPOs or car companies.

7.2.4 Final remarks

The job that Bristol City Council is conducting is crucial to lay down the fundamentals to create an attractive EV market. The Council is in a good position to accelerate the transition because operates the highways and owns the land where charging points can be installed. This is a critical point, but must be mentioned that it would be difficult for the Council to install charging points without the UK government funds. As a Council, and not as a private company, the intervention is attractive because of this funding.

As already highlighted, Bristol is in an initial stage for the adoption of EVs. The "chicken and egg" problem is still a dilemma. People ask themselves why buying an EV if there are not

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enough places to charge it and the charge points operators say they do not want to install more because they need more cars to use these. Also, this initial stage it is not just the only ask from private companies and operators to entry the market. On the whole, the private sector has a business model that works by giving free charge points and collecting the profit from the energy with high prices for the driver. It is quite a new market and operators work by stealing market shares. So, there has to be an important critical mass for it to extent the market and be to be profitable for them.

In this situation, we believe that the development of charging infrastructure network is a key element to promote EVs, as well as reducing gas emissions (CO_2, NO_x and PM emissions) and improving city's environment. Endmost, citizen's barriers for the use of the EVs are quite related to the facilities to charge their EVs. But, we believe that from a public strategic point of view, it is fundamental to offer an adequate number of charging points in the city that integrates EVs needs, and the city has a key role to play in the promotion of the whole electromobility ecosystem. Being at this initial stage is a good signal to start setting the fundamentals to attract the private sector in order to operate in the urban areas under a win-win situation between them, the public sector and citizens. An example could be the CPOs and EMPs from the sector, who are important players to engage in EVs market. At the end, it is fundamental to reach a critical mass of EVs mobbing around the city in order to guarantee a minimum amount of incomes.

In contrast, and behind technical problems, it is also true that EVs prices are high and not all citizens can afford them. This way, the strategy should incorporate incentives for the purchase of EVs. It is true that these incentives could benefit first adopters who can purchase EVs, but it is necessary to have a critical mass and incentive for purchase or having an EV are key.

7.3 Co-wheels

7.3.1 Enterprise's presentation

Co-wheels is an independently owned national car club that provides low emission, hybrid and electrical cars for organizations and communities across the United Kingdom[51]. It is the largest car club in the country and manages 650 services across towns and cities. To this end, Co-wheels is at the forefront of EV provision in car clubs across the country[52]. The company works

[51] Source: https://www.co-wheels.org.uk/about_us

[52] Source: D5.7. Transport Infraestructure Adaptation Including EV Charge Point Installation. REPLICATE project. H2020-SCC-2015 Smart Cities and Communities Innovation Action (IA). 20/07/2018

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under a social enterprise model essentially, and has been operating for 10 years. In addition of providing car sharing to public, they provide pool cars to local authorities, organizations and corporates, but mainly public administration institutions. They count with a fleet of around 400 vehicles in total – 100 of them are specifically EVs –, and a staff of around 35 workers.
Regarding the REPLICATE project intervention, Co-wheels roll out the Car Club Electric Vehicles (EVs) in close collaboration with the City of Bristol who undertakes the charging infrastructure intervention. Its objective has been to expand the existing Car Club in Bristol with EVs alongside the placement of e-bikes in a shared corporate scheme[53]. For the case of EV cars, Co-wheels has provided 12 e-cars in the project area. The company offers the service which entails 12 full electrical vehicles (BEV) – added to its existing fleet and uses 12 off street charge points. For the case of e-bikes, Co-wheels has implemented 12 e-bikes in Bristol project area. The company offers the service which entails the product of e-bikes and services for booking, charging and maintenance.

7.3.2 Customers and value needs

Co-wheels has different types of customers depending on its business model. The main business models are two. One regarding car members club who are individuals – pay as you go business model- and one regarding public bodies and corporates who uses Co-wheels services as a service for workers – closed fleet business model.
As depicted from figure 42, the first segment, the customer map (demand side), as mentioned in chapter 3, identifies the jobs and tasks customers want to perform, the negative aspects they want to avoid, and the positive aspects and benefits customers want to gain from the service.
From the perspective of customers, as observed on the right side, customers' jobs, the is a clear need from them to access sustainable transport as a service to move. Customers, understood as a car free, are committed to not having an own car. There could be several reasons. Most important ones are related to costs of purchase and maintenance of a car as well as to be eco-friendly, which means contributing to energy efficiency models of transports to combat climate change. Furthermore, customers want also an easy manage service to pick EVs, reliable and simple, at convenient locations that facilitates access and arrival, and connection to other possible means of transport.
On the contrary, pains that lead to negative emotions of customers, are related to different items. There are customers that are aware of high costs of owning a car – fuel or electrical – and they have decided to search for affordable alternative transport methods. They cannot afford these costs. Same customers or others are concerned about the environmental impact of traditional transport and have decided to adopt also alternative transport methods. For both

[53] Source: D5.5. Car Club expanded with ten Electrical Vehicles. REPLICATE project. H2020-SCC-2015 Smart Cities and Communities Innovation Action (IA). 25/01/2019

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types of customers, no matters the reason for adopting shared EVs and being a car club member, their pains concern to the adoption of this type of transport model in the city. From their point of view, as a car club members, they are concern about social and environmental awareness at a level society that has not fully adopted this type of transport with great societal and environmental values and impacts. To this end, their pains concern to a low level of the model adoption linked to low promotion, need of EV infrastructure and street parking space.

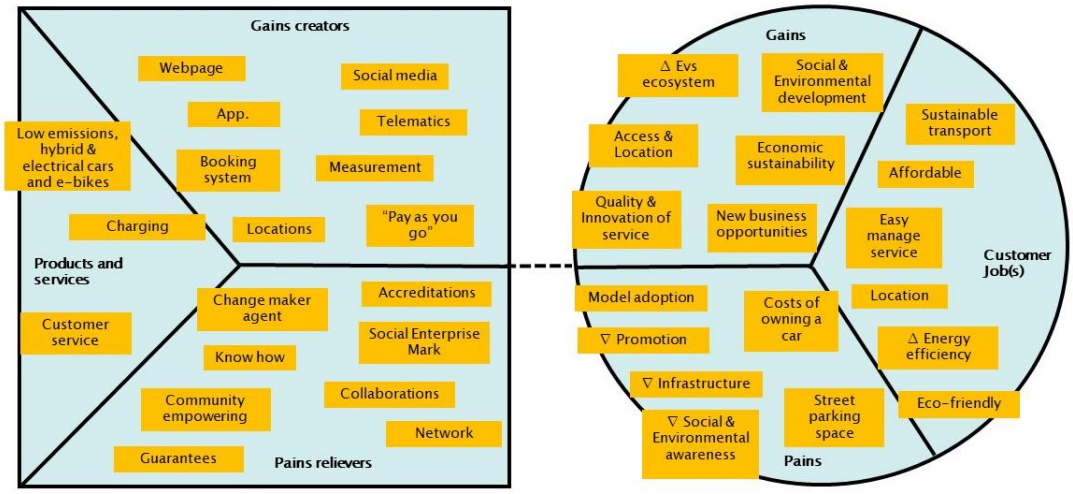

Figure 42.- Value Proposition Canvas of Co-wheels

However, in customers' gains, aspects that lead positive emotions and make easier customers' tasks when using a service, these expect an increase of the EVs ecosystem with fewer owner cars and more sharing services that lead to a model of transport economically sustainable with social and environmental outcomes. Somehow, the customers expect a transport model based on mobility as a service rather than the traditional mobility business model based on ownership and fuel carbon vehicles. To this regard, customers want to use a service based on quality and offering innovative aspects to solve their pains and get the jobs' done. Important aspects for customers' experience are access and location to the service. Access refers to the simplicity of booking and purchase the service. As we will see, Co-wheels presents gain creators in such items that clearly make easier customers' experience on such items. And location refers to proper places where EVs charging stations are placed, easy to get to them, useful at destination, and well connected to other transport services.

On the left side of the VPC in figure 42 we can see the product and service canvas, which theoretically, should respond to the challenges, issues and preferences that customers have.

Co-wheels offers mobility as a car sharing format. The service lends cars to customers members who just need to book and pay per use. They have the EVs and e-bikes, the parking

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space, and the charging infrastructure. Regarding e-cars, they use 12 22kW charge points using a Renault Zoe as a car.

Pain relievers respond to the "pains" that customers present. An important and fundamental pain reliever is Co-wheels know-how. The club has more than ten years of knowledge and experience in providing car club and fleet management services. To this end, Co-wheels is clearly pushing for sharing vehicles rather than owning them. It is well accredited with different certifications and recognition of its task and way to do thinks, such as the Social Enterprise Mark which demonstrate that they are annually and impartially assessed against transparent criteria for social enterprise. Besides certifications, Co-wheels does a great task in community empowering by different types of social media instruments. At the end, Co-wheels represents a change maker agent with is model of vehicles provision and tries to match locations in proper areas where there are connections to other transports fostering in this way the network of mobility in Bristol.

The gains creators in the service side in figure 42, meant to respond to customers' preferences that shape their purchasing decisions. An important gain creator for customers is the booking system. Members can book online using the website or the Co-wheels app on an easy way. Through the system – website, app. or social media such as Twitter or Facebook – they can see which cars are available, location and costs depending on the type of car. Also, the EVs have charging cards to access the regional re-charging network. Co-wheels uses telematics on-board cars to provide real time state of charge information of cars to the Co-wheels software to attend delivery and combine this information with schedules for trips. Obviously, these telematics offer a wide range of data from vehicles (books per month, hours booked, miles, etc.).

7.3.3 Business model

The mission statement of Co-wheels aims to regulate car usage and being committed to offer a high-quality service involving community and working towards environmental sustainability. As a social enterprise, Co-wheels mission is not based on profit. That is the reason why, to map the intervention's main stakeholders, activities and goals, we use a Mission Model Canvas to define its business model, as seen in figure 43, as the core of the project resides in such mission achievement, instead of earning money.

The value proposition of Co-wheels is the roll out of EVs on a comprehensive efficiently public management using and enlarging networks to provide an accessible, flexible and affordable transport with a clear impact in reducing carbon footprint. Furthermore, could be also highlighted some important social impacts regarding social inclusion and contribution to change behavior. At the end, Co-wheels provide accessible and affordable services to those who cannot afford the expenses of owning a car as well as being a catalyst to impulse new models of transport of high sustainability.

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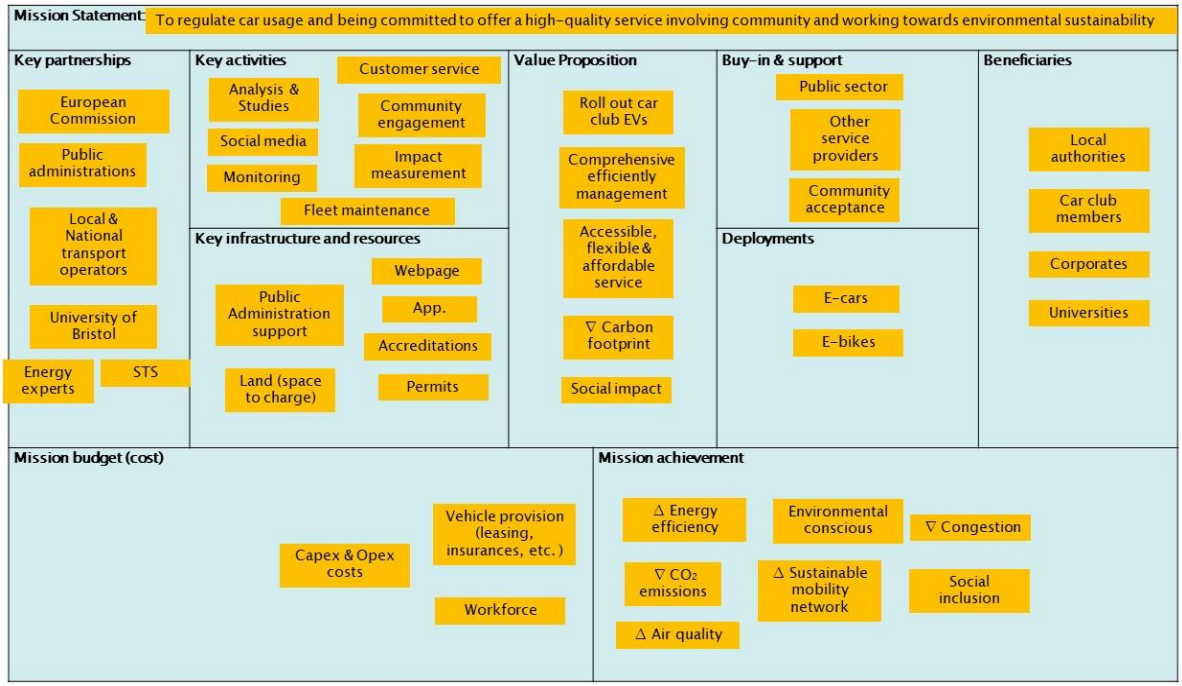

Figure 43.- Mission Model Canvas of Co-wheels

The beneficiaries of the service are of different types depending on the business model. On one side, there are individual customers as car members and customers from small medium size public and business organizations who will use the cars as an alternative to roller ship car, as a second car or as a mean to encourage workers to use car clubs' cars to get to work. On the other side, the public sector principally that are provided with car solutions for their workers for regular trips.

The delivering value of the pilot needs the political buy-in. The intervention has already the buy of the politicians, because the City of Bristol is setting up the EV strategy for the coming years. Furthermore, the REPLICATE project has been working closely with the Go Ultra Lowest West project. This project is run by the UK government and provides a range of information and infrastructure to facilitate the uptake of EV, as well as funding. To this end, local councils are key to roll out services for future developments, as they are potential customers for fleets as for economic, social and environmental impacts that the model could bring to a city. At this point, we can considerer that it is critical for future developments to have public authorities buy-in, especially for solution that imply massive developments. Also, there is the need from other service providers in a city, such as bus operators or bike providers in order to provide wider solutions towards mobility as a service. Finally, there is the community acceptance which imply car owners who do not want to lose street parking space and could represent a blocker in some locations.

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The business model delivering value implies the implementation of the services. The Bristol City Council deploys 24 for new charging points, 12 on street charge points and 12 off street charge points. Co-wheels works on street charge points deploying all tasks needed to offer the service (leasing, location, booking service, regulations, etc.).

To produce value, Co-wheel counts with different stakeholders. As mentioned before, the buy-in of public authorities represent a key stakeholder because they promote this type of transport model. At different political levels, the EU, the UK government and the Council of Bristol are promoting, financing and funding programmes which clearly helps to enlarge these types of interventions. In general, the public authority's commitment is key for the model. There are several reasons for that commitment. Obviously, there is a will to reduce carbon emissions, but also to search for other benefits that the models bring such as less traffic, integration of public private transport networks, change behavior, social inclusion or fleets for own works. In general, Co-wheels has to work closely also with car manufacturers (i.e. Renault for leasing cars) technology providers and mobility operators from transport networks where it operates. Regarding e-bikes, Co-wheels works with different partners. It has bought the bikes to Raleigh UK Ltd and works with the public administration and Sustainable Travel Solutions (STS) to provide the service.

The model implies different key activities. A principle activity is related to analysis and studies in order to understand which will be the next level of the model. In this sense, Co-wheels is highly committed on how the business evolves from traditional car hire or car scenario, which could include to move to a whole perspective of mobility as a service, looking at the car service as one source and how to connect with other mobility sources in such scenario. So, Co-wheels is looking on how sustainable transport will move and how they could be a key factor on that. Also, this analysis and research focuses on charging and products technology as well as searching and identifying great locations for EVs on-street parking spaces. For the case of the REPLICATE project, Co-wheels has searched spaces attending its convenience for car club members and connections to other types of transport using advanced data sets and mapping tools with different metrics. These metrics are merged with demographic and socio-economic information, travel patterns and car usage levels. So far, another important activity was to get permissions both for connection power distributors and traffic regulation from the Council of Bristol to ensure parking place on street. Once permissions were on board, the Council provided the new charging points and connected them to the back office.

Besides these activities, the business model relies on key resources and infrastructures. Regarding resources, must be highlighted the support from public administration, both national and local, as well as the EU project grant. As mentioned, the UK government is pushing for the transition towards EVs in transport and mobility and it has financed Bristol through the Go Ultra Lowest West project. The Council can borrow zero cost money or at low interest from the UK government for energy efficiency projects. At this point, Co-wheels business model is

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viable by itself, but in order to grow needs public authorities' involvement in providing resources towards sustainable mobility transport which implies infrastructure.
The budget (cost) to maintain services are mainly concentrated for the vehicle provision. This is the highest one, representing almost 90% of the budget, which implies lease costs and insurances for placing cars in the street. To cover such costs, Co-wheels has different sources of revenue streams. The most important one comes from members fees and charges for the car club members business model. Regarding the public sector and corporates business model, Co-wheels has service contracts where the customer pays monthly fees per the usage of vehicles. In both cases there are also fill charges.
Finally, the business model relies on the mission achievement. As mentioned, Co-wheels is a social enterprise, and they are not just there to make money. Its business is a vehicle to achieve its mission statement which has great returns to the community. Co-wheels, as a Social Enterprise and Community Interest Company, presents successfully social and environmental impacts. Regarding social impacts, they improve social inclusion providing access to car at affordable prices, fostering change in citizens' behaviours about community, and enhancing a better mobility transport network for cities. In fact, car club members make more trips by public transport, walking and/or cycling after joining the club[54]. That is a key factor to understand Co-wheels as a change maker actor in a city. Social inclusion is also a contribution from Co-wheels, not just for prices, but also because of connecting excluded areas where access to public transport or affordable transport is more limited in comparison with central areas. They bring connections between these areas. Regarding environmental impacts, as an example, 12 e-bikes and 11 e-cars have a total carbon savings per years of 4.32 and 17.27 tonnes, respectively.

7.3.4 Final remarks

The intervention is of great public value. Co-wheels represents an important stakeholder in promoting smart ecosystems for sustainable mobility transport. Unlike the competition, it seems that Co-wheels is certainly more dynamic, more responsive and an independent business. The fact that they are a Social Enterprise implies great returns to the community. On the contrary, primary competitors are enterprises that provide car club solutions in the street and through pool cars, but they are run pretty much from a car rental perspective. It is still quite a traditional hire car rental attitude towards the business.
The model of Co-wheels is highly scalable and replicable. They base its strategy on organic growth in England through increasing locations and fleet in strategic areas where they can be part of the transport network. It is a viable and economic sustainable business model that

[54] Source: D5.5. Car Club expanded with ten Electrical Vehicles. REPLICATE project. H2020-SCC-2015 Smart Cities and Communities Innovation Action (IA). 25/01/2019

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depends on membership fees, charges and service contracts with public organizations and corporates. From a scale up strategy, Co-wheels when into an acquisition last year focused on gathering investment. Part of the acquisition was a join venture with a company car in Germany to keep growing. But with the Covid-19 and the pandemic situation from year 2020, Co-wheels have been looking at maintaining the business, although they keep looking for partners within the tech sector, the mobility sector, electric charging companies…to search who they can work with in new locations. They have a mix strategy to keep growing where they are right now, but also introducing to new locations working with local partners.
At this point, it is crucial to search for right locations where smart projects such as REPLICATE are present in a city and provide great synergies among stakeholders to foster smart mobility solutions. Also, go to market in some locations could represent a risk for Co-wheels. The reason is that making a business sustainable it is about people's and cities' awareness of what is a car club. Furthermore, there are places where does not make sense to get in because there are not transport links to support a car club. Supporting travel infrastructure is crucial.

7.4 Esoterix

7.4.1 Company's presentation

Esoterix Systems Ltd. is a for-profit SME with a vision of introducing economically, socially and environmentally sustainable urban transport services that meet the needs of all citizens. Its mission is to develop the technology to operate on-demand urban transport services and the technology to integrate such services with other modes and other citizen services. It has demonstrated that there is undiscovered demand for affordable, reliable, highly convenient (near-door-to-near-door) transport in cities through the field trial of a commuting service buxi (a bus price for taxi convenience) to co-located out-of-town employers in Bristol in the UK[55].
Regarding the REPLICATE project, Esoterix participates in mobility actions with its focus in On-demand EV Minibus (WeGo) service, routing and scheduling, and user interface. WeGo provides highly convenient, personalised 'A-to-B' journeys in a shared vehicle, offering new levels of service at an affordable price. The service is events based, with passengers booking transport

[55] Source: DoA REPLICATE (691735). REPLICATE Annex 1 – DoA to the GA. Description of action: mobility actions, p. 203.

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to-and-from community events, clubs or "events" such as a connection to a rail or coach service. Passengers book transport at least one hour before the event is due to take place. With one hour to go they are texted their exact pick-up location and time. The price is £1 each way, payable online or in cash to the driver. WeGo minimizes its costs by only running when there is custom (passengers booked). Passengers are able to book WeGo alongside the event it is serving, e.g. a link to book on the Eventbrite events platform or a link to book on a connecting rail service. Event holders are being encouraged to subsidise the transport (to increase the likelihood of people attending their event) and in this way WeGo can become financially sustainable. WeGo is delivered in an electric "Hackney Cab", an accessible 6 passenger seat vehicle in which the seats are laid out in a social style (facing each other). The use of electrically powered vehicles to deliver multiple journeys will positively impact congestion, air pollution and greenhouse gas emission[56].

Figure 44.- LEVC Electric "Hackney Cab"[57]

To summarize, Esoterix offers mobility solutions to fill network gaps in the public-private transport in the city of Bristol. Its solutions cover a wide range of customers' needs and always provide economic, social, and environmental benefits.

7.4.2 Customers and value needs

The value proposition of Esoterix responds to a transport and mobility shift paradigm in Bristol. Esoterix is a clear example where customers' needs are taking in account and the whole business model is developed from that perspective. In this sense, the final customer has to be understood as citizens who benefit from personalized transport, although Esoterix has different types of customers who are part of the mobility value chain in Bristol, such as the public sector, mobility operators or private companies. Regarding the REPLICATE project,

[56] Source: D5.6 On-Demand EV Minibuses (BUZZ) deployed. Esoterix. REPLICATE project. H2020-SCC-2015 Smart Cities and Communities Innovation Action (IA). 31/01/2019

[57] Source: D5.6 On-Demand EV Minibuses (BUZZ) deployed. Esoterix. REPLICATE project. H2020-SCC-2015 Smart Cities and Communities Innovation Action (IA). 31/01/2019. P.9

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Esoterix's direct customer is the Council of Bristol who wants to set up and apply a set of different interventions in transport towards a smart mobility system. As it is shown below, figure 45 shows the Value Proposition Canvas (VPC) of Esoterix's intervention and provides a clear vision of the relationship between the market and the service. In this sense, the market has to be understood from a variety of customers' needs, although citizens' are the main beneficiaries at the end of the value chain, because WeGo service tackles the Council's needs, which at the end serve to citizens' needs.

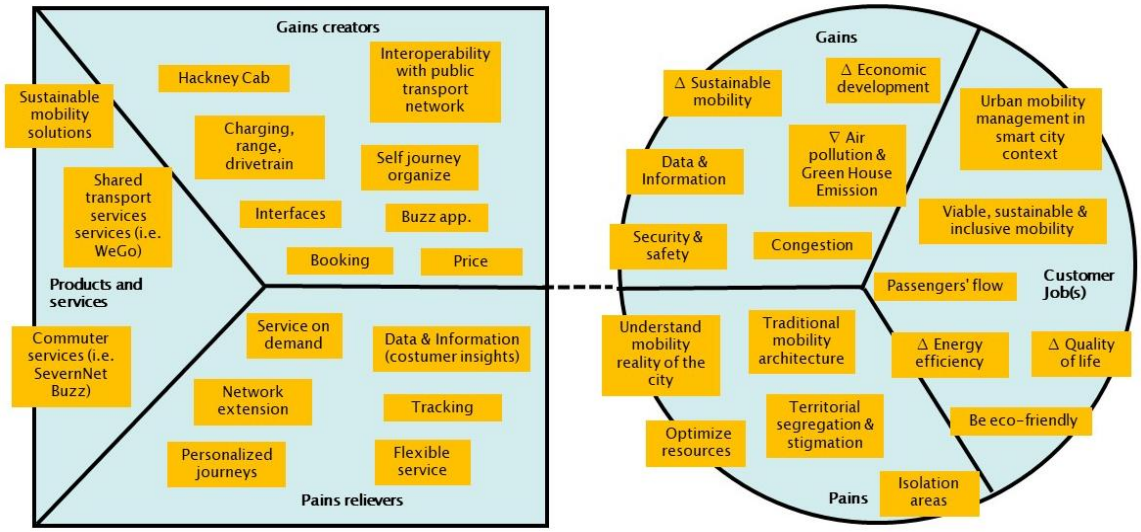

Figure 45.- Value Proposition Canvas of Esoterix

The first segment, the customer map (demand side), as mentioned in chapter 3, identifies the jobs and tasks customers want to perform, the negative aspects they want to avoid, and the positive aspects and benefits customers want to gain from the service.

From the perspective of customers, as observed on the right side, customers' jobs, there is a clear need from the Council to offer mobility solutions to specific zones of the city where there are limited mobility options which implies less routes and consequently increase mobility disadvantages to their neighbours. These disadvantages are of great importance. A clear example is the need from neighbours to get easily to working areas located in suburban areas outside the city. To this end, the mobility issue has to be understood also as a maintainer or enabler of the citizen's quality of life. It is about inclusive mobility. So, the Council needs to increase passengers' flow in concrete and between areas to offer mobility solutions and this has to be done in a viable and sustainable manner regarding economic and environmental issues respectively. The mobility solution has to be eco-friendly which means being economically viable, socially inclusive and environmentally sustainable.

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Regarding pains, aspects that lead to negative customers' emotions, the main aspects involve understanding which is the reality of the mobility in the city and how to offer an appropriate solution as a public policy. Although there are a few routes which are financially supported by authorities, the reality is that Bristol functions primarily under a traditional mobility architecture where routes and connections are based just in their economic viability, which means defining routes and frequency in terms of volume of demand and density of population. The effect of such architecture is the isolation of areas which in turn has many negative consequences for their neighbours in terms of economic and social inequalities, as well as territorial segregation and stigmatisation. It is also worth pointing out, that the alternative of not having mobility solutions from a public transport point of view, is to take the car (although the REPLICATE area has the highest rates in the city of no having a car, which also represents a clear sign of relative deprivation). The lack of adequate public transport also has an impact in environmental issues such as air pollution, CO_2 emissions and congestion.

On the other hand, gains, aspects that led to positive emotions and make customers' tasks easier, there are several issues. The Council of Bristol needs to introduce new paradigms of mobility based on sustainability and not just on cost effectiveness as it works with operators at present. Furthermore, the sustainable solutions need to be based on real data and information about the needs and use of the transport. Obviously, sustainability implies gains such as the decrease air pollution, CO_2 emissions and congestion in concrete areas. But, the Council wants also to increase the economic development where the customer lives as well as certain areas for economic development like places with large employers and shopping areas who are also possible customers from Esoterix' solutions. The Council of Bristol knows that mobility issues impact job opportunities, as well as offer great possibilities to large employers making easier to get to access employment or to shopping areas where are interested in increase passengers' flows.

The second segment, the value map (supply side), describes how the proposed business model challenges the customer expectations and the proposed value for the use has to be created. To this end, as observed on the left side of figure 45, the solution clearly tackles many of the customers' jobs and tasks.

Regarding products and services, Esoterix designs, implements, and operates different sustainable mobility solutions for transport in Bristol. One of the key aspects of its solutions is that they are created to offer a response to the gaps in the transport network. As already mentioned, these gaps have terrible consequences for the citizens. The intervention of the REPLICATE project, as mentioned in the introduction, based on the "WeGo" mobility service, delivers a demand responsive transport service to improve access to events in the areas of Ashley, Easton and Lawrence Hill. At the end, Esoterix's solutions deliver attractive, convenient and financially sustainable passenger transport services so that everyone in society can access jobs, healthcare, social interaction, etc.

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To this end, pain relievers clearly solve customers' problems. One of the main pains of customers is understanding and managing mobility reality of the city. The reason is that there are network gaps which imply many negative consequences. These consequences affect the city, the citizen, the neighbourhood, and stakeholders such as mobility operators or private companies, and the environment itself. Esoterix offers a transport based on purpose and the need of demand – Esoterix works and designs according to data from routes, times, consumer insights – aspects that are already not completely covered by the public-private transport network nowadays. They service of WeGo offers the possibility to connect events and transport systems such as railway or bus. It is a clear example of the network expansion of transport as well as connects different groups of people and events. The fact is that the connectivity between transports is highly disrupted, for example in terms of frequency and delays.

On the other hand, gains creators, solutions that lead to customers' benefits there are several issues well explained in D.6. It is important to highlight some issues regarding the service model and the EV. An important aspect is the interoperability with the public transport network with connections target as events and avoiding duplicate services. The pricing is also an important gain creator because Buzz pricing is set at price of £1 flat rate each journey. This must be understood as an inclusive price because targets of the REPLICATE project intervention are from significant social deprivation areas. Passengers can pay through the Buzz app or directly to the driver in cash. The Hackney Cab used in Buzz is zero emissions and has place for six people. The operation requires also from charging points, range (80 miles up to 297 depending on the range extender) and the drivetrain for propulsion.

7.4.3 Business model

The second business tool to analyse the business model is the Business Model Canvas (BMC). Figure 46 describes the BMC of Esoterix service. As mentioned in chapter 3, the BMC reflects the logic on how Esoterix is creating, producing and delivering value to the customer.
As mentioned for the VPC, the value proposition of the business model is to provide 'transport for purpose' consolidating demand at best places. The service provides flexibility and personalized service using real data and information. This benefits Esoterix as well as possible project partners because the service only runs when there is demand and reducing costs when does not have to operate. The pricing is also important. The pilot project takes place on areas with significant social deprivation. To this end, £1 flat fare each journey could be understand as an affordable and inclusive service. Furthermore, as already mentioned, the service is social inclusive and environmentally sustainable. Inclusivity implies many aspects, but it is worth highlighting some of the benefits from the service such as mobility itself, job opportunity, tackling loneliness and social isolation, territorial stigmatization, etc. And environment implies benefits such as the decrease air pollution, CO_2 emissions and congestion in concrete areas.

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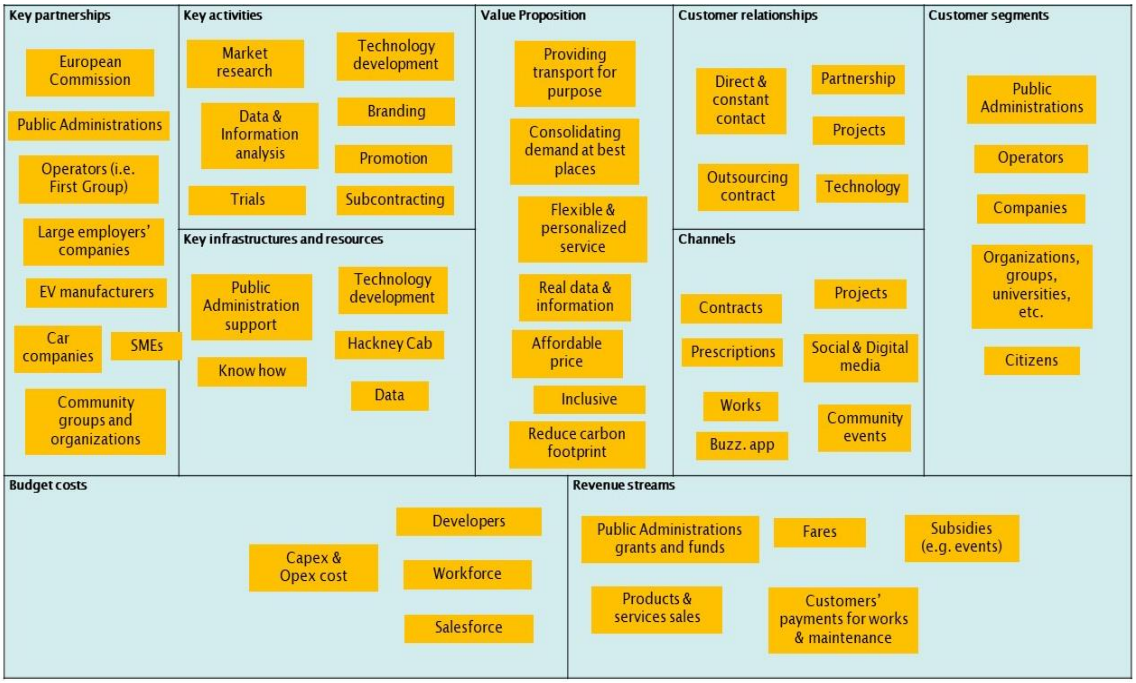

Figure 46.- Business Model Canvas of Esoterix

The customer of Esoterix is diverse. The public administration segment is a principle one, such as in the case of the REPLICATE project with the Bristol City Council, as well as the citizen itself who pays for the transport. An important customer are also operators, such as First Group who operates 95% of the bus public network. Esoterix was contracted to cover certain areas that are unserved. Also, the company can work with large employers' companies setting a service for their workers or mall shopping centres which are interested in receiving people. Furthermore, there can be customers such as organizations, groups, events…that are interested in mobility services. There are many actors that need Esoterix mobility services to cover gap and/or are interested in people moving around.

The delivering value of the business model presents different types of customer relations such as direct and constant contacts, outsourcing contracts, partnerships, social & digital media, projects and community events. In general, Esoterix uses a direct and personal approximation to the customer, set a meeting, and explain about Esoterix's products and services. It is a door-knocking activity with anyone who gains from people moving around. In contrast, the relation with the final user – passenger – could be trough the technology (Buzz app.) or paying directly to the driver. Regarding channels they are mostly direct channels between Esoterix and the customer through contracts, projects and collaborations, although there is an indirect channel as mentioned, through the Buzz app for booking and paying.

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Figure 47.- Example of a promotion campaign in a community event[58]

The producing value of the business model implies multiple and varied stakeholders. The stakeholder's structure is classified by those who: i) promote the service – EU and public administrations, in the case of REPLICATE project the Council of Bristol; ii) finance/fund the action – EU and the Council; iii) produce and deliver value – the Council, car companies, SMEs, groups, etc. Regarding stakeholders, it is important to remark that Esoterix always tries to complement the existing network and not to compete. To this end, principle and critical stakeholders are cities and city councils who at the end are key players in the transports system and should invest more in transport provision towards a transition. Obviously, operators, concretely bus operators, are of much importance. Regarding SMEs, Esoterix work together with City Fox Group, Classic Taxi and Urban Things for adapting and innovating in its operating and service models.

The business model implies different types of key activities. Obviously, market research is a fundamental one to identify customers' needs, networks gaps, etc. in order to create attractive selling proposals. Also, Esoterix does a key activity related to data and information regarding consumer insights and mobility knowhow in concrete areas. This data and information are of great value and fundamental to understanding the reality of mobility and to offering solutions to customers. In the end, it is all about data to understand where the demand is and where will be (the later demand). This is the value that Esoterix offers for example to operators. The fact is that Esoterix can bring users to them and help them improve their service. Esoterix understand how people behave because works with a behavioral model which estimates, for instance, how different people value price against convenience; and as people use the service

[58] Source: D5.6 On-Demand EV Minibuses (BUZZ) deployed. Esoterix. REPLICATE project. H2020-SCC-2015 Smart Cities and Communities Innovation Action (IA). 31/01/2019. P.8

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Esoterix use machine learning to iterate the model. Some people are all about price and another do not mind because is about convenience. Esoterix works to understand this across the population and then have a very powerful tool for an operator or a local authority to understand what passengers want. It is about capturing, analyzing and understanding the data.

Regarding promotion, besides door-knocking, Esoterix also uses banners, mailshots and different tools from social and digital media. But, as mentioned, there is an important work attending events in place and talking with people about the service but also about social and environmental benefits of their services to raise social awareness.

Also, Esoterix does subcontracting activities to business to offer the service, such as taxis. This is because they are a technology company and prefer to partner with operators who manage the day-to-day activities such as licenses, managing, organizing drivers, etc. Here the working rhythm is different and there is not much space for innovation.

Besides these activities, the business model relies on key resources and infrastructures. One of these resources is the public administration support, especially regarding the REPLICATE project where besides grants and funds, collaborations are working well. Esoterix also has a great knowhow about the topic that is constantly fed through the knowledge they acquire through data analysis and technology development. In this sense, it is important to highlight the capacity of Esoterix to redefine services.

Finally, the business model focuses on the cost/revenue structure. As observed in figure 46, Esoterix has different sources of revenue streams: public administration grants and funds, especially in the REPLICATE project through the EU grant; products and services sales; billing from users (fare); or subsidies. These subsidies could be from an employer, a mass transit operator or a local authority who are interested in people to move. Regarding costs, the more significant ones are operating cost (Opex costs) where Esoterix incurs for running operations. From an economic point of view, the service needs critical mass and volume to be viable. At the moment, depends quite on off-peaks hours to introduce its service. They are keen to grow quickly and are preparing an investment round.

7.4.4 Strategy

Currently, Esoterix is offering a type of solution that is not in the market, at least regarding concrete areas of the city of Bristol. The current transport model is quite based on value for money, while Esoterix's model is based on value for purpose or demand. To this end, figure 48 presents a comparison, through the Strategy Canvas tool, between the traditional model and the on-demand model. This is an exercise based on the analysis of data collected throughout the REPLICATE project, which reflects those points of similarity and difference between models. In some way, it is not about substituting one for another, it is about combining them trying to shift to a holistic approach about the transport system in Bristol.

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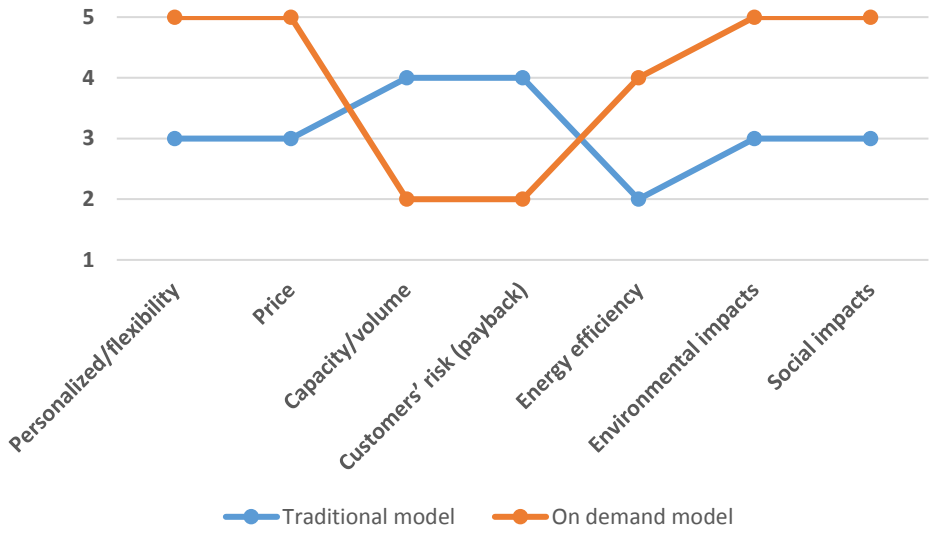

Figure 48.- Strategy Canvas of Esoterix

As observed, the businesses reflect the strategy positioning of each model. The items have a score of 1 to 5, where 1 means less weight compared to the model (disadvantage) and 5 greater weight compared to it (greater advantage) when facing the market.

The first item is the personalized and flexible journeys. Contrary to the traditional model, Esoterix's solutions such as WeGo, runs the service by booking and can modify routes according to needs of the demand. The traditional model has fixed routes and bases its business model on frequency and volume. This is not a negative aspect per se because is attending demand in many places of the city, but leave others uncovered because they are not profitable. The second item is about price. Esoterix is very aware of the final customer (beneficiary) which is attending and knows that the ticket price has to be affordable and inclusive, otherwise its service would not make sense to the passengers. And besides that, a higher price could compete with the alternative of taking the car.

The third items regard to capacity and volume. In this sense, the traditional model has great capacity and volume to overcome demand but just because operates in places where there is demand. Esoterix would be able to address capacity and volume in concrete areas if its model were better known and had a strong support from the Administration and the operators. Esoterix routes would not compete with traditional operators; rather Esoterix would integrate their services with the core network to maximise overall efficiency. The fourth item could be a problem to Esoterix regarding sources of investment, specifically the private one. The return capacity from Esoterix seems to be low because of the sales volume. That is the reason why Esoterix's solutions although they are personalized and flexible, must have a higher critical

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mass. Moreover, if the model does not have other stakeholders support who share risks too, would be difficult to engage private investment.

The on-demand model is more energy efficient than the traditional model. As already mentioned, besides technical aspects from EVs, the fact is that the service only consumes when service demand and operates with small units comparing to buses or trains. Also, WeGo measures the primary energy consumption and the CO_2 emissions from each service and contrast them with other modes of transport users would otherwise have taken to calculate differences and saving per journey regarding primary energy, air pollution and CO_2 emissions.

Finally, the fifth item regards to social impacts. The service is designed to be inclusive with fully accessible vehicles and no reliance on owning a smartphone. This helps to tackle aspects such as price, loneliness, social isolation, territorial stigmatization…but implies also an economic development for the territory and final destiny connections. The capacity to move people is needed by many actors, such as large employers, mall centres, organizations, events, etc. who would profit from this movement.

7.4.5 Final remarks

The value proposition of Esoterix is very attractive for the transport system in Bristol. Esoterix has the capacity to discover and tackle scope problems from this system offering solutions that are highly adaptative and do not enter into competition, to the contrary its solutions complement and augment the traditional systems to improve it.

Esoterix presents many key success factors. One of the most important it is its capacity regarding data and information analysis about mobility issues. For them, the objective is not just to bring the customer to the schedule operator, but bringing the insights about this customer. For the moment, the traditional system, for example the bus company, does not know much about their customers, e.g., it does not know where customers have come from or where are going to. These data are of great value to Esoterix's business model, but also for these types of operators, as well as public administrations and other actors involved in mobility issues or that could benefit from this knowledge about customers mobility. The fact is that historic and current customer insights is a key element for many actors of the value chain. Furthermore, it is key to consolidate demand which imply economic, environmental and social benefits for many stakeholders. Another important aspect to highlight, is that Esoterix measures different environmental aspects comparing difference between systems to identify savings in primary energy consumption, air pollution and the CO_2 emissions. Furthermore, these aspects can clearly be monetarized and presented as a clear gain of its business model.

In practical terms, as highlighted by Esoterix, the WeGo business model depends highly on subsidies from local authorities, agencies and charities once it is established. From an economic point of view, the service needs critical mass and volume to be sustainable. To this end, they need to grow sales quickly to pass the breakeven point which will let the business clarify where investment should be placed to become more profitable.

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From our point of view, the strategy should focus on sales, at least in the short-term. Esoterix already has the knowhow, the team and above all the capacity to offer attractive and innovative solutions beyond WeGo solution to cover gaps. To this regard, we believe that the value proposition of Esoterix has to be known by a wide range of possible clients who can benefit from it. Esoterix has something that is lacking in the market and that is customers' experiences and insights. In this sense, investment should concentrate in public administration investment as well as private investment with social and environmental targets with long-term returns. A key aspect is that the investment clients' portfolio presents a mix of titularities to share risk investment.

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8. Information and Communication Technologies

Information and Communication Technologies (ICT) are one of the most important elements of the transition to smart cities. ICTs in the context of smart cities are seen as a valuable resource for achieving 'strategic urban development goals' (Schuurman, Baccarne, De Marez, & Mechant, 2012, p. 51). It is therefore crucial for smart cities to develop the infrastructure for these technological services through different type of organizations. There are key elements such as wireless networks, connectivity opportunities, Internet of Things, Big data Open data and Linked Data, sensors, controls-room, etc. that are of great value for cities and regions' economies, as well as for environmental and social benefits. Next organizations' analysis shows how these organizations develop different business models and strategies to implement energy efficiency interventions in REPLICATE's Lighthouse Cities.

8.1 Sistelec

8.1.1 Company's presentation

Sistelec *S.A* is a leading Spanish company that operates in the telecommunications sector offering technological solutions in different fields, such as security, mobility, connectivity, and remote control[59]. As a company, Sistelec is mainly a wholesaler, with a workforce of around thirty people and a turnover of EUR 10 million per year approximately. In addition to the city of San Sebastián, Sistelec has also presence in cities such as Madrid, Barcelona, Pamplona, Bilbao and Logroño, as well as other cities and territories where it works with local partners on different projects.

Sistelec is an operator that develops its own infrastructure and has the capacity to sell it. In addition, it has part of the wireless network, as well as the physical fiber optic network (dark or passive network). For the case of the wireless network, Sistelec acts as a service operator offering WIFI to the citizens and self-provision of services to the municipalities. And for the case of the fiber optic network, Sistelec makes it available to other type of companies such as telecommunications operators, private entities, etc.

In relation to the REPLICATE project, the pilot in the city of San Sebastián focuses on the development, implementation and deployment of a high- throughput Wireless Broadband

[59] Source: https://www.sistelec.es/

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network based on legacy of WiMAX technology (Worldwide Interoperability for Microwave Access) in the district of Txomin/Urumea[60]. This network increases the capacity and security of the network, supporting the district's connectivity with the entire city of San Sebastián. One of the most important aspects of this network, based on postWiMAX technology, is security, as it ensures the privacy and confidentiality of the information. In addition to encryption of communications, new security and authentication protocols are implemented to prevent unexpected intrusions. Sistelec uses novel equipment with Wireless Broadband technology as well as multi-stream radios (using MIMO techniques) to create the transport layer, which increases the coverage areas (suitable for urban environments of smart cities thanks to bounces in buildings), and include robust wireless security protocols. The transport network develops relevant applications to manage all the services received by the high-throughput mobile network [61].

8.1.2 Customers and value needs

The ICT industry is growing at a dizzying rate. The development of new products and services places it as one of the most important sectors globally. Economic trends in the ICT sector show clear growth in addition to making it an attractive sector for investment. This is a key factor for smart cities, since part of their development depends on this type of technology in key areas of cities. Today, the development of this sector is essential for governance in cities, regions and countries, both economically, environmentally and socially.

As observed below (figure 49), Sistelec's Value Proposition Canvas (VPC) offers a clear and adequate relationship between customer and service needs in the smart cities business area. The relationship shows needs from Fomento de San Sebastian (FSS) (right site) and services from Sistelec (left site).

From the customer's point of view (right side of figure 49), there are different jobs and tasks related to the need to offer a high-throughput wireless broadband network. Starting from a general vision, and considering a medium term, one of the key aspects for the public client is to offer an efficient public service for the citizen in a smart city context.

FSS is the agent responsible for the wireless communications network of the San Sebastián City Council. To achieve this key aspect, through the Replicate project, and together with Sistelec, the goal of integration between the municipal wireless network and the municipal cable transport network has been achieved. Offering an efficient public service for citizens begins by achieving optimal management of the work carried out by the different departments

[60] Source: D3.10 Report on High speed mobile network based on postWIMAX technology. REPLICATE project. H2020-SCC-2015 Smart Cities and Communities Innovation Action (IA). 31/01/2018

[61] Source: DoA REPLICATE (691735). REPLICATE Annex 1 - DoA to the GA. Description of action: Installation and deployment of high speed mobile network based on post WIMAX technology, p. 35.

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of the City Council, and for this it is essential to have a corporate communications network with full coverage in the territory of the city.

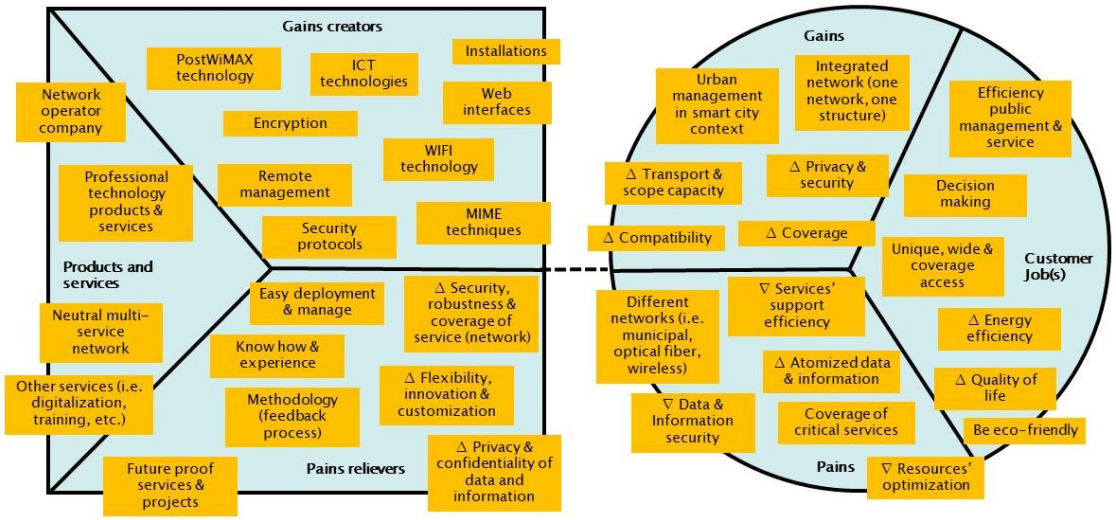

Figure 49.- Value Proposition Canvas of Sistelec

Once this configuration is reached, the potential use of the network allows access and coverage to other public services as well as economic and social agents. In this sense, the customer's task is focused on having a single network, with enough access and coverage to cover multiple and different types of demands. Furthermore, from an internal point of view for FSS, in addition of supporting its public services, it allows the support of data and information to make decisions regarding its own customers – City Council, citizens, companies – in certain services it offers. Finally, the wide access network has an impact on key aspects of public services such as the increase in energy efficiency and quality of life.

There are other aspects that require special attention. The evolution of technology has allowed the development of better wireless network, which originally born with the aim of offering a public citizen WIFI. Now having greater communication capacities, the network is currently considered to communicate much more demanding services such as critical situations for example for those responsible for security. However, due to the vertical and departmental operation of the services, there is still a lot of work to be done to unify the systems that each department uses, since there are duplications. This situation can lead to problems such as the atomized use of data and information by departments; the decrease in the security of these data and information in the exchange processes; and obviously, the optimization of public resources.

In this sense, the customer has reached an integrated, compatible network with a greater transport capacity and range than the previous one. But there is the need to integrate all the

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networks and systems at different levels of telecommunications in a single way, with a single configuration and with a unique or common structure. In this way, the customer will have a more robust network with sufficient coverage to support services improving especially critical services, in addition to offering other potential ones. In this way, the traditional concept of a network linked to certain services offers the opportunity, for example, to transport the City Council network to the territory, to the citizens, to provide municipal services as well as to offer this network as a layer for companies, projects, pilots, events, etc. Undoubtedly, this integration, support and network reached allows greater efficiency for the smart management of a city.

From the point of view of products and services, as indicated in the introduction and attending to the information of needs defined by FSS, Sistelec develops, implements and deploys the high-throughput wireless broadband network. It creates a neutral network, a multi-service network that can accommodate different needs of the City Council and agencies. It is a network that can serve any agent that enters in it. Sistelec is a wireless network service operator to offer WIFI to citizens and self-provision of customer services, However, in the case of San Sebastian, FSS is a public communications operator and it is the one who manages the use of the described network and the citizen Wi Fi service. Sistelec also makes the dark web available to telecommunications operators and private entities.

Sistelec's value proposition has a series of pain relievers to solve the customer's pains. One of the most important aspects regarding FSS is the know-how and experience acquired over many years. Sistelec has collaborated with FSS since 2010, when a first wireless network project was deployed with the aim of trying to cover certain areas of the city and test the technology for future uses in collaboration with other companies working for FSS. Subsequently, since 2015, they collaborate in the REPLICATE project to offer the wireless broadband network. Related to this know-how and this historical experience, Sistelec approaches the client by providing innovation in its technology but applies it in a flexible and customized way according to customer's needs because FSS manages directly the network. In fact, one of the key activities of Sistelec's business model is centered on the analysis and the study of the specific needs of FSS in relation to the wireless network and the services it must, as well as FSS requires, define the accesses for a direct management of the network for public workers. In this sense, Sistelec offers a solution that starts from the specific needs and requirements of FSS, such as transparency, complementarity, access to multiple services, minimal delays, remote management, tests, etc.

As introduced, high-speed wireless broadband networks are one of Sistelec's main gain creators. Within the REPLICATE pilot, Sistelec has improved this technology compared to the traditional WiMAX network that was developed for the city years ago with the objective to provide just specific services. In addition, as indicated in the introduction, it offers encryption of communications, and implements new security and authentication protocols to avoid unexpected intrusions. Sistelec uses state-of-the-art wireless broadband equipment as well

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as multi-stream radios (using MIMO techniques) to create the transport layer, and includes robust wireless security protocols. The transport network develops relevant applications to manage all the services received by the high-throughput mobile network.

8.1.3 Business Model

Nowadays, the communications systems seem to have become a commodity, but the reality shows that to run a computer, a telephone or any application, there must be a lot of infrastructure to support it. Sistelec, as operator and wholesaler, develops its own infrastructure, in addition to the services, for the implementation of networks. This is a highly competitive sector, with a mature market, but as indicated in the VPC, Sistelec's business model shows key differentiation aspects, such as experience, technological and customer knowledge, innovation, proximity, and customization.
In this section, the authors explain through the Business Model Canvas (BMC), which is presented in figure 50, how Sistelec carries out its value proposition to develop, implement and deploy the high-throughput wireless broadband network.

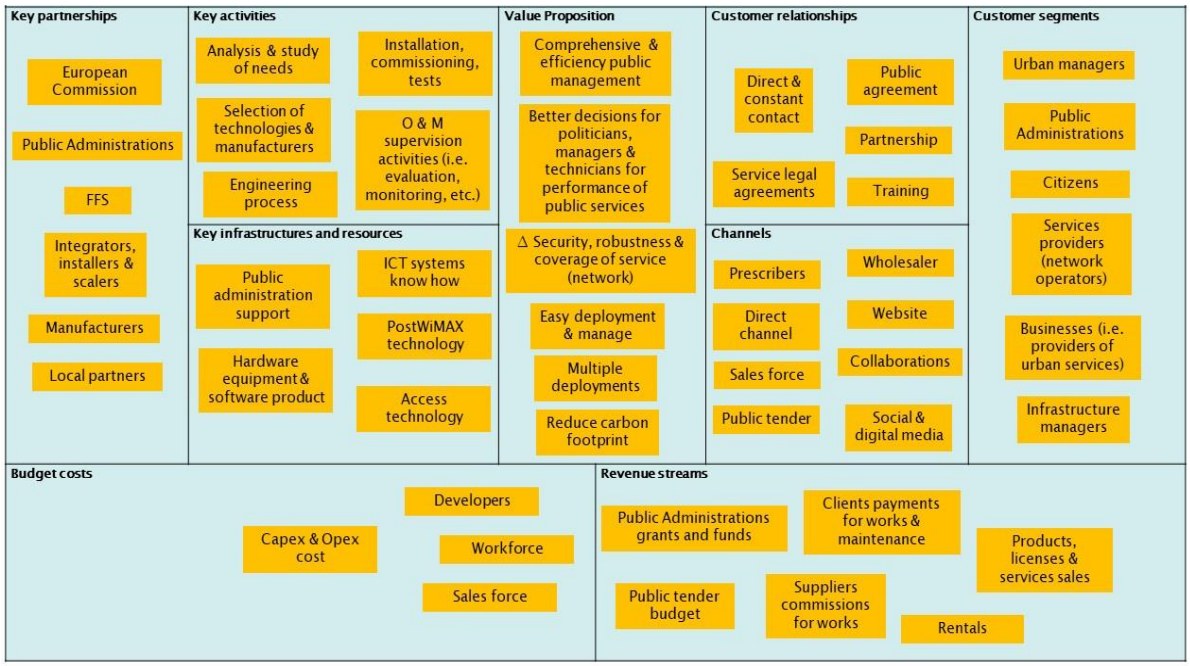

Figure 50.- Business Model Canvas of Sistelec

The analysis of the VPC makes possible to identify the key aspects of Sistelec's value proposition. Sistelec creates an integrated network, of a neutral nature, which provides transport and scope capacity. In addition, it is a robust network with coverage capacity that allows FSS to offer different services and allows all agents to get connected. For this reason,

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FSS is capable to offer a more efficient public service and can make better decisions according to the needs of the City Council, citizens and companies. In addition, it offers the possibility of incorporating new public services, as well as economic and social agents, that want to connect, quickly, easily and without incurring new costs.

Sistelec's business model focuses on two customer segments, the private and the public. Regarding the private segment, Sistelec, as an operator, offers its products and services to citizens and private entities. However, regarding products and services such as the REPLICATE pilot, Sistelec works for private companies with a certain size, which have at least an extensive network and communication systems to run their business. In this sense, they are clients with enough infrastructure and potential such as airports, ports, supermarkets, etc.

Regarding the public client, public administrations, which includes city and regional councils, public departments and institutions etc. Sistelec focuses on small and/or medium-sized cities, around 250,000 people. In small cities, Sistelec enters by offering itself as an operator; that means that the client does not buy infrastructure, buys services. The main reason is that these types of clients do not have the capacity to support the infrastructure because they do not have financial, material or human resources. In these cases, Sistelec plays an integrator role to offer the service in a more agile, sustainable way, where the client does not have to contract many services or do redundant tasks. On the other hand, regarding medium-sized cities, the size of this type of client allows having infrastructure, resources and sometimes, as in the case of San Sebastián, having its own network and internal services. These aspects are key because cities with this size and a high volume of services must have their own and internal infrastructure and resources to be able to support their services.

Relationships with customers and channels are of different kinds. Regarding relationships, Sistelec mainly uses direct and indirect relationships. For the case of direct relationships, there is the direct channel through sales force, prescribers, public competitions, collaborations, etc. And for the case of indirect relationships, there is the indirect channel through intermediaries, partners and Temporary Business Associations (TBAs). In addition, Sistelec is an operator that acts as a wholesaler. Its policy focuses on working to replicate its models in different cities through third-party partners through collaborations and projects. Local partners are sought to make a partnership and offer a joint solution. This type of channel responds to an strategy approach based on the knowledge and proximity with the client, because one of the key aspect to work with the public client – city councils, regions, etc. – is to know very well the his needs in order to offer an adequate and efficient product and service. In general, Sistelec work with partners in different cities and territories through specific agreements.

The production of value implies different activities, but among them excels the analysis and study of customer needs and interests. Regarding the REPLICATE pilot project, Sistelec started working with FSS in 2015, when FSS was preparing the project proposal. FSS conveyed the needs it had regarding the network and the idea of looking for a pre-commercial or embryonic technology to carry out in the project. Therefore, the needs of the Municipality were analyzed

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in order to make a first-rate technological selection and see what type of technology could respond. Once the technology was selected, Sistelec developed all the engineering -theoretical calculations and engineering to verify that what was being devised was buildable and executable -. Subsequently, the hardware equipment, both infrastructure and terminals, were supplied as well as the installation, commissioning, stakeout, tests, etc. were carried out. Nowadays, Sistelec carries out operation and maintenance supervision activities such monitoring how the network operates and functions to manage problems and make continuous improvement.

In addition to these activities, the business model involves different resources and infrastructures. The support of the public administration is very important, not only in terms of financial resources for pilot projects, but also in terms of publicity, notoriety and market access. Furthermore, as already mentioned, Sistelec has collaborated with FSS since 2010 in different network projects. The wireless broadband network are antennas, which serve to connect the servers with the users; to do so, ICT technologies are needed, which in this case configure the network. The network is a cloud that has different services, including transport services. These transport services are supported on the Wireless Broadband networ that the FSS has. To construct and offer it, there is the need of an access technology – WIFI -, and to get to this access technology there has to be a transport network, which is implemented by the wireless broadband network. Finally, it is about ICT knowledge and technology to link servers with users.

Regarding the production of value from the business model, stakeholders are key to the development of Sistelec. As pointed out, the public sector, such as the EU and public administrations, is a driver for its products and services. This plays an important role in promoting actions, pilots, R&D projects, as well as offering financing and grants. During the pilot project, Sistelec collaborates closely with FSS, which acts as a telecommunications administrator as a public administration. Sistelec and FSS have been working together for years on different topics, such as digitization services, citizen services, training on new technologies, etc. They have been working together for years on the capabilities of WIFI technology for the business development of FSS - business development for companies, citizens, etc. -.

Finally, the business model focuses on the cost / income structure. As shown in figure 50, Sistelec has different sources of revenues: public bidding contests; financing and funds of the public administrations; sale of products, services and licenses; customer payments for works and maintenance; rents and commissions. In general, Sistelec is interested in having contracts for the operation and maintenance of products and services, although it does so with a non-closed model, a model of minimums - for example, services to critical infrastructure - but justified according to needs. Contracts are usually defined with a job bank where standard jobs, materials, units are listed ... and only what is necessary is executed. Regarding costs, the

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most important elements come from Capex costs, especially the labor of developers, engineers, etc.

8.1.4 Strategy

Sistelec's business model strategy against the competition focuses on quality and service. In general, operators and companies such as, Mimosa Networks, Ubiquiti Networks, Proxim, ZTE (LTE) or Huawey (LTE), tend to introduce technological solutions from their catalogs without considering customer needs. To this end, figure 51 presents a comparison through the Strategy Canvas tool between Sistelec and its competition. This is an exercise based on the analysis of data collected throughout the REPLIICATE project and secondary data from the competition, which reflects points of similarity and difference between companies.

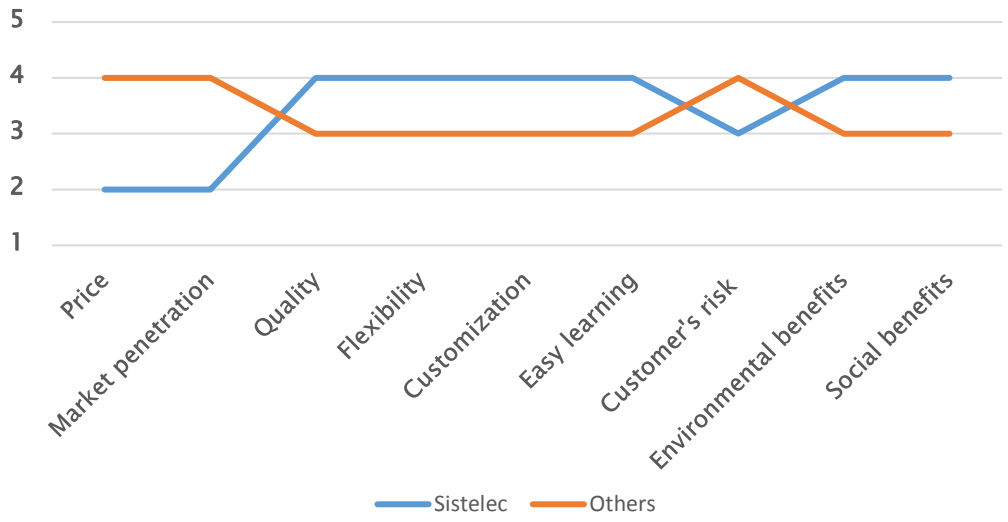

Figure 51.- Strategy Canvas of Sistelec

As it is shown, we have chosen nine indicators that reflect the strategic position of Sistelec and the competition. The indicators have a score of 1 to 5, where 1 means the worst possible score and 5 the best in terms of the market valuation.

The first indicator is the price. Sistelec is below the competition. This difference is explained because Sistelec works with an ad-hoc strategy. This fact means that it works with specific solutions to solve the client's problems. As we have explained in the analysis of the VPC and the BMC tools, Sistelec's business model stands out, among other aspects, for its analysis and study of customer needs, as well as for involving the client in the technological selection based on his requirements. To this end, Sistelec does not introduce his catalog of products and services, on the contrary adapts it to the client's needs, as well as incorporates the client in the decision-making process selection. This adaptation aspect influences the cost and

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consequently the price. Obviously, introducing products and services from a pre-established catalog is not the same as creating, adapting or adjusting these products and services to the client by incorporating him into the value chain from the beginning.

This aspect, as well as Sistelec's capacity and volume, also influences market penetration. Often, the budget circumstances of the public client, in addition to the current COVID-19 situation, carry a cost requirement to exercise the purchase. Obviously, this aspect is detrimental to a strategy and business model focused on quality and service. Obviously, cost and quality are not antagonistic concepts if the investment is considered in the long term. However, from the point of view of the public client, public investments do not always take place in that long term.

Sistelec differs from the competition due to its quality. As mentioned, one of the key activities of Sistelec is the technological selection after analyzing and studying the client's needs. This selection is based on a high-level technology, without which the capacity and flexibility of the network would not be possible. Therefore, Sistelec does not make a proposal focused on cost based on a catalog, on the contrary, it makes a proposal focused on the needs of the client, which also makes the client a participant in that technological selection. Therefore, whether due to technical characteristics of scope, capacity or security, as well as the role that the client plays in the selection, Sistelec's commitment is based on the quality of the product and service.

In this sense, the flexibility indicator also stands out. The reason is that Sistelec creates an integrated network characterized by its neutrality. In addition to the public and open nature of the network, neutrality implies access from any equipment, with any type of restricted communication and without data download restrictions. This is an aspect that differentiates Sistelec from the competition, since the network is publicly owned and involves aspects that clearly makes resistance to the majority of operators. A clear example of this resistance on the part of the operators is the ability to charge different prices to different users. Sistelec is changing the paradigm to approach the market.

Quality and flexibility are closely linked to Sistelec's strategy based on customization. As pointed out, Sistelec works with an ad hoc strategy, therefore it must analyze and study on a well manner the client's needs, both present and future, to offer a solution according to the needs of this client. In this sense, Sistelec bases the experience on the client's interests and allows the client to adapt or make changes “manually” - obviously with the support of Sistelec - to achieve their preferred experience. It is not just about personalization, it is about customization.

There is an interesting and key indicator for the client, where we believe that Sistelec may be below the competition, this is the risk that the client assumes in terms of payback. The question is that Sistelec does not work at cost, but at quality and service. The goal is to offer well-functioning networks, robust equipment, with warranty, and a long product lifecycle. In this sense, the competition works with catalog of products and services without using an ad-hoc strategy, based on customization, which can favor faster returns focused on the short

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term. In addition, Sistelec works with network schemes where planned returns are not just based on economic terms, but instead seeks for other types of returns based on the characteristics of its network. Although the value proposition of these non-economic returns breaks with the traditional paradigm of the operators, it is true that these returns can be more difficult to account in terms of specific public budget items. The question focuses on what is offered. While Sistelec offers a comprehensive general solution, end operators tend to offer vertical solutions, not so general, based on catalog.

Finally, we find the environmental and social indicators. We believe that the policy of customization and proximity to the client allows Sistelec to differentiate itself from the competition in environmental aspects. The reason is that Sistelec can adapt its value proposition very well to the customer's environmental demands and its monitoring can be more specific and concise. On the contrary, both Sistelec and the competition, especially with regard to the public client, must improve their value proposition in terms of the environment. This is not the case with social benefits, since Sistelec's value proposition offers more aspects such as privacy and security, continuous access, data download...in short, Sistelec offers very advantageous aspects at a social level as a result of the characteristics of a neutral network.

8.1.5 Final remarks

The analysis of the value proposition, business model and the business strategy allow us to observe that Sistelec seeks differentiation in product and service quality, as well as personalized customer service. In addition, it is based on a strategy of approaching new customers through local partners, who have a greater understanding of the needs and characteristics of clients in specific areas. We find interesting to highlight that in addition to the economic savings of the solutions proposed by Sistelec, its solutions offer greater management capacity for the public customer compared to the competition, which, as we mentioned, usually works with vertical solutions and products' and services' catalogs.

Regarding challenges, the actual situation about Covid-19 will probably imply a cost reduction in public administration budgets. In general, we believe there will be a slimming in public budgets. Sistelec plays medium long-term benefits promoting quality and service, but should incorporate also catalogue prices in order to adjust budget's clients and positioning with competitors. On the contrary, must be highlighted its ad hoc strategy with a high impact in efficiency and optimization which at the end reverts also in public budgets.

Finally, we believe that Sistelec has to maintain or invest in sales force to sell its products and services that have been successful in the case of the REPLICATE project. To this end, Sistelec must exploit these types of channels with public administrations who become great prescribers. Obviously, as mentioned, many of the possible intangible benefits from its works could be monetarized and could be added to the sales proposition.

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8.2 Eurohelp

8.2.1 Company's presentation

Eurohelp consulting, *S.L* is a consulting and service provision company specialized in the field of ICT that operates since 1997 and has more than 250 employees[62]. Eurohelp is a specialist company in what is called e-government, electronic systems for the public administration. It works with different products and business services: i) traditional systems, such as electronic file management; ii) horizontal service platforms, such as electronic signature; iii) smart city, such as the REPLICATE project; iv) verticals, in niche spaces, such as optimization of waste management, air quality and mobility routes; and v) traditional services, such as technical assistance, support and customer service centers.

The technologies that support Eurohelp's activity to offer its products and services are closely linked to the web world, to data support activities in the big data environment, both open data and linked data, and recently in the world of blockchain. Regarding blockchain, for example, Eurohelp is in the two most important blockchain projects in the Basque Country, focused on the registry of contractors of the Basque government and the registry of attorneys of the Bilbao City Council.

In relation to the REPLICATE project, the pilot in the city of San Sebastian focuses on the Smart City ICT platform. Within the project, Eurohelp collaborates in the definition of the platform. Initially, it collaborates in the identification and definition of all the modules and components of the platform together with the technology center Tecnalia, as well as other partners. Once these modules and basic components of the platform architecture have been identified and defined, Eurohelp is responsible for the development of two modules: linked data and citizen participation.

In relation to the different actions of the REPLICATE project, Eurohelp works and processes the data in an open source, public and in a linked way to publish them in the Open Data Cloud[63]. The data come from different actions: building energy consumption and efficiency energy improvements; district heating; electrical vehicles; transport infrastructure; mobility department; citizens; etc.

In the linked data module, Eurohelp takes the data that are generated from multiple sources, different platforms or centers, such as the REPLICATE project or San Sebastian's Smart City

[62] Source: https://eurohelp.es/

[63] Source: DoA REPLICATE (691735). REPLICATE Annex 1 – DoA to the GA. Description of work and role of partners, p. 29-34.

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Platform[64], link them through different methodologies, processes them to publish them in Resource Description Framework format (RDF) and link them to existing data on the semantic web. One of the main tasks in this process is data transformation. Data are obtained in different formats depending on the source and translated from format to link them. The decision of the link format depends on different factors, such as ontology, that is, the nature of the data. An example of this process would be the mobility data, where it is necessary to understand what the data represent to know which ontology can model them and which databases can be linked. In summary, Eurohelp carries out a process for selecting technologies, building modules, and implementing them within the infrastructure developed by DonostiaTIK (Municipal ICT Department) and which is integrated as part of the general structure of the platform. Once this process is deployed, a set of energy, mobility and ITT data systems are selected to undergo this transformation process and published in RDF format.
In the citizen participation module, Eurohelp develops, implements, and publishes different participatory processes, previously selected and defined. The module is articulated in participatory processes that can be divided into different phases and actions according to their type and need. In addition, the possibility of integrating and reflecting physical citizen actions on the platform is also offered. The objective is to offer a photo of all citizen participation in the city of San Sebastian, a global vision of the participatory processes through the web[65].
Initially, the linked data and citizen participation modules were two disconnected parts, but the final objective is that the data generated related to citizen participation are linked to the linked data module.

8.2.2 Customers and value needs

The ICT industry is growing at a dizzying rate. The development of new products and services places it as one of the most important sectors globally. Economic trends in the ICT sector show clear growth in addition to making it an attractive sector for investment. This is a key factor for smart cities, since part of their development depends on this type of technology in key areas, such as housing stock rehabilitation, transport, mobility, energy efficiency, citizen participation, etc. Nowadays, the development of this sector is essential for governance in cities, regions and countries, both economically, environmentally and socially.
As it is shown below, Eurohelp's value proposition (see figure 52) offers a clear and appropriate relationship between customer and service needs in the smart cities business area.

[64] Source: https://www.donostia.eus/datosabiertos/
[65] Source: https://www.donostia.eus/ataria/es/web/partaidetza/home

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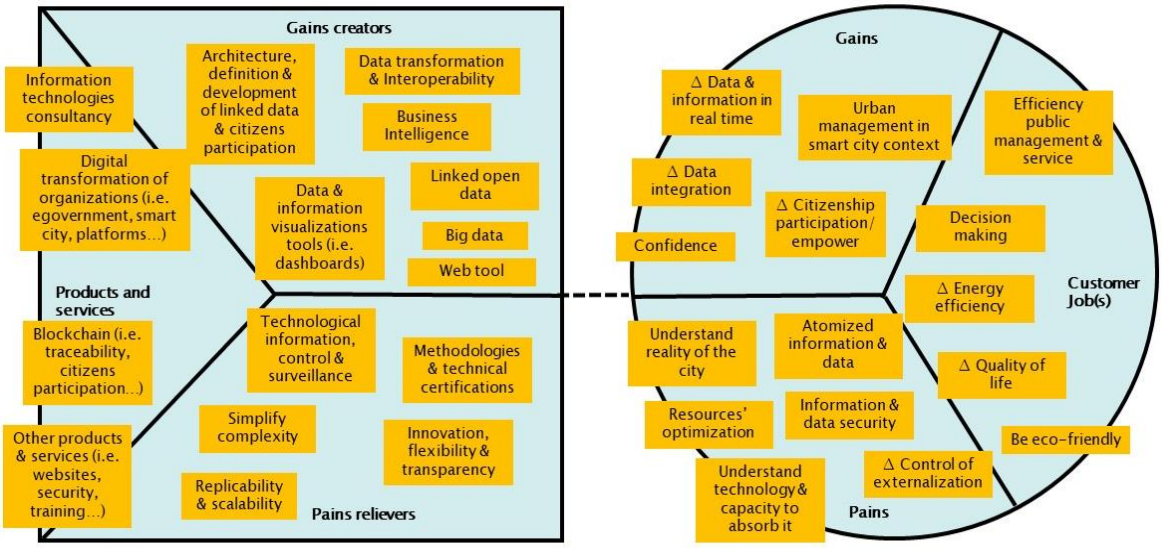

Figure 52.- Value Proposition Canvas of Eurohelp

From customers' point of view (right part of figure 52), there are different jobs and tasks related to the development of ICT platforms linked to linked data and citizen participation. One of the key aspects, especially for the public client, is to offer efficient management of the public service, in this case based on the management of data and information in different areas, as well as citizen participation. This efficient management of information is key for decision-making in the public administration, both internally in relation to the operation and management of public resources, and externally to offer services in accordance with the needs of citizens and the territory. We observe how effective data and information management in areas such as energy efficiency, mobility or citizen participation has an impact on aspects such as energy efficiency, quality of life for citizens and the environment itself.

Regarding pains, aspects that generate negative emotions for the customer, there are different issues. Firstly, the data and internal and external information managed by public clients is key to understanding the reality of the spaces they direct and manage. Often, these data and information are collected partially and through different methodologies both by departments of the same entity and between territorial institutions. In general, this disparity and partiality in the collection, treatment and disposal of information has harmful effects both for the internal management of the institution, for example at the level of economic resources and decision-making, as well as for the execution of public services, such as urban mobility services. Secondly, we find annoyances closely related to the obligation of the public function, that is, the need to understand the technology that is used, control and possess the data of the citizen and the territory, and offer a guarantee of security in the treatment of these data and the information that is generated. In general, more than a nuisance we would be talking

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about a guarantee, that is, a need to safeguard the ownership of public data against the private sector.

In this sense, the customer expects a trust, as well as a guarantee, in the service offered, but above all in the management of data and public information. In addition, it hopes to obtain a data integration service between areas and departments that offers information in real time to be able to exercise adequate decision-making and in accordance with public management in the framework of a smart city. This entails a continuous, active and updated information processes as well as citizen participation and empowerment in decision-making.

From the point of view of products and services, as indicated in the introduction, Eurohelp focuses on linked data and citizen participation in a process of digital transformation of organizations through urban platforms in smart city contexts. Regarding the pilot of the REPLICATE project, the platforms are based on three key aspects, such as participation, open data and transparency.

To this end, pain relievers clearly solve customers' problems. One of the main pain relievers is project and data integration, which clearly helps the customers to simplify complexity. In this sense, pain relievers such as technological development, control and surveillance of data are key aspects that offer reliability, trust, and confidentiality to the client. In addition to transparency, Eurohelp has a strong commitment to innovation and flexibility for the client, adapting its developments to its needs. Offers proximity to the client with a clear effort to customize the product and the service to simplify the complexity that ICTs represent in innovative topics such as linked data or platforms. In this sense, it is important to point out that Eurohelp's proposal with the San Sebastian pilot fits very well according to the technicians, who indicate that the platform is very intuitive and reflects the same steps they traditionally followed.

To carry out its value proposition, as we mentioned, Eurohelp carries out the architecture, definition and development of the linked data and citizen participation modules. To do this, it focuses on the transformation and interoperability of data using different methodologies supported by business intelligence and big data. Furthermore, Eurohelp offers the data and information through simple, easy-to-use visualization tools that summarize the information to the customer.

8.2.3 Business model

Eurohelp operates in a sector that is growing again after the financial economic crisis of 2009. Within the framework of public administration, Eurohelp benefits from current legislation, which obliges the administrations themselves to maintain a relationship with the public through electronic channels to carry out procedures, inquiries, certificates, etc. Current legislation is forcing public administrations to digitize. On the other hand, there is a natural process of digitization in most sectors of the economy, which also pushes public

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administrations to carry out digital transformation projects. These two aspects are key to favor digitization and create a window of opportunity for companies in the sector.

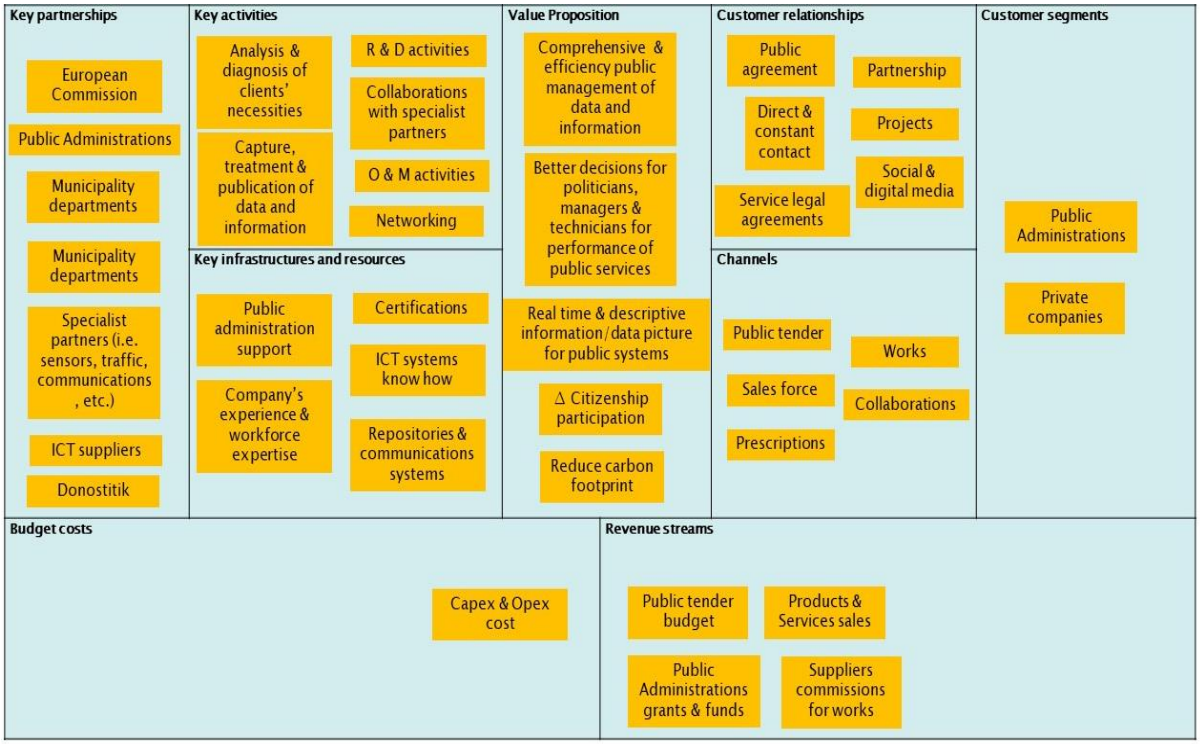

Figure 53.- Business Model Canvas of Eurohelp

Currently there are many spaces in which to work, but both the public administration and the companies in the sector do not have the capacity to face all these spaces and challenges. In this sense, the rate of opening of the window of opportunity depends on this capacity. On the one hand, there is a great variety of ideas, not only in the digitization of traditional systems, but also in the contribution of new services to citizens through ICT, social networks, using open data, linked data, blockchain methodologies, etc. But, on the other hand, both the sector and the market are not capable of generating projects at an adequate pace to address all these ideas due to organizational capacity, financial resources and above all, human resources.

There is an important window of opportunity regarding its size and the possible activity that could be generated, but the problem or the unknown, as we mentioned, is its rhythm. The public administration does not have the capacity to generate new projects at a high rate, and the sector lacks the capacity to absorb all the demands of the administration itself. Obviously, it all depends on the areas and types of project. Business areas such as traditional systems, big data, citizen participation or blockchain have a greater capacity to absorb demand, but an

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innovative area such as linked data has not yet. Consequently, there are business areas with a lot of competition and others that remain uncovered.

The objective of the intervention, as mentioned in the introduction, focuses on the development and implementation of the linked data and citizen participation modules of the Smart City ICT platform of San Sebastian. The value proposition is part of a digital transformation process of the Municipality that allows collecting, processing and understanding the data and information of the Municipality itself as an organization, of the city and of its citizens. Figure 53 describes the business model is the Business Model Canvas (BMC). As mentioned in chapter 3, the BMC reflects the logic on how the company is capturing, producing and delivering value.

The value proposition of Eurohelp focuses in offering a comprehensive and effective city service management of data and information. This comprehension allows politicians, managers, and technicians to understand the situation regarding citizens' participatory processes on different topics and let them take better decisions for the performance of public services with real time data and information. In this sense, there is a clear increase of citizenship participation in the city. In addition, the aspects of linked data, as mentioned, offer data and information processed in an open, public and linked way to publish them in the Open Data Cloud. The treatment of data and information from actions such as building energy consumption and efficiency energy improvements; district heating; electrical vehicles; transport infrastructure; mobility department; or citizens has a clear impact on economic, social and environmental aspects for the city.

Eurohelp's value proposition is aimed at the public and the private customer, although the public client is prioritized for Eurohelp. The main reason is that aspects such as linked data or citizen participation are demands that are normally made by city councils, county councils and regions. In addition, these business areas applied to the public client are easily replicable and scalable. In fact, linked data offers the possibility of automatically linking data between administrations and private entry systems. It is an expansive system that is entering chains of links of cities, companies, etc.

Customers relation are of different types such as direct and constant contacts, partnerships and projects, public agreements, etc. In smart city projects, Eurohelp can be a promoter or collaborator. Sometimes, Eurohelp goes directly to the public administration to propose an idea or line of activity that may suit the client, or it goes through collaborations, projects or consortiums with technology centers, universities, or private companies. Typically, these relationships are used to seek European or state funding. Eurohelp does a lot of technological surveillance and for this it needs to be a technological collaborator with its own clients, either to promote initiatives or to participate in projects.

In the case of non-bankable R&D projects, Eurohelp uses traditional channels such as public tenders. Many of Eurohelp's clients demand homologation processes using different types of classifications to certify technical aspects, technical and economic solvency, etc. In large,

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important tenders, where a global smart city system has to be implemented, Eurohelp usually presents itself through consortiums or as a client of a large company to which it offers vertical solutions in its proposals. Basically, they are very large platforms where Eurohelp collaborates developing, implementing and getting linked to them.

Regarding the production of value from the business model, the European Commission as well as the public administration are key to the development of Eurohelp, both from the point of view of financing and revenues. In addition, the public client acts as a promoter and facilitator for the entry of new clients. In part, the fact of having a public client, as mentioned above, forces Eurohelp to constantly use methodologies and certification techniques, aspects that strengthen it. In addition, Eurohelp constantly works with technology centers, universities, specialized companies in certain aspects such as sensors, traffic, communications, etc. Especially in REPLICATE-type projects, focused on smart city aspects, collaboration, and work with this type of stakeholders with specific technological knowledge is very important. The line of collaboration with the universities is very important for Eurohelp. The relationship with them makes it possible to search, maintain and attract talent workforce, both for the universities themselves and for Eurohelp. On the other hand, the line of collaboration with technology centers allows R&D work.

The production of value implies different activities. In addition to the technological surveillance activities and collaborations, already mentioned, the first thing Eurohelp does is an analysis of the situation and the needs of its client, seeing their status in the three key aspects: participation, open data and transparency. Depending on the situation, an analysis is carried out and different proposals are made depending on the platforms that the client has. The differences between public administrations, by ownership, size, budgets, idiosyncrasy, etc. imply for Eurohelp to put a lot of effort into the diagnostic phase, since this is vital for the implementation of solutions. Normally, after an implantation, there is maintenance activity, as many of Eurohelp's products are living systems that are evolving. In general, maintenance, technical and functional updating, etc. it is hired by public companies of the City Council through service level agreements.

In addition to these activities, the business model involves different resources and infrastructures. The support of the public administration is very important, not only in terms of financial resources for pilots, but in terms of publicity, notoriety, and market access. In addition, as mentioned, Eurohelp needs certifications that are marked by regulations and are strictly necessary to be able to access the public client. In general, most of the products and services in the smart city area are addressed with workstation infrastructure, with servers, communications, software, etc. that are owned by the company. The delivery and final data are at customers' premises, although Eurohelp has repositories and systems for testing with the customer through continuous connections. For example, the San Sebastian platform is on its servers, it is not a Eurohelp infrastructure. Everything that Eurohelp develops is located on

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the client's servers. Even in the case of San Sebastian, development is already done at its facilities, although Eurohelp operates remotely helping and supporting them.
Finally, the business model focuses on the cost/revenue structure. As observed in figure 53, Eurohelp has different sources of revenue streams: public tender budget; public administration grants and funds; products, services, and license sales; clients' payments for works and maintenance; and commissions. As mentioned, public tenders are one of the most important sources. On the side of the cost streams, the most important items come from Capex costs, specially manpower from developers, engineers, etc.

8.2.4 Strategy

Eurohelp's business model strategy against the competition focuses on proximity to its customers, offering smart products and services which are built based on the customer needs, pains and pain relievers. Its know-how on public administration is highly deep because of its long experience working with it. In fact, almost 75% of its clients' portfolio are public clients. As mentioned, companies such as Telefónica, Indra or Gnoss are direct competitors, although Eurohelp can join them in collaborations regarding the type of public tender. On the contrary, should mention that the strategy relies quite on niches markets and depends on the type and interest about the client. To this regard, items such as the price can be adjusted. It should be mentioned too, that competition is higher regarding the participation module in comparison with the linked data module. The participation products and services are more expanded and used in the market and therefore the offer is higher, such as the case of the participation platform from Madrid.
Figure 54 presents a comparison through the Strategy Canvas tool between Eurohelp and its competition. This is an exercise based on the analysis of data collected throughout the REPLICATE project and secondary data from the competition, which reflects points of similarity and difference between companies.
As it is shown, we have chosen nine indicators that reflect the strategic position of Eurohelp and the competition. The indicators have a score of 1 to 5, where 1 means the worst possible score and 5 the best in terms of the market valuation.
The first item is price. Eurohelp is below the competition due to its capacity and volume compared to big companies. In that sense, competitors' capacity to penetrate the market is higher and can get many contracts. By contrast, must be highlighted that platforms from competitors tend to be quite big and weighted.
In terms of quality, technical quality, we believe that competitors are at a same level. Technical aspects, products and services can be used by all and are placed in the market. Nonetheless, Eurohelp differs in important items such as customization, flexibility and easy learning. Regarding customization, should be pointed that Eurohelp clearly offers abilities and tools to the customer to manage platforms and adjust them to his needs. In terms of flexibility,

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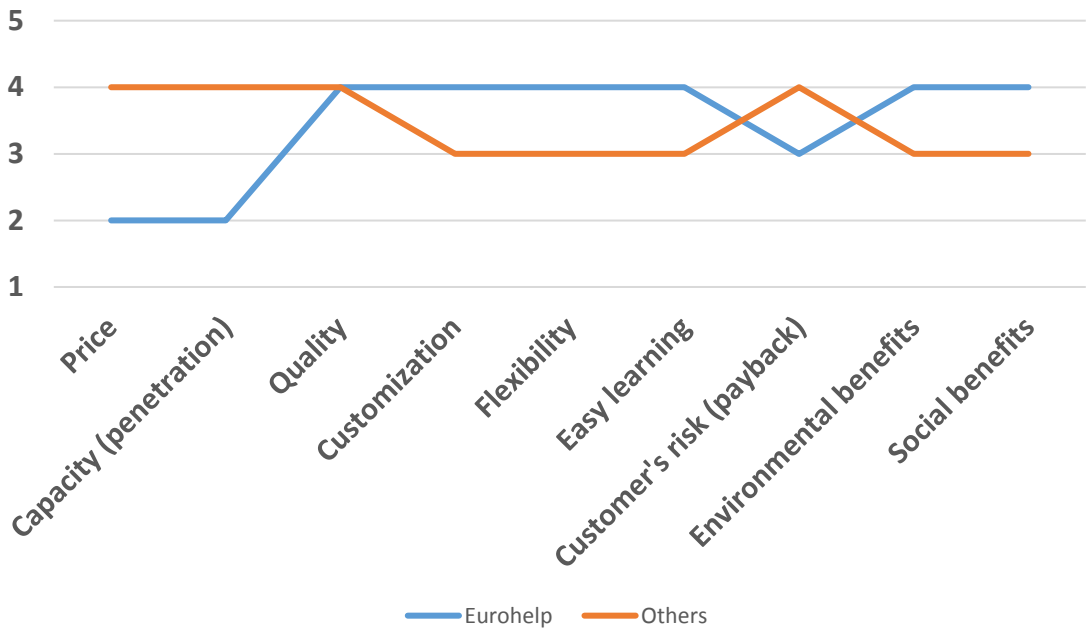

Figure 54.- Strategy Canvas of Eurohelp

Eurohelp's platforms are easier to be implanted for institutions, unlike the competition which works with big and weighted platforms. Furthermore, Eurohelp tries to implant its systems paying close attention to customers' infrastructure. And regarding easy learning, it is important to mention that the pilot from the REPLICATE project has imply an important user experience from public technicians who have pointed out the intuitiveness to manage platforms.

Another important item is the customers' risk in terms of paybacks. In this sense, the returns capacity seems to be lower and could imply a longer period. But this item is quite liked to the price and depends widely on the strategy used depending on the interest in the customer. But in general, items such as customization and easy learning imply higher cost services that could affect this return.

Finally, the strategy of Eurohelp based on its proximity with the customer to solve its needs could imply major environmental and social impacts. In fact, its value proposition highlights the importance of energy efficiency to reduce carbon footprint as well as the increase of citizenship participation in decision making which clearly could affects its quality of live. From this perspective, its approach based on open source is also a clear sign to increase the public value of the services offered by the public customer to its citizens.

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8.2.5 Final remarks

Besides the competition aspects mentioned, a company such as Eurohelp has to collaborate with other companies to afford a smart city project of such wingspan. The experience and know-how with the customer are of great value, as well as technical aspects and teams know-how, to sell in possible collaboration or directly to the customer. In fact, in its sector they are the company who has more experience in the already implanted services. Furthermore, from a functional point of view, many of the customer's activities and services that have been implanted are extrapolated.

In general terms, the situation of Eurohelp regarding the public customer could be a problem nowadays because of the Covid-19 situation that clearly affects public budget from institutions. Public administration is in a process of digitalization in other to use electronic and digital channels to offer services, but novelty products and services such as linked data can be affected. In this situation, we believe that the value proposition of Eurohelp has to focus in the resources' optimization impacts for the customer because of the implementations, as well as environmental and social impacts, and in the huge potential that products such as linked data can imply to the customer. For example, there is a massive potential from the parking space in real time that are already published in linked data. Here the potentiality would be if a company can connect with them and develop an application which informs in real time about the occupation and tells you which parking space is free. This is just an example, but the great thing to pay attention on is in the value that the data is offering to the own public customer as well as possible future developments. It is a clear example of added services that could imply an economic development for a city as well as feeds its smart ecosystem.

8.3 Euskaltel

8.3.1 Company's presentation

Euskaltel *S.A* is a Basque telecommunications company. It is an operator of broadband, telephone, landline, mobile and television services. Outside the Basque Country, Euskaltel is deployed territorially in collaboration with local operators, to which it provides its services. The Euskaltel group operates throughout Spain using different brands, but with the same network and the same services. Nowadays, it has a network in various Spanish communities,

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such as the Basque Country, Asturias, Galicia, Navarra, Rioja and Catalonia, and they already implementing in the rest of Spain.

Beyond the characteristic products and services of a telecommunications company, Euskaltel develops the implementation of Big Data for mobility services in San Sebastian. Mobility is a key aspect for the city. There are factors such as weather, tourism, calendar, traffic, etc. that directly affect mobility aspects of the city itself and of citizens, such as events (sporting, cultural, specifics) or city holidays. These events, in addition to other circumstances, generate specific demands to manage mobility, such as parking issues, public space management and access to specific areas[66].

Regarding the REPLICATE project, as we commented, Euskaltel obtains aggregate urban mobility data based on operational information from mobile network companies through the following action and decision parameters[67]:

- *Donostialdea, the region around the city pilot location, is selected as the study area, collecting relevant geolocated data over time.*
- *Flexibility on the geometries of the sectors in which the study area is divided, according the different decision-making needs.*
- *Configurable period to perform the aggregation (set for Replicate to 30 min).*
- *Query capabilities to obtain origin/destination matrices, with all the data added, applying any filter of days or hours. These services provide enough temporal accuracy to cross calculated mobility patterns with additional information as weather or event calendar to understand the relevance of such factors.*

In summary, the use of Big Data in the context of the aggregate characterization of urban mobility based on operational information from mobile network companies improves real time knowledge of urban mobility.

8.3.2 Customers and value needs

The ICT industry is growing at a dizzying rate. The development of new products and services places it as one of the most important sectors globally. Economic trends in the ICT sector show clear growth in addition to making it an attractive sector for investment. This is a key factor for smart cities, as part of their development depends on this type of technology in key areas such as mobility in cities. Today, the development of this sector is essential for governance in cities, regions, and countries, both economically, environmentally and socially.

[66, 2] Source: D3.9 Use of Big Data for mobility services. Euskaltel. REPLICATE project. H2020-SCC-2015 Smart Cities and Communities Innovation Action (IA). 31/01/2019

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As observed in next figure, Euskaltel's value proposition (figure 55) offers a clear and adequate relationship between the customer and service needs in the smart cities business area.

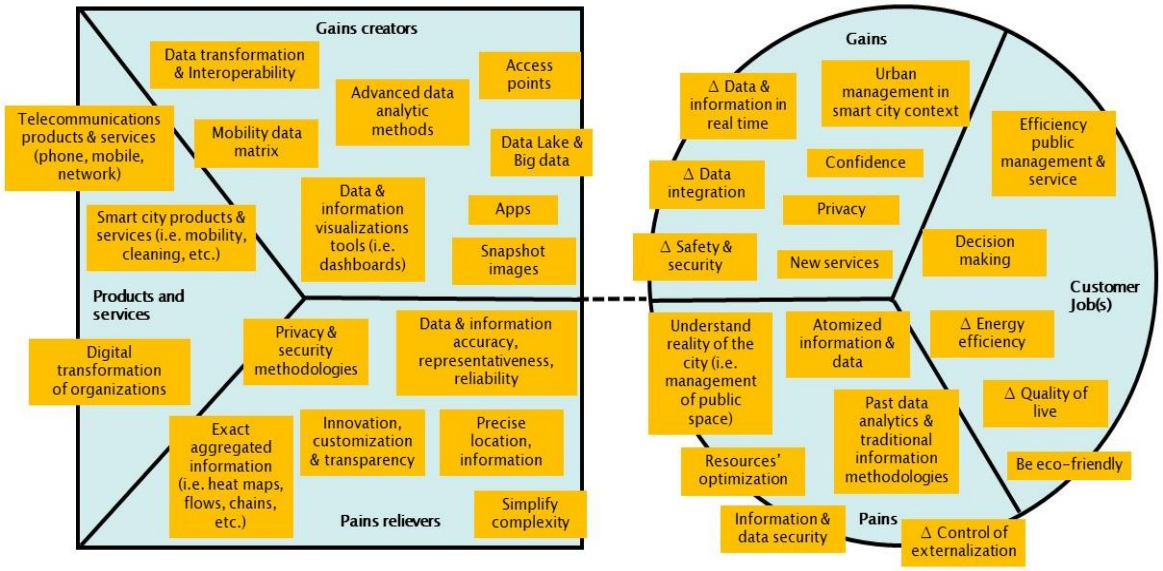

Figure 55.- Value Proposition Canvas of Euskaltel

From the customers' point of view (right part of figure 55), there are different jobs and tasks related to mobility management. One of the key aspects, especially for the public customer, is to offer efficient management of the public service, in this case based on mobility management. As we mentioned, there are circumstances and factors that affect mobility, as well as mobility situations that affect the day-to-day events in a city. This efficient management of information is key for decision-making in the Public Administration, both internally in relation to the operation and management of public resources, and externally in order to offer services in accordance with the needs of citizens and the territory. We observe how effective data and information management in the mobility area has an impact on key aspects such as resource management, decision-making, road and citizen safety, quality of life for citizens and the environment.

As for the customers' pains, aspects that generate negative emotions, there are different issues. One of the main problems of the client, specifically for the public client, is to understand the reality of mobility in their areas of activity. As discussed in other ICT pilot analyzes, the data and information managed by the public client is key to understanding reality and being able to make decisions. Often, data and information are collected partially and differently depending on the department, using different methodologies. In general, there is a disparity and partiality in the collection, treatment and disposal of information that seriously affects the internal and external management of public policies. For example, even today, the

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most common methods to collect data and information on mobility behaviors in the city are done through traditional methodologies and tools, such as interviews, questionnaires...which entail a significant number of limitations that clearly affect to the accuracy, representation and reliability of the information.

In this sense, the customer hopes to be able to make decisions according to the reality with which they work and offer actions based on updated, accurate and real-time information. Trust, management, and privacy in the processing of personal data are also key aspects for the client. In addition, the treatment and management of the data and information obtained by geolocation can open a space to new services, as well as improving those you already have. A clear example would be all the data and information about population movements in certain areas - geolocation, flows and chains of people - that can be very useful when deciding to open a business.

From the point of view of products and services, as we point out in the introduction, Euskaltel is an operator of broadband, telephone services, landlines, mobiles and television. In the specific case of the San Sebastian pilot, Euskaltel develops the implementation of Big Data for mobility services. In this sense, Euskaltel differentiates itself from the competition - telecommunications operators - by opening new business lines that contribute to a digital transformation of organizations, as shown in the San Sebastian pilot.

Euskaltel's value proposition has a series of pain relievers to tackle for client's pains. A key aspect of this type of ICT companies is the simplification of the complexity that the data processing and management entails for the public client, aspects that are often atomized by departments and are based on past data and information.

In order to carry out its value proposition, Euskaltel has a series of gain creators that allow it to offer value to its customer and differentiate itself from the competition. One of the key aspects of the action is that Euskaltel uses data and information from two networks; one is the mobile network and the other is the WIFI Hotspot network, which the company itself deploys. There are access point applications in different areas of the city, so that a citizen with his mobile can connect to public WIFIs of different clients. This aspect, in addition to offering a wide coverage and security in the connection, facilitates the downloading of data and information from a WIFI without having to use the own data rate. This is an added service that is offered to customers who hire broadband for their homes and mobile lines. The advantage, comparing to any other operator that only relies on mobile lines, is that it offers greater precision. WIFI, unlike mobile antennas, allows a location with greater precision and accuracy. The data and information that is collected are transmitted in real time within the network, both for the WIFI network and for mobile phones.

Furthermore, Euskaltel is capable of knowing the volume of people in a specific location with time gaps of two minutes. This information is used to operate the network and identify aspects of density and movement of these people. Euskaltel, through various methodologies, such as Data Lake and Big Data, as well as mobility data matrices, treats the information anonymously

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and the customer obtains it every thirty minutes. Every thirty minutes there is a calculation of the population movements in the city that the client receives through a set of different visualization tools.

8.3.3 Business model

The objective of the intervention is to offer anonymous, aggregated, and processed data and information to the client, which correlates with their own data and information parameters to carry out actions in mobility aspects. In this sense, Euskaltel's value proposition allows the customer a complete and efficient management of data and information on mobility to make decisions and carry out actions. In addition, Euskaltel offers data and information in short periods (thirty minutes) that are constantly updated. In this sense, as we mention, we must highlight the precision and accuracy that Euskaltel offers with the data and information through the use of two networks and access points (antennas), which also allows offering a greater representation, reliability and security of geolocation data and the networks that capture these data. Geolocation data, such as movement data, add a lot of value to the client, and the exploitation and treatment of them offers many uses to the city.

Euskaltel's value proposition of its traditional products and services, network, telephony, television, are aimed mainly at private customers, both citizens and companies that hire its services as an operator, although it also works for public customers. Within the framework of Big Data, mobility and its derivative services, Euskaltel is primarily aimed at the public customer, specifically the Public Administration, at all levels. In addition to data and information on mobility, Euskaltel also works in other areas, such as cleaning. Regarding the private client, Euskaltel wants to promote this business area, since it considers that private citizens, shopping centers, small businesses, or merchant associations can benefit from its value proposition. The processing of geolocation data, through heat maps and flows, can offer accurate information, in real time, for decision-making and actions by these clients. A concrete example could be the decision to open a business. A private client could be interested in the geolocation services of flows and chains of people to decide to open a business.

Relationships with clients are of different types. Within the framework of smart city projects, direct relationships with the client predominate, as well as public tenders and contracts, collaborations and projects. Euskaltel highly values proximity to the customer as a strategy to offer a customized service. Its distribution channels are sales force, public tenders, prescriptions, jobs and collaborations.

Regarding the value production of the business model, stakeholders are key for Euskaltel. Both the EU and the Public Administration are key actors for this type of action from the point of view of financing and revenues. In addition, the public client acts as a promoter and facilitator for the entry of new clients. Euskaltel, like most operators, constantly works with technology centers and companies specialized in certain aspects, such as specific traffic or road

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algorithms. Obviously, Euskaltel tries to control the entire value chain, but sometimes these specialized companies add a lot of value for Euskaltel solutions.

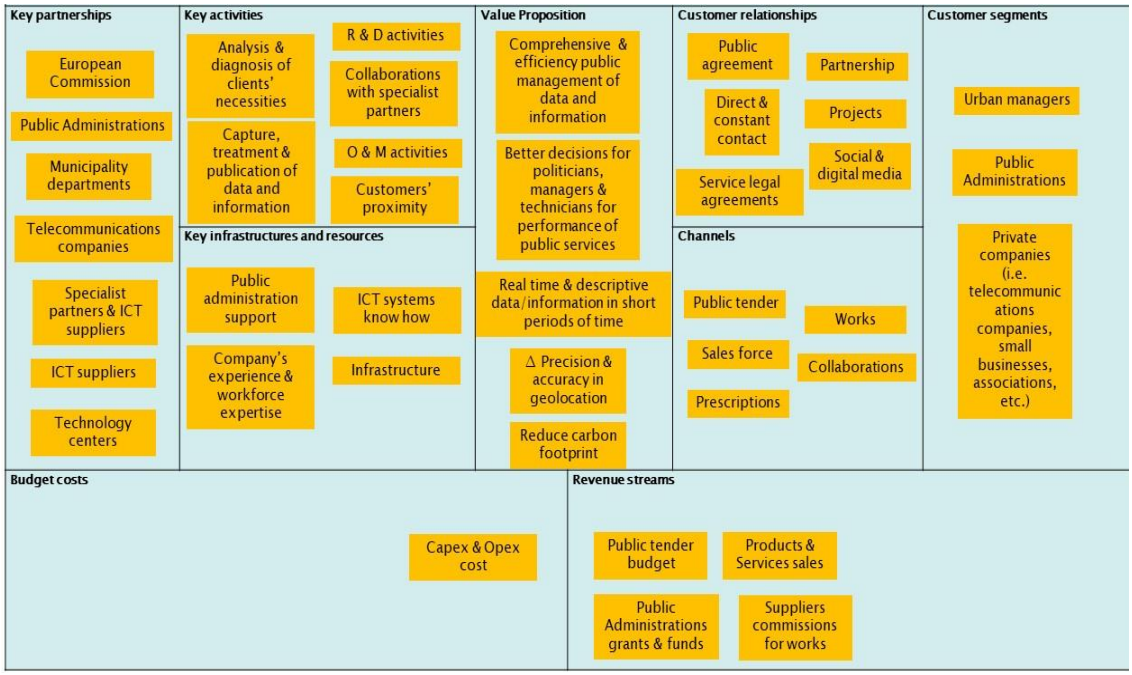

Figure 56.- Business Model Canvas of Euskaltel

The production of value involves different activities, including the analysis and diagnosis of customer needs, R&D activity, analysis of data and information in real time, operation and maintenance of services, and proximity activities with the clients. Obviously, all development activities are key for Euskaltel, in addition to the proposal for data analysis and presentation of information for the client. In this sense, the objective of Euskaltel is for the client himself to see the potentials of geolocation data and combine them with his own data to improve his decision-making, actions and also to be able to relate them to other data sources. This aspect is key to creating new services.

In addition to these activities, the business model involves different resources and infrastructure. The support of the Public Administration is very important, not only in terms of financial resources for pilots, but in terms of publicity, notoriety and market access. Also, as we mention, Euskaltel places special emphasis on the knowledge and specialization of its workers in order to offer highly innovative products and services. For this reason, the figure of the developers is key. Finally, the infrastructure of networks and access points is vital for Euskaltel, as it represents a critical success factor. If Euskaltel experience drops or failures in the networks, the service cannot be offered.

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Finally, Euskaltel's business model focuses on the cost and income structure. From the point of view of costs, one of the most important items is the developers, engineers and scientists who do data analytics, processing, etc. Also, they obviously need staff to generate reports and perform all commercial activities. In addition, the activity of subcontracting services to experts and specialized companies is an important cost, such as those mention on the creation of specific algorithms. At the income level, Euskaltel has different traditional sources, such as the sale of products and services, public tenders, minor contracts, commissions, billing between operators, etc. It is important to point out that Euskaltel has public funding for the development of pilots such as the REPLICATE project or R&D works.

8.3.4 Strategy

Figure 57 presents a comparison through the Strategy Canvas tool between Euskaltel and its competition. This is an exercise based on the analysis of data collected, which reflects points of similarity and difference between companies.

As it is shown, we have chosen seven indicators that reflect the strategic position of Euskaltel and the competition. The indicators have a score of 1 to 5, where 1 means the worst possible score and 5 the best in terms of the market valuation.

The first item is location. Refers to the precision of the citizens' location. The advantage of Euskaltel model based on the use of data and information from two networks - the mobile network and the WIFI Hotspot network, which the company itself deploys -, is precision. There are access point applications in different areas of the city, so that a citizen with his mobile can connect to public WIFIs of different clients. Helps you to download services without using data plans. The WIFI has a coverture radius much smaller than a mobile antenna so allow them to locate with greater precision.

The second items respond to capacity and volume of data. Although Euskaltel has a very important market share, about a third, its representativeness must be extrapolated. Euskaltel is a virtual mobile operator, without a physical network. It has the entire network, except the antennas. So, it is also a disadvantage for the access item. This can be a disadvantage compared to companies such as Movistar or Vodafone, which, having their own antennas, have, for example, data on foreign tourism. These companies can receive clients from abroad. Here, the capacity and volume of data depends on other formulas, such as buying from other operators. It should also be noted that Euskaltel can also sell data to those operators that do not have penetration in its market. At the end, operators have a very close relationship and are continually billing each other depending on need.

On the contrary, we believe that its proximity with customers, allows Euskaltel to understand the concrete needs, pains and gains. To that end, Euskaltel uses offers pain relivers, already mentioned, such as customization and easy manage that are crucial for its public customer. The reason is that Euskaltel has known very well how to export data thanks to the customer

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insights. In fact, FSS has understood very well the utility of these data and how these can help to improve its service.

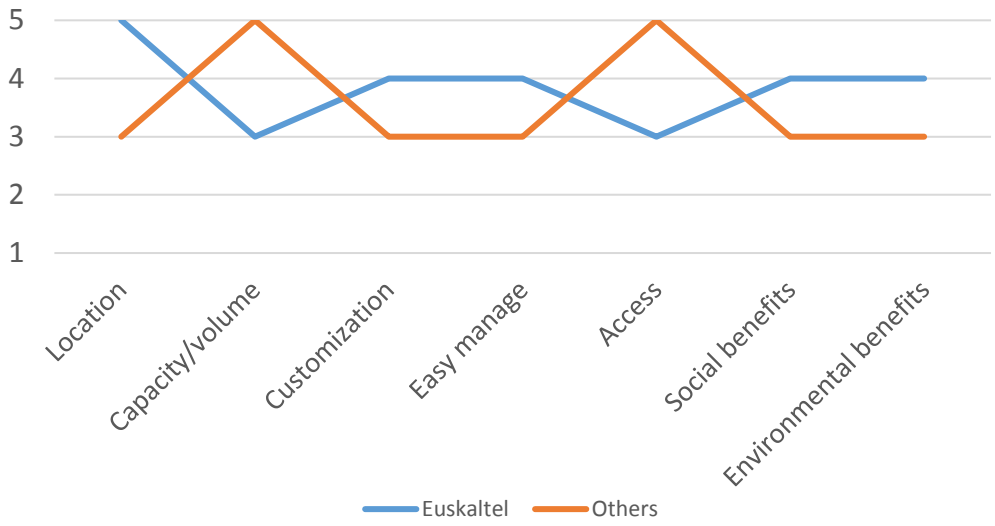

Figure 57.- Strategy Canvas of Euskaltel

Finally, Euskaltel's strategy based on customers' needs and knowledge about the environment where operates, has allowed them to understand better which environmental and social impacts should imply the intervention. To this regard, the intervention clearly tackles concrete environmental needs such as energy efficiency in mobility, for example having the possibility to design new routes thank to the data and information, or social gains such confidence, privacy or security from data, for example using adequate procedures to aggregate and anonymize these data.

8.3.5 Final remarks

Euskaltel's model is very innovative in Spain, although there are operators in other countries that are already developing it. Currently, it seems that no operator in Spain offers it. In this sense, Euskaltel has very well developed the technical part of data analytics, but it still needs to develop the business part to scale-up or replicate this type of intervention. At this point, a key aspect of Euskaltel's business model is the value of the data.

How can we know the value of the data? The data acquires exchange value to the extent that it is useful for the public customer and, above all, for the citizens represented by the public administration, as it is the case of the REPLICATE project intervention. Therefore, if the solution solves customers' jobs, pains and gains, then the customer will set a price. This price will be set according to the KPIs achieved established in the monitoring and evaluation phases of the project itself. A clear example of KPIs is smart decision making and to what extent can be

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constructed to predict the behavior of the different actors in mobility when a need must be satisfied. To what extent does the data provided contribute to making these decisions?
Complementary, Euskaltel can take advantage of the data and its value to the extent that it can better understand its market and thus create customer approach strategies where, as a partner, those can present added value to the customer, reflected this in new indicators, such as the creation of new services through the data provided. In short, the price represents the acquisition value of the data. In the case of the public customer, it will be represented by the value that this data has to create, capture and deliver public value, and to the extent that the company generates added value for the customer.
However, in a market where initiatives of this type are still incipient from the side of the public customer, we believe that the business model should focus on promoting the product and the service to attract a greater volume of the market segment we are targeting. For this reason, we believe that it is essential to work towards business models based on integrations or networks where there are different companies that work together to share data that help the customer to see the opportunity that this data creates and where, each company specializes either in one part of the value chain or in a complementary but interrelated product/service for the customer. Therefore, working on the integration of the value chain or in collaboration networks to deliver value to the customer can favor or enrich the offer, as well as create marketplaces. In short, these are business models in which risks and benefits are shared, value propositions are redefined, new channels are created, as well as can help create competitive barriers for new or future players.

8.4 Leycolan

8.4.1 Company's presentation

Leycolan *S.A.L* is a technology-based company for the efficient management of road and industrial lighting. Leycolan's main objective is to offer innovative solutions in lighting management. Leycolan designs, manufactures, and installs hardware and software components that respond to the smart lighting needs of institutions and companies on an economic, operational and environmental level[68]. Leycolan's value proposition focuses on optimizing lighting management through energy savings, reducing maintenance costs, and expanding additional services in the lighting infrastructure beyond its traditional

[68] Source: https://www.leycolan.com/es/quienes-somos

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characteristics. The value proposition has a clear economic, social, and environmental impact for Leycolan's customers.

In relation to the REPLICATE project, the pilot[69] in the city of San Sebastian consists of:

- Replacement of ninety streetlights in an area covered by two cabinets. The proposal replaces 250W and 150W HPSV streetlights with LED lamps of two different models:
  - Fifty-two conventional 250W lamps for 120W and 100W Philips brand LED lamps.
  - Thirty-eight 150W lamps per SULKA model LED lamps with 100W COB LED technology.
- In addition, the pilot includes the installation of an intelligent remote-control of the public lighting system, controlling point by point, monitoring energy consumption, managing calendars, regulating the lights according to the needs of the environment and the presence of transport and people.
- Possibility of implementing new services for citizens using the current infrastructure. Specifically, it includes audio services, cameras, sensors, vehicle meters and energy meters.

Finally, with the implementation of new LED light technology and new devices for remote-control management and additional IP services, the system has become a LAN, where each light pole is a smart point and where it is possible to connect an IP device that can work over the Internet and promote IoT activities in the area. In addition, the remote-control system contributes to reducing the maintenance of public lighting (costs), since the system can have the knowledge and information of each lamp, the work regime that has been implemented, and so on, and can report alerts to the maintenance department, considerably reducing maintenance costs compared to older conventional systems, where maintenance was carried out only through a physical visit to each lamppost, except for those mandatory inspection visits.

Leycolan's smart system is simple, an aspect that makes it different from the competition. In all lighting circuits there is a header with a cabinet from which the circuits are distributed and where the software developed by Leycolan is located. In this cabinet you can put the header or concentrator that is connected exclusively to the network cable. Through this cable, all communication is made. This means that each lighting fixture is connected to the power cable from end to end and communication is transmitted. In addition, the necessary IP service components are added to the pole of the lighting fixture, connected to the headend, which transmits data and information through the Internet.

[69] Source: D3.11 Report on Public Lighting System. Leycolan. REPLICATE project. H2020-SCC-2015 Smart Cities and Communities Innovation Action (IA). 31/01/2018

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8.4.2 Customers and value needs

The lighting industry, both from the public and private point of view, continues to use conventional lighting systems, in addition to operating and maintaining works that are rigid for the customer, without exploiting the opportunities offered by smart lighting. As shown below (see figure 58), Leycolan's value proposition tries to change such a traditional vision on lighting and offers a clear and adequate relationship between the customers' needs and the products and services offered by them.

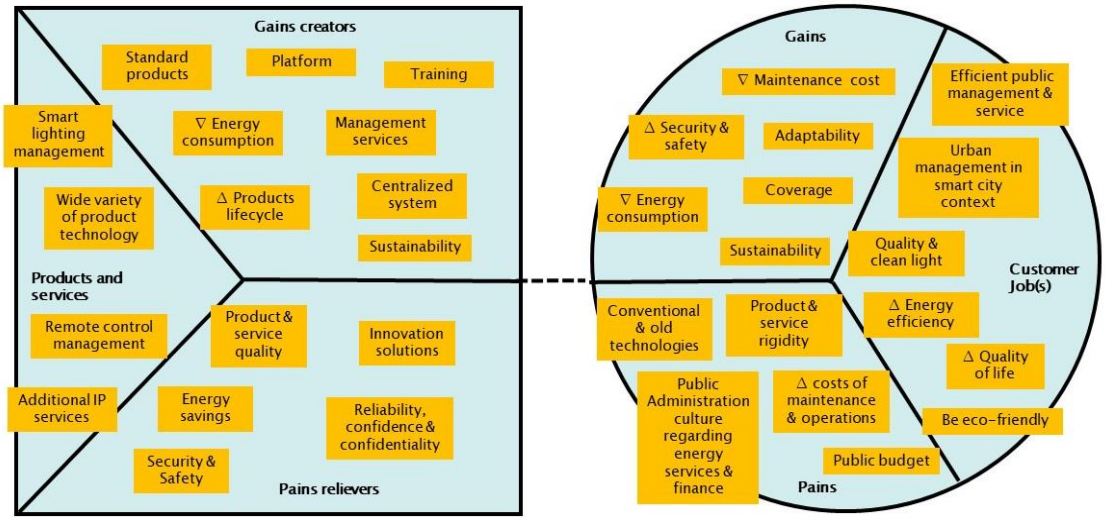

Figure 58.- Value Proposition Canvas of Leycolan

From the customers' point of view (right side of figure 58), there are different jobs and tasks related to smart lighting. One of the key aspects, both for the public and the private customer, is the increase in energy efficiency. From a purely economic point of view, energy efficiency translates into an increase in the products' life cycle, through its various components and materials, as well as a reduction in energy costs. Also, the quality of light, along with maintenance and additional services, has a clear social and environmental impact in the areas that it is implemented.

Regarding pains, aspects that lead to negative emotions of the customer, there are different issues. Firstly, the customer – public and private –, continues to use conventional and often old technology and infrastructure. Over the last few years, lighting technology has improved a lot in terms of efficiency, but dynamics are only focused on the change of the product, for example LED technology to save on consumption and costs, and forget the management of the product itself and the offered service – the smart management of lighting –, which has a greater impact in terms of efficiency. Another important aspect for the customer is the rigidity

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of the product and the service. Usually, when the useful life of a product is over, for example the LED technology of seven or eight years old, and you replace it with a lower power or with a multi led one, it means changing other elements of the lighting fixture, such as the casing. The point is that often, the change of a part implies a change in other components and materials that make up the lighting fixture. This change has cost implications in maintenance as well as environmental implications. This is not a minor topic. In the case of San Sebastian, the city has 30,000 lighting points with an annual energy consumption cost of around EUR 3.5 million, of which EUR 1.75 million are maintenance costs.

Regarding these pains, Leycolan's value proposition presents different value generators. As observed in figure 58, Leycolan offers a service that differs from the competition, for example from Phillips, because it introduces a maintenance service that reduces costs. One of the ways to reduce this maintenance cost is focused on using standard products that are easily replaceable and adaptable to the lampposts. The objective is to change the elements at the end of their useful life without changing all the elements of the lamppost. The main idea is that you can change the LED without having to also change the casing. This aspect of differentiation from the competition, in addition to reducing maintenance costs, offers greater sustainability from an environmental point of view by always maintaining the useful life of all components and materials of the lighting fixture.

From the point of view of products and services, as indicated in the introduction, Leycolan focuses on the optimization of lighting management through energy savings, the reduction of maintenance costs and the expansion of additional services. To do this, it has a wide variety of technological products focused on different components of the lighting fixture developed by Leycolan itself. In addition, it offers its own remote-control system that integrates electronic devices for detection, system control, power regulation, data transmission by wiring, communication, etc.

In short, Leycolan's value proposition through an intelligent lighting system allows higher levels of efficiency, reduces energy consumption, lowers the cost of maintenance and operation, and obviously has a greater environmental impact, both in reducing the CO_2 emissions, as in the consciousness of the customer.

To achieve this value proposition, Leycolan offers high-quality products and services, which also responds to a clear differentiation strategy with respect to the competition to respond to the needs of its customer. At this point, product development and investment in R&D are key aspects that offer reliability, trust, and confidentiality. In this sense, Leycolan has a clear commitment based on proximity to the customer, offering flexible, adaptable, and innovative solutions to the customer with a clear effort to customize products and the services.

As introduced, the use of standard, easily adaptable and replaceable products - components and materials - is key to lengthening their life cycles and reducing replacement costs. In addition, the use of a remote management system, connected to the network, allows an exhaustive control of profitability parameters, offers specific safety standards, and reduces

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operations and maintenance costs, for example by reducing the number of maintenance visits. per installation.

8.4.3 Business model

Leycolan operates in a very competitive industry in which there are important companies, such as Phillips, Indra, or Vodafone, that tend to coopt the market in large volumes. Leycolan's strategy goes through a slow and sustainable growth, based on products and services development of innovation and quality, reduction of maintenance costs, customization and proximity to the customer in smaller markets. In addition, Leycolan maintains a strategy of differentiation with the competition focused on simplicity and standard products, easily interchangeable and adaptable, which allow specific substitutions and replacements without having to change other elements of the product. In this section, authors explain, through the Business Model Canvas (BMC), which is presented in figure 59, how Leycolan works on it successfully.

The objective of the intervention, as mentioned in the company's presentation, is to change and improve the lighting system and implement new services taking advantage of the existing infrastructure. Leycolan's value proposition focuses on the optimization of lighting management, through the design and updating of facilities through the application of LED lighting technology, the implementation of remote-control management and the transformation of the electrical infrastructure in a communications network. In terms of optimization, Leycolan highlights three key aspects: i) the reduction in energy cost by 80% and as a consequence, a significant reduction in light pollution and a significant reduction in CO_2 generation; ii) the reduction of maintenance costs based on the intelligent remote management system; and iii) increasing the capacity of services in the existing infrastructure, such as voice, image, sound, sensors or video surveillance.

Leycolan's value proposition focuses in two customer segments, public administrations, which includes municipalities, regions, managers of infrastructures such as harbors, airports, etc., and private companies and industries, which includes large companies with external or internal areas, residential area managers, outdoor businesses, construction companies, etc. In relation to the public segment, Leycolan can work with cities of up to 50,000 inhabitants. Above this figure, it is difficult for Leycolan to access due to its capacity. It can get pilot projects, as in the case of the city of San Sebastian, that cover certain areas, but it is difficult to cover more populated territories.

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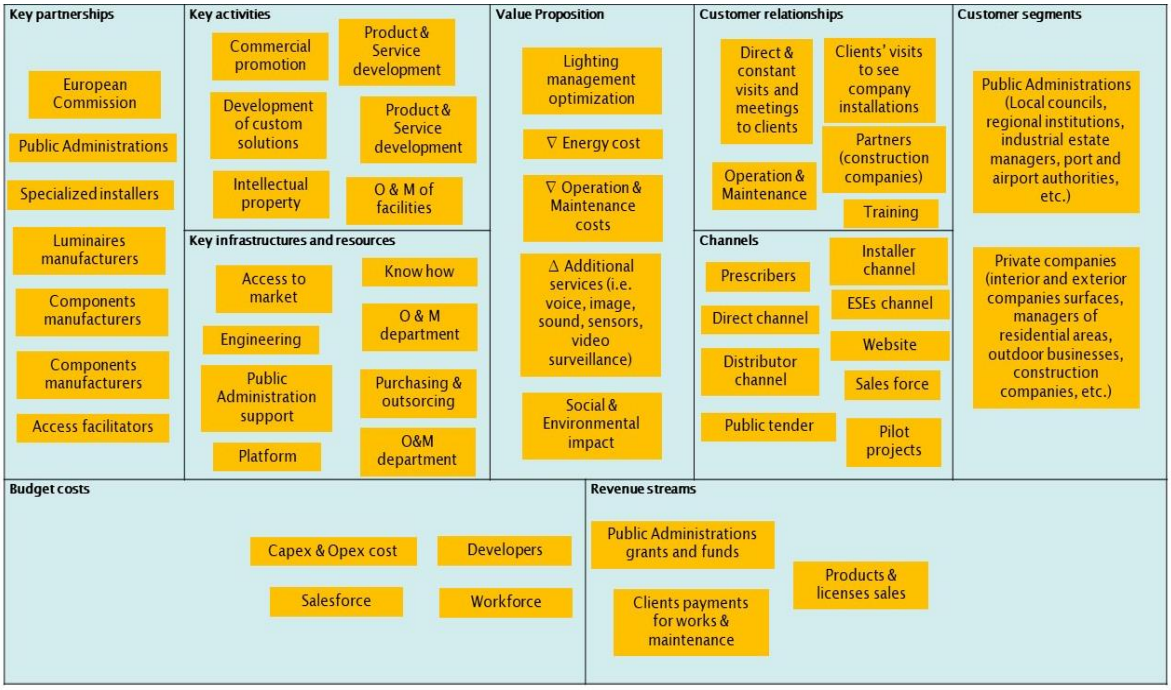

Figure 59.- Business Model Canvas of Leycolan

In general, the public segment is attractive to Leycolan. Obviously, the public sector is a good, reliable prescriber, which offers them notoriety. Furthermore, at least in the case of the Basque Country and Navarra, municipalities and regions usually have more budget, access to funds and they work well. On the contrary, these types of customers do not usually like consortiums of energy services companies or large projects that they cannot undertake with their own financing. In this sense, it is a market that acts safely and does not like having high levels of debt. This is a positive aspect, but it implies a barrier to the energy services companies' philosophy that Leycolan works with, which allows them to enter tenders with low paybacks and even funding. For this reason, in addition to capacity and competition in the sector, Leycolan works with small and medium-sized municipalities which works/operates part by part - by lighting packages - according to time and budget. A small municipality goes from 100 to 500 points of light and a medium one can reach 1,000 points of light.

Leycolan can enter or achieve larger sales volumes through remote management software. In other words, Leycolan not only sells comprehensive projects (lighting, remote management, maintenance, etc.), but also just products. This is the case of remote management software, which can be delivered directly to the customer. This allows Leycolan to access higher volumes, but with a certain limit, because large markets invite large companies to play in the sector, such as Phillips, Indra or Vodafone.

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Relationships with customers are of different types, but direct relationship with the client predominates, face to face, with visits and meetings where the Leycolan system is presented, the company's facilities are shown, specifications and needs to be covered are defined, studies and budgets are presented, project set-ups and follow-ups are made, etc. To this end, contact with the customer, proximity and customization are key aspects of Leycolan's strategy to differentiate itself from the competition.

The main distribution channels for the delivery of value are five: i) the specifiers, made up of installers, architects, politicians, ESEs; ii) the direct channel through supply and installation for end customers; iii) the distribution channel through supply, but without installation in these distributors; iv) the installer channel through supply to final customer installers; and v) the ESEs channel through the supply with / without installation to ESEs. In addition to these channels, Leycolan also uses public tenders, pilots, such as the REPLICATE project, the sales force and its website.

Regarding the production of value from the business model, stakeholders are key to the development of Leycolan. As mentioned, the public sector, made up of the EU and public administrations, are promoters of smart lighting systems with LED technology and additional services. They have an important role to promote actions, projects, pilots, in addition to offering possible financing and subsidies. In the case of San Sebastian, we observed how, through the pilot of the REPLICATE project, it offers an opportunity to enter an important city, an important aspect in terms of publicity and notoriety for Leycolan. The public sector, through the administration, are key stakeholders to facilitate access to clients.

Focusing on the production chain, Leycolan has specialized installers. These installers, with proven solvency, offer the capacity to meet present and future demands in the market where Leycolan operates. Furthermore, as installers also exercise a prescription function. In addition to them, Leycolan works with different manufacturers of luminaires, as well as manufacturers of different components, for example communication nodes, electronics, sensors...with the ability to scale and meet a growing demand.

The production of value involves different activities, among which stands out everything related to the development of high-quality products and services. Leycolan makes a very strong commitment to innovation in R&D to offer quality. Everything that is installed is already well tested, revised and comes from very interesting lighting developments, with new models that are difficult to copy by the competition in the short term. In addition, its technological development offers huge flexibility and adaptability between components and materials. In this manner, in addition of extending the useful life of the products, it allows them to have solutions for any type of situation. This implies being able to adapt its own technology to products and lighting infrastructure of other brands and so offer versatility. In addition to this aspect, a key activity for Leycolan's business is maintenance. As indicated for the value proposition, reducing maintenance costs is crucial to differentiate them from the competitors.

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At this point, remote management and standard products – in terms of versatility and adaptability – are key factors.

In addition to these activities, the business model involves different resources and infrastructures. The support of the public administration is very important, not only in terms of financial resources for pilot projects, but also in terms of publicity, notoriety, and market access. Also, as mentioned, Leycolan places special emphasis on the know-how and specialization of its workers in order to offer highly innovative products and services. To this end, the figure of the engineers is key in its workforce. Finally, the remote management system, managed through a platform, is key to control lighting fixtures, offering security and reducing maintenance tasks and costs. Leycolan offers a management and visualization platform (remote management) to the customer, in addition to training, so that the client can control the data and information of the lighting fixtures.

Finally, Leycolan's business model focuses on the cost and revenue structure. Regarding costs, Leycolan has high fixed and variable costs. In the case of the current structure costs (engineering), these represent 43% of its sales, while variable costs, purchase of components, materials, assembly, and installation subcontracting, etc. represent 65% of sales. In addition, it must also be considered that the distribution channel has significant margins, around 30-45% over the point of sale. Obviously, it is important to point out the cost of the debt because Leycolan is financed using credit and loans as well.

Table 3 presents different cost models – zero alternative (ZA), conventional technology (TC), LED technology (LED), smart technology (SMART)– for the customer depending on the products and services per light point. The ZA model implies to keep with what is now running, without investment cost and identifies just maintenance and energy costs; the TC model implies the investment cost of replacing a lamppost plus maintenance and energy costs; the LED model implies replacement with LED technology plus maintenance and energy costs; and the SMART model implies replacement and added services with SMART technology plus maintenance and energy costs.

The total investment per unit increases depending on the model. Obviously, as the model improves there is also the need for a larger investment. If we compare the first and seconds models, that means to continue with the current lighting system and therefore not make any change (zero alternative) or do the investment for replacement (TC), with the rest of models, the annual maintenance and energy costs (EUR 204,24) quadruples the costs from the second model (LED technology) and the third one (Smart technology). This difference is reflected in maintenance and energy savings, although the cost of energy carries a bit more weight. Between the third and fourth models, the maintenance savings are similar although the third model is a bit higher, while the energy savings are higher in the fourth model. Considering the sum of both costs, maintenance and energy, the third model saves EUR 155,8 per unit, while the fourth saves EUR 164,28.

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Therefore, the zero-alternative representing the first model and the conventional technology representing the second models, have both a higher cost compared to the rest models, both in maintenance and energy, in the medium and long term. The cost of not changing the model or just replacing is more expensive and has a very high energy impact that translates into economic costs, as well as environmental costs.

Table 3: Main lighting costs by type of technology (per unit)

CONCEPT	Zero alternative (ZA)	T. Conventional (TC)	Tec. LED	Tec. SMART
INVESTMENT				
Total cost investment per unit	0,00	200,00	450,00	550,00
Differences of investment		-200,00	-450,00	-550,00
MAINTENANCE				
Annual cost of maintenance	55,00	55,00	14,00	17,00
Savings in maintenance €/year/lighpoint			-41,00	-38,00
Savings in maintenance in %			75%	69%
ENERGY CONSUMPTION				
Annual cost ENERGY (4,100 hours year)	149,24	149,24	34,44	22,96
Savings in energy €/year/lighpoint			-114,80	-126,28
Savings in energy in %			76,92%	84,62%
TOTAL COST OF SERVICE (Maint. + Energy)	**204,24**	**204,24**	**48,44**	**39,96**
Savings operation (Maint. + Energy) €/year/lighpoint			-155,8	-164,28
Savings operation in %			76%	80%
RETURN OF THE INVETMENT vs TC (Years)			**1,60**	**2,13**
RETURN OF THE INVETMENT vs ZA (Years)			**2,89**	**3,35**

Changing the model, for both the third and the fourth models, implies a high investment, especially depending on the number of light points to be installed, but it presents very interesting returns on investment in short time. The investment is recovered between 1,60 years (LED) and 2,13 years (SMART) in comparison with TC, and 2,89 years and 3,35 years respectively in comparison with ZA. From a municipality's point of view, these returns seem very interesting and could incentivize to make the change. Furthermore, the difference between the third and the fourth model is only a little over half year. Finally, it is also

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interesting to highlight the impacts of improvement at the environmental and social level, which are often not counted in the returns at the economic level. From the point of view of a municipality, we can point out aspects such as the reduction of pollution, light intrusion or the increase of biodiversity, as well as aspects of improvement in public safety, environmental awareness or quality of life.

At the income level, Leycolan has different sources. The first income depends on the facilities installed for the public customer to be able to later offer the rest of value-added services and maintenance activities. On the other hand, regarding the private customer, income does not depend so much on subsequent services because Leycolan works with closed packages where margins are not so tight to get into the market. The point is that with the public customer there is usually a reduced gross margin in the first installation to have a revenue generation and gross margin in the subsequent service, although with the public administration it is often difficult to sign maintenance contracts. To this end, it is important to note that it is important to control the margin of the supply chain. As discussed for the cost section, this is a channel with a high margin. In this sense, we do not talk about income rather about saving.

8.4.4 Strategy

Currently, Leycolan's business model strategy goes focuses in a slow and sustainable growth, based on the development of innovation and quality products and services, reduction of maintenance costs, customization and proximity to the customer in minor markets. In any case, while safeguarding Leycolan's capacity and volume aspects, it is interesting to compare its strategic positioning with the strategic positioning of large companies, such as Phillips, Indra or Vodafone. To this end, figure 60 presents a comparison, through the Strategy Canvas tool, between Leycolan and its competition. This is an exercise based on the analysis of data collected throughout the REPLICATE project and secondary data from the competition, which reflects those points of similarity and difference between companies.

As observed, the business models reflect the strategy positioning of a company. The items have a score of 1 to 5, where 1 means less weight compared to competitors (disadvantage) and 5 greater weight compared to them (greater advantage) when facing the market.

The first item is the price. Leycolan is below the competition. This difference reflects its capacity and volume. Leycolan cannot lower prices on products and services regarding competitors because it cannot tackle medium and large markets. Faced with this situation, we observe the second item, the catalogue, where Leycolan, by capacity, cannot be placed at the same level as the competition. Its catalogue is smaller in comparison. On the contrary, in terms of quality, the third item, Leycolan has made a strong commitment in product development, through investment in R&D and a highly qualified workforce. As mentioned before, Leycolan has a product - components and services - well developed and tested. The competition can also work with this level of quality, but they tend to use foreign product suppliers to reduce costs. In this sense, the fourth item, closely linked to quality, reflects how Leycolan can follow

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the parameters of the competition regarding the level of lighting, clearly linked to the quality of its products. The technology of the components to create the product and the LED technology are available to the entire industry. The same occurs with energy consumption, highly correlated with the technology available and accessible to all competitors.

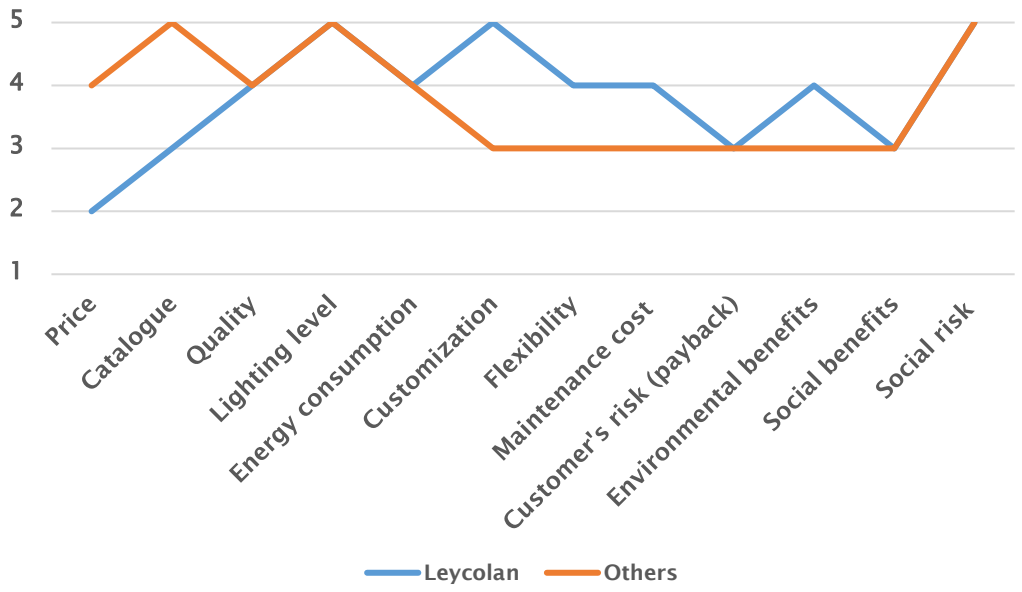

Figure 60.- Strategy Canvas of Leycolan

As shown in the figure, Leycolan stands out from the competition by customizing products and services, its flexibility to adapt to customer requirements, and its maintenance costs. These aspects are reflected and commented on in Leycolan's business model. As indicated, the direct relationship with the customer is key. In this sense, Leycolan's proposal involves designing, building, and implementing infrastructure and service to customer needs. In addition, Leycolan has a component replacement policy that allows adaptability to components and products from other brands and to change only one component when its useful life ends, thus extending the lifecycle of the rest of the components. This is due to two key aspects: firstly, the use of standard products and secondly, the strategy for maintaining the infrastructure through its monitoring platform, which controls all profitability parameters. These indicators, characteristic of a local sales and customer service policy, are key to differentiate them from the competition.

There is an interesting and key item for the customer, where both Leycolan and the competitors maintain the same level, this is the payback. In general terms, paybacks are similar, as discussed in the main cost table (table 3), because they respond to the technology of the product – LED technology – and do not usually take into account maintenance costs and

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added services. At this point, if public administrations adequately integrate these added services into their accounts, they would probably have lower paybacks. But as shown, paybacks are quite short, between one and two years approximately.

Finally, there is one item for environment and two for social aspects. The policy of customization and proximity to the customer allows Leycolan to differentiate itself from the competition in environmental aspects. The reason is that Leycolan can adapt its value proposition very well to the customers' environmental demands and its monitoring can be more specific and concise. On the contrary, both Leycolan and the competition, especially public customers, must improve their value proposition in terms of the environment, through added services, and not just through LED technology. This seems to be a common aspect of the sector. The same reflection could be pointed for social benefits that smart lighting can bring. These are crucial aspects, such as security, the use or recovery of a space, etc. that are not present in the value propositions of the sector and can be very interesting for the public customer. On the other hand, there is a special attention to social risks on the part of the industry. The main reason is that these are risks linked to data protection and are usually highly regulated by public regulations.

8.4.5 Final remarks

The analysis of the strategy allows us to observe that Leycolan seeks differentiation in product quality and customer service. We believe that it is a successful strategy to access the market during last years. By contrast, Leycolan, due to its characteristics, should try to grow in sales, rather than in structure, to reduce its capital costs and improve its profitability. One of the main ways to achieve this could be to attack the market with volume through its software for remote-control of the structure and lighting services, in addition to continuing with its policy of pilot project to access medium and large market. In fact, Leycolan has been pioneer in remote-control. They were the first company to talk about and do implementation ten years ago.

Nowadays, the strategy from Leycolan has changed and it is having positive thresholds. The reason is that the market is suffering many changes. Many local and European companies have been acquired by Asian companies or have entered into bankruptcy. To this end, Leycolan has made some change in order to obtain positive results. They have simplified R+D because the market does not value some new developments. They also have externalized some engineering processes because there is quite a high rotation among engineers. So, they keep an internal know-how but simplify processes to lighten costs structures.

Within this framework, we believe that it is important to give great value to the reduction of costs for the public administration in the medium and long term, due to the aggregation of services and information that can make public lighting possible, both economically, environmentally and socially.

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8.5 Silfi

8.5.1 Company's presentation

Silfi is a public owned society – 100% public ownership[70] – which directs the public lighting service in the City of Florence since 1982[71]. Furthermore, Silfi is also in charge of the traffic lights and infomobility services such as video surveillance, fiber-optic network and maps, as well as other smart city services[72]. As a company, Silfi is enrolled as an ESCO at national level[73]. Regarding the REPLICATE project, Silfi implements the new lighting system with technological equipment for value-added services. The lights in the district are changed with more efficient technologies and the network equipped with additional services linked to the Smart City Platform (extended already as Smart City Control Room) implemented in the ICT. In particular about 1.000 mercury vapour lights has been replaced by LED technology of which 286 only changing the bulbs and 695 with a complete refurbishment of the network[74]. Regarding value-added services, Silfi focuses in four important elements for the Council of Florence:

- Public WIFI: fast access points to connect – no need to register
- Traffic sensors: linked to mobility issues in order to control the territory (limited traffic zones access)
- Video surveillance: CCTV and sensors for monitoring to provide safety and security items as well as stablishing a system of preference according to vehicles
- Environment: environmental sensors according to sustainability criteria

To this end, the lamppost is understood as an aggregator of services which implies a clear optimization of the service provided by Silfi. Various services hang from the same infrastructure – which before depended each one on their own infrastructure – and collect and provide aggregated data for multiple purposes.

[70] Silfi is participated by different partners from other municipalities and regions.
[71] Source: http://www.silfi.it/EN/index.php?id=5&label=Company
[72] Source: http://www.silfi.it/EN/index.php?id=59&label=Infomobility%20services&display=59
[73] Source: D7.5 Report on management models v2. SPES. REPLICATE project. H2020-SCC-2015 Smart Cities and Communities Innovation Action (IA). 17/04/2019
[74] Source: DoA REPLICATE (691735). REPLICATE Annex 1 – DoA to the GA. Description of action: Smart lighting (FLORENCE – SILFI, THALES), p. 47.

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8.5.2 Customers and value needs

As already introduced, Silfi's intervention consists in the refurbishment of the public lighting infrastructure adding sensors for new services such as video surveillance, traffic control, WIFI and environmental issues. In figure 61, we present the Value Proposition Canvas (VPC) of Silfi's intervention for the pilot intervention in the City of Florence. The VPC is a useful tool to plot how the value proposition of the business model considers customers' needs, problems and preferences to perform the intervention on smart public lighting.

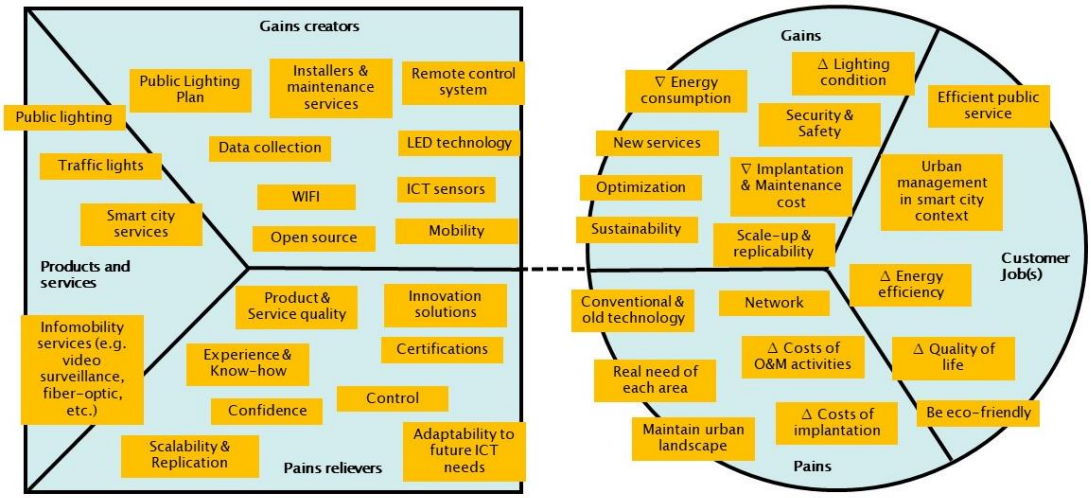

Figure 61.- Value Proposition Canvas of Silfi

From the point of view of the customer, right side of figure 61, there are several tasks and jobs that customers need to do to accomplish the intervention's objectives. Considering public lighting as a public service, the City of Florence —understood as the customer— needs to offer an efficient public service for its citizens, who represent the beneficiaries of the service. To this end, the urban management of the public lighting infrastructure needs to be smart in order to deliver public value. According to the typology of the intervention, being smart implies efficiency regarding public budget resources, which are linked to management, but also implies increasing energy efficiency to accomplish savings targets set in the SEAP objectives and the Smart City Plan from the City of Florence. Nevertheless, public lighting service main target is to increase safeness of roads and public spaces by providing the optimal level of lighting for pedestrian, drivers and environment. Customers' concerns are then related to economic, environmental and safeness issues, which are closely linked to an increase of citizens' quality of life.

These customers' tasks and jobs carry different concerns, which mean aspects that lead to negative emotions of the Council to perform the intervention. One of the most important

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concern is that part of the lighting infrastructure is not energy efficiency because it is based in conventional and old technology such as mercury vapour lights. Furthermore, Florence has to deal with another important issue, because it has to manage both the network of the public lighting system and the added value services. To this end, Florence has to deal also with costs of implantation which can represent a huge problem because part of the lighting infrastructure – designs of the luminaires – must follow concrete municipal regulations to maintain urban landscape – special boundary conditions of an UNESCO historical city[75]. This is not an easy problem to solve, because the traditional lighting designs were not designed to add new technologies from added services. On the contrary, they were thought on image aspects according the landscape and on offering light. Obviously, the lack of an efficient and wide coverage network impacts on operation and maintenance costs of the service. Finally, from a smart point of view, Florence needs to acquire a better knowledge what the real needs of each intervention area are. Some lighting operators and companies tend to propose some area's improvements, for example when deciding the number of lampposts to put, that not always obey to efficiency aspects, on the contrary obey to sales aspects based on profitability. Into the bargain, more infrastructure than necessary may imply a higher cost, for example in power aspects.

On the other hand, the customers expect a set of gains from the intervention which led them to accomplish objectives. The City of Florence wants to improve lighting conditions and take advantage of the lighting infrastructure – the pole – as a main city resource to group different services, not just the lighting service. The reason is that the city is plenty of poles which often just offer one service, such as street light, traffic light, etc. This situation clearly impacts the optimization of services, the reduction of implantation and operations and maintenance costs, and the increase of sustainability. Obviously, the substitution of mercury vapour lights by LED technology has a great impact in decreasing energy consumption, but this decrease is also achieved thanks to the optimization in reducing the infrastructure, gathering services and improving the network.

On the left side of the figure, there are first the products and services offered by Silfi to deal with customers' jobs, needs and benefit. As introduced, Silfi replaces 1,000 mercury vapour lights by LED technology of which 286 just changes the bulbs and 695 does a complete refurbishment of the network. This refurbishment allows Silfi to incorporate different services and sensors that are fundamental for the city, such as public WIFI for connections, mobility sensors, video surveillance cameras and environmental sensors. Silfi it is also in charge of the fiber-optic network for the city and works also on the Smart City Control Room.

[75] Source: D7.5 Report on management models v2. SPES. REPLICATE project. H2020-SCC-2015 Smart Cities and Communities Innovation Action (IA). 17/04/2019

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Regarding solution technologies, aspects that solve customers' improvement, Silfi covers many of them. Silfi has an historical experience and know-how about the public service in the city and understands the market. Silfi offers products – lighting components and sensors – based of quality trying to search for those brands with long lifetimes which also fit under the idea of aggregation to reduce cost of implantation works and maintenance activities. Also, the solution could be scale-up and replicated to other municipalities and regions. In fact, Silfi's new partners understand and appreciate the real work that Silfi has done and it is doing regarding smart services that could be useful in their municipalities and regions. Furthermore, innovative solutions from Silfi have made possible to adapt all new features to the pole maintaining design standards where needed and have left room for future needs of ICT sensors and networks capability. Another important function is the confidence that Silfi offers about the real needs of each area regarding lighting and added services. This confidence tackles possible private operators or companies' sales based just on profitability.

On the other hand, the gains creators are those features that deal with customers' desires mentioned as gains from the intervention. The implementation of the LED technology clearly impacts in energy consumption providing a higher environmental sustainability. Also, data collection from added services such as WIFI, video surveillance and mobility and environmental sensors brings an optimization of different services that lead to an efficiency in the provision of services as well as an optimization of resources through complete control of the network using also remote-control systems. So, gain creators impacts energy consumption, optimizes services infrastructure and reduces costs.

8.5.3 Business model

The business model of Silfi is well constructed on customer needs, pains and gains. The fact is that Silfi has a long track record working for the Municipality installing and managing the public lighting infrastructure and system in the whole city as well as other services. This offers Silfi's an added value to know what the Municipality and its beneficiaries need from public lighting and other services which has already been managing.

Figure 62 presents the City Model Canvas (CMC) for the smart public intervention carried by Silfi. As mentioned in chapter 3, the CMC reflects the logic on how the city is going to produce and deliver public value in a way that is economically viable, socially inclusive, and environmentally sustainable (triple bottom line). The business model reflects how Silfi, a company participated by the Council of Florence, in close collaboration with the Council, proposes to tackle the objective of the intervention. To this end, the mission statement of Silfi focuses in reducing GHG emissions and offer an efficient management of public infrastructure using lampposts as an aggregator of services.

As mentioned for the VPC, the value proposition of the business model focuses in lighting refurbishment, energy efficiency and management optimization. Energy efficiency is gained mainly through LED technology. But optimization is gained through the additional services

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installed in the lamppost infrastructure that obeys Silfi's strategy based on understanding the pole as an aggregator of relevant services beyond the light service. Clearly, this strategy has an impact on operation and maintenance costs if all services are considered. Furthermore, the value proposition impacts on environmental and social aspects such as energy consumption, light pollution, security and safety for citizens, etc. This value proposition is aimed to benefit citizens as well as the Council and its departments to optimize public resources and make decisions according public value and the needs of the city itself. We do not have to forget that all added sensors to the lighting infrastructure collect important data of great public value.

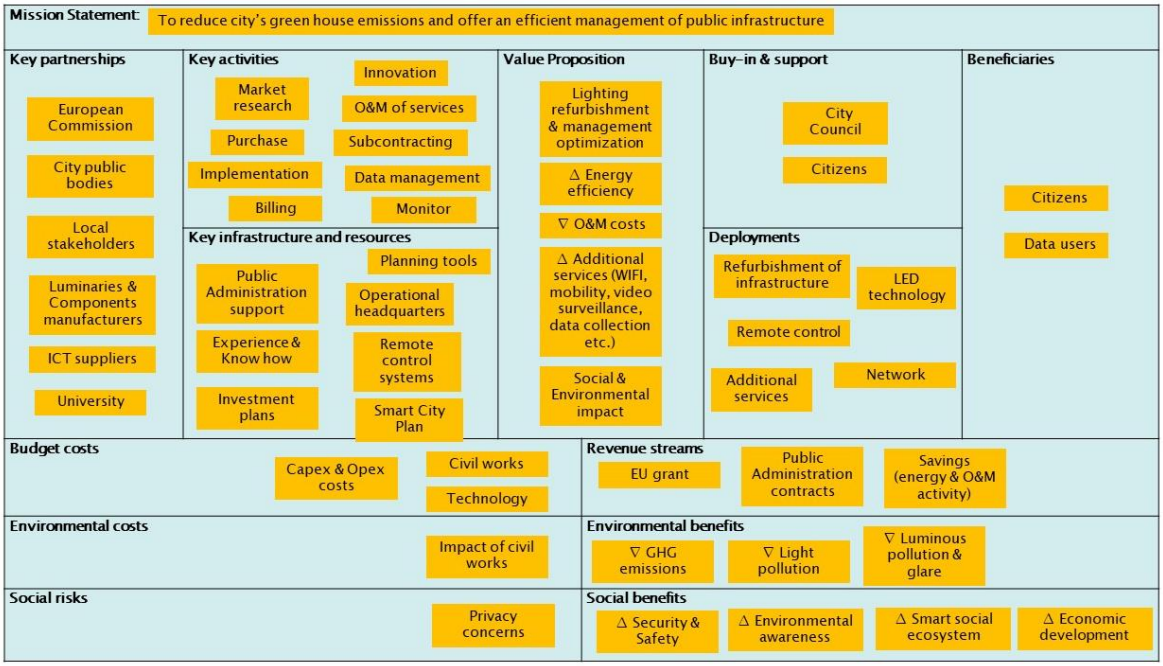

Figure 62.- City Model Canvas of Silfi

In order to provide the intervention, the delivering value needs the buy-in of politicians and citizen's acceptance. To this regard, the political will has been crucial to act as a promotor towards smart features in the city. This will is embodied in the Smart City Plan[76]. On the contrary, the video surveillance could have some resistances from citizen regarding privacy matters. To this end, Silfi follows strict regulations on the matter (GDPR) and works with anonymous and aggregated data that are not strictly related to safety and security objectives. The delivering value, as already introduced for the gain creators, focuses in the LED technology and smart services controlled by remote-control, refurbishment of infrastructure and

[76] Source: http://www.spesconsulting.com/sites/default/files/Firenze%20Smart%20City%20Plan.pdf

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enforcing the network. To overcome these deployments, Silfi works closely with different stakeholders. On one part, the strategy and implementation of the intervention has the involvement of different public department because of the variety of services, as well as the funding support from the EU and the investment from the Council. Also, Silfi has to work closely with many local stakeholders related to the design and urban matters of the city. On the other side, Silfi, as a company purchases luminaries, components and ICT sensors to suppliers.

The production of value implies many activities. An initial as well as constant activity is market research. Silfi has to check carefully all products and verify benefits according to different requisites such as lifetime or adaptability. This last item is quite important because the strategy of aggregation different services to the lamppost implies making them compatible at an electric level, manageable and responsible. This is not an easy task because there has to be trial error tests, a way to split services, develop different arrangements on a same structure, link and connect them, etc. In fact, these activities always imply to restore many aspects in order to aggregate services to the pole and to the pole box, but also to maintain the design trying to limit the impact of works and image. Technological innovation is also key. The smart lighting intervention implies much more than LED technology and incorporates many elements to the pole and to the box of the lamppost.

Another important activity is the management of energy. In general terms, energy savings represent a source to hold the investment. To this end, the City of Florence has an investment plan with Silfi that is based on energy savings as well as operation and maintenance savings. These two savings represent source of revenues for the business model. Also, Silfi buys energy through an aggregator center. They have 800 delivery points (electric meters). They buy it from a consortium that manages 19,000 delivery points. So, Silfi does an aggregate purchase of energy to provide to the city and has a canon through a services contract.

Also, Silfi has an operational headquarter. It is a central from where it manages all services 7/24 (lighting, video surveillance, fiber distribution, etc.). This resource is key from an operational point of view, as well as conceptual one to get knowledge, to manage data on services, incidents and maintenance in real time. This center offers Silfi an absolute control.

Finally, the sustainability of the business model focuses on the triple bottom line: cost/revenue, environmental costs/benefits, and social risk/benefits.

Silfi has different types of revenues. There is the EU grant regarding the REPLICATE project and other national programs to extend the pilot action (PON METRO, white certificates…), as well as the service contract with the Council based on energy costs and maintenance savings generated by the services. Silfi is linked to strict measurement parameters regarding energy saving targets as well as maintenance costs that has to achieve. To this regard, savings come from the reduction of operating and maintenance costs for the whole service as well as being optimize with the infrastructure. The optimization of the service as well as its management though remote-control allows to reduce time, resources, and energy as well as to increase

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lifetime products. In fact, the intervention has an estimation of EUR 394,200 cost savings per year[77].

The budget cost is related to the Capex costs, expenditure in fix assets such as the infrastructure (civil works), and Opex costs, operating expenses for the correct function of the service. In general, 70% of costs are related to the civil works, while 30% of costs are related to technology. This is a crucial aspect because it means that civil works are strategic. A detailed estimation and planning in civil works allow Silfi to perform much more in the service.

The environmental impacts are highly positive. The most important environmental impact is the decreasing of CO_2 due to optimization of the network and energy efficiency. The forecasts expect savings was around 40% which implies 350 tons of CO_2 per year only with the pilot action, already achieved. On the contrary, there could be mentioned an environmental cost such as the increase of the energy use during civil works, but this is of little importance in comparison with environmental benefits. The impact of the extension phase already started in other 4 districts on the electricity consumption, is estimated to be about 11,8 GWh, with a consistent savings on energy bills (between 1,5 and 2 million € per year depending on electricity tariffs). Additionally, a study has been carried out about the external costs saved per year that can be estimated around 340.000 €/y related to the indirect effects of pollutions savings in the electricity production. The external cost values take into account health, agriculture, materials and biodiversity damage associated with greenhouse gas emissions and of other pollutants (atmospheric gasses, heavy metals, trace pollutants) of the national energy mix.

Finally, as observed in the business model, the social benefits are also higher than the social risks. Must be highlighted an increase of public safety and security because of vigilance and perception of citizens; an environmental awareness of citizens because of smart improvements; an increase of the smart social ecosystem development in the city already highlighted in its Smart City Plan; and the economic development related to the data and information gathered by Silfi and the municipal control room. In the case of social risks, as mentioned when analysing the citizens' buy-in, there are possible concerns by citizens because of monitoring activities and data collection in public spaces which could affect privacy matters.

8.5.4 Final remarks

The business model for the smart public lighting in the City of Florence is very interesting and presents important elements to be scalable and replicable. The aggregation of services has a clear impact on the optimization of the city's resources, in addition to increasing energy

[77] Source: D7.5 Report on management models v2. SPES. REPLICATE project. H2020-SCC-2015 Smart Cities and Communities Innovation Action (IA). 17/04/2019

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efficiency. However, the concept of smart in Florence, beyond the product itself, focuses on the service, applying important criteria of contracting, expenses, guarantees, etc. linked to effective parameters of mediation and return. In fact, the public know-how acquired from Silfi in the intervention will serve to exchange and transfer knowledge and experience to other cities. Other partners from Silfi's company has already mentioned this idea because they want to replicate the model in other cities and regions. At this point, replication should be carefully based on an adapted strategy to the territory. We do not have to forget that Silfi has a long track record working with the City of Florence which is a big city – has infrastructure, network and financial muscle – but entails complex systems. In this sense, depending on the type needs and size from cities, the replication could be done through aggregation of cities and involving an ESCO in the model to provide services in collaboration with Silfi.
On the contrary, in a city such Florence, a model of this magnitude is not sustainable without public aid. The point is that the model, although it follows an ESCO philosophy, encompasses many services and the investments made to carry out all the actions are based on a public point of view with long-term returns. For example, heritage preservation and maintenance is very high. The part of the model that can obtain relatively fast returns focuses on the installation of LED technology, but if the civil works costs of all the actions and the addition of other services are considered, the return is more complicated. The question depends on many items such as the size of the city and its complexity of management. In general terms, depending on the type of action, a large, complex city presents savings of around 30%, while in a small city, less stressed, savings can be more significant and reach 60% or even 75% with added services. At the end, the intervention is part of a city planning that is clearly strategic for the city and therefore, implies high investments.

8.6 Public lighting scale-up strategy

Finally, we present a scale-up strategy proposal based on public-private collaborations which could help to scale-up and replicate smart lighting interventions for municipalities and regions. Figure 63 presents an initial strategy for this scale-up.

1- Municipalities should make a clear analysis of the situation regarding public lightings, identifying the needs for them.
2- Also, they should define present and future specifications that public lighting should incorporate, such as infrastructure, light, sensors, etc. In addition, an important element to bear in mind besides technical aspects, is the design of the lamppost because of concrete requirements and regulations from municipalities.
3- It is also important to do an stakeholders' mapping. This mapping should consider local partners to empower them and create synergies which impact at an economic, environmental and social level in the municipalities.

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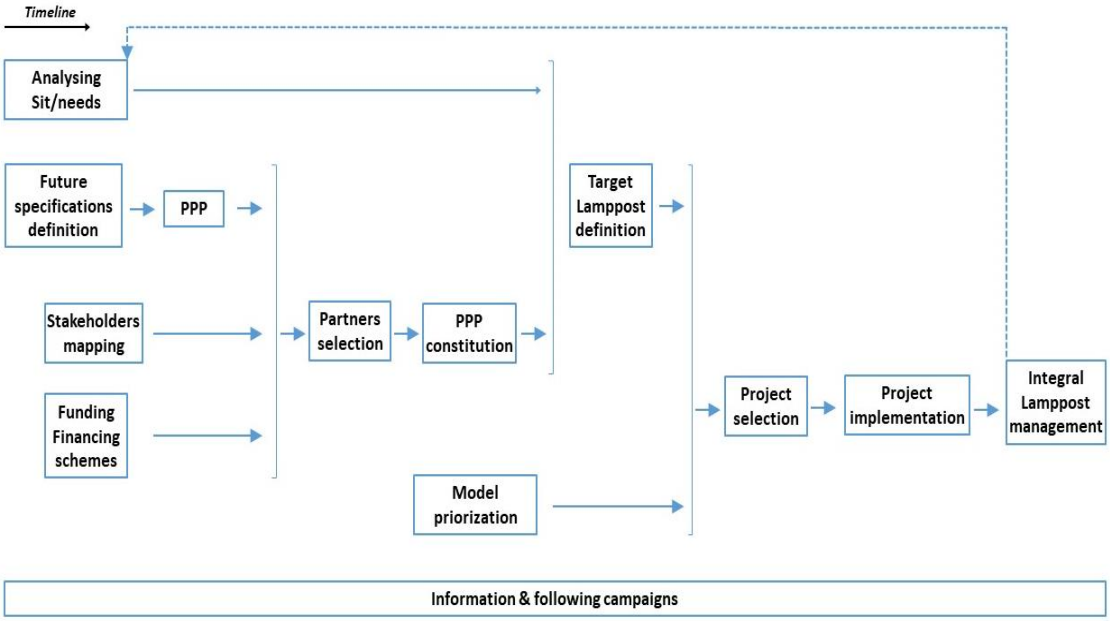

Figure 63.- Scale-up proposal for Public Lighting collaborations

4- Municipalities should also define funding and financing schemes. It is important to identify all financing resources, both public and private, at different territorial levels. In this sense, it is important that the financing should be durable to allow viability and sustainability of the interventions in the long term.
5- All this strategic process should begin with information campaigns, both for citizens and potential stakeholders. The economic, environmental and social benefits are of great value, but sometimes there are less economically quantified benefits, also of great value, that citizens should know. In addition to energy efficiency or the reduction in O&M costs, there are aspects of luminosity, biodiversity, security, etc. which are very important and show be informed.
6- Municipalities should define and create public-private partnerships (PPP). Which type of partnership we want as a city and we can promote. At this point, municipalities should define a set of indicators to evaluate the PPP itself as well as the service that will take place.
7- Once the definition of the partnership that the municipality wants to apply is done, as well as funding and financing schemes, resources, and stakeholders mapping, it is the right moment to do the partners selection according to established criteria.
8- After this selection, municipalities should constitute the PPP. This PPP, understood as an "ongoing agreement between government and private sector organisations in which the private organisation participates in the decision-making and production of a public good or service that has traditionally been provided by the public sector and in which

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the private sector shares the risk of that production" (Forrer, Kee, Newcomer, & Boyer, 2010), could be a significant advantage to replicate interventions in smaller cities of the regions, with less capacity in comparison with San Sebastian or Florence. Furthermore, could represented a source of financing too using a sharing risk model.

9- Once they have done this constitution, they should identify and define the different projects to be implemented in their own cities or across the region.
10- Select the most appropriate project according project.
11- Due to the fact that municipal budget is limited and it is difficult to implement everything that is desired from an initial phase, there must be a prioritization model based – jointly – on the lamppost target that has been identify. To this end, prioritization has to consider those spaces with the greatest impact in terms of economic viability, environmental sustainability and social inclusion.
12- Once the prioritization is made, the private company from the PPP must carry out the management and implementation of the project. This management should not be understood as an externalization, on the contrary should be understood as an indirect management where must be control procedures and an extreme symbiosis between the municipality and the company.
13- Finally, this process should be based on a closed circle. When a particular project is finished, another selected project should start. It is important to involve the private managers more and more because they can help municipalities improve the efficiency of the system. In this indirect management, as mentioned, it is very important to focus on outcomes, rather than outputs.

8.7 Mathema

8.7.1 Company's presentation

Mathema is a Florence-based software company, founded in 1987, mainly focused on the Information Technology (IT) field. Mathema's appetite for research and innovation, from its early beginning, has been recently acknowledged with the appointment as PMI Innovativa (Innovation Performing SME) according to a recent Italian law (d.l. 3/2015 "Investment Compact". Mathema' work revolves around the development of Smart Cities, Smart mobility and Digital Security sectors, as well as what is known as Industry 4.0, or the fourth industrial revolution. The term Industry 4.0 is based on the comprehensive transformation of the whole sphere of industrial production through the merging of digital technology and the internet with conventional industry, providing a highly integrated value chain. The term involves many

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diverse fields, such as Information and Communication Technologies (ICT), to digitise information and integrate systems, Network Communications, Big Data or Cyber-physical systems[78]. This concept is very useful in the framing of Mathema's activities, that as stated in the Replicate project, span from Very Large Database Management (VLDB), Crowd sense information, Ontology based Data Fusion and Mining, to Social Intelligence, Big Data/Open Data analytics, Augmented reality and Service Gamification.

In their 30 years of experience, Mathema has mainly partnered with large companies, such as banks, ministries, and public institutions, as well as with small and medium enterprises, allowing them to digitalise their processes and implement new technologies. Since the beginning they have had a strong tie with public administrations, associating with local universities and research institutions, and participating in Public-Private projects, with institutions that vary from regional Italian administrations to the European Union. They have also participated in international projects, in countries such as Malta or Georgia. Mathema's role in the Replicate's Florence Pilot is to develop two applications: the first, related to the e-taxi management in the Municipality of Florence, for the effective management of the Replicate's fast charging stations (localization, availability, reservation of the stations); the second, a "Serious game" application, called GoalGreen[79], developed to raise awareness about energy saving from the data collected from users' energy consumptions. With these applications, their mission is to manage the fast recharging network efficiently and engage the citizens in a change of behaviour towards energy saving and environmental consciousness.

8.7.2 Customers and value needs

Mathema's intervention consists in the set-up, development and integration of the two mobile applications, as well as in the storage, treatment and analysis of all data involved, both for their own work on the platforms and for further research and development. In figure 64, we can see the Value Proposition Canvas (VPC) of Mathema's intervention in the REPLICATE pilot in Florence. The VPC is a useful tool to plot how the Value Proposition, in this case Mathema's, is well-defined and positioned around the customers, in terms of their preferences and attitudes when deciding what products/services to purchase, and what tasks they want to perform.

From the point of view of the customer, left side of figure 64, there are several tasks that the customer wants to perform. We can classify customers' jobs to be done in: functional, practical and mundane considerations; social, the customer sense of duty and role in society; and emotional, these are the customer preferences or insecurities. As we can see, energy efficiency and sustainability are the main concerns of the customer. Both worries play an important role

[78] https://www.europarl.europa.eu/RegData/etudes/BRIE/2015/568337/EPRS_BRI(2015)568337_EN.pdf

[79] Available on Play Store (https://play.google.com/store/apps/details?id=com.mathema.goalgreen) and on Mathema Web Site (https://www.mathema.com/goal-green/)

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in the customers' tasks, as they concern customers' desire to be much more eco-friendly and have a sustainable and ecological lifestyle, to face the current and upcoming climate change challenges and be more energy-efficient, both for environmental and economic reasons. Thus, for the customer, having control over his own energy consumption is crucial nowadays. This way, the customer could be able to manage his own energy consumption efficiently. Therefore the need of greater transparency and control on energy consumption, also with the possibility of having an aggregate overview of data, is perceived as key.

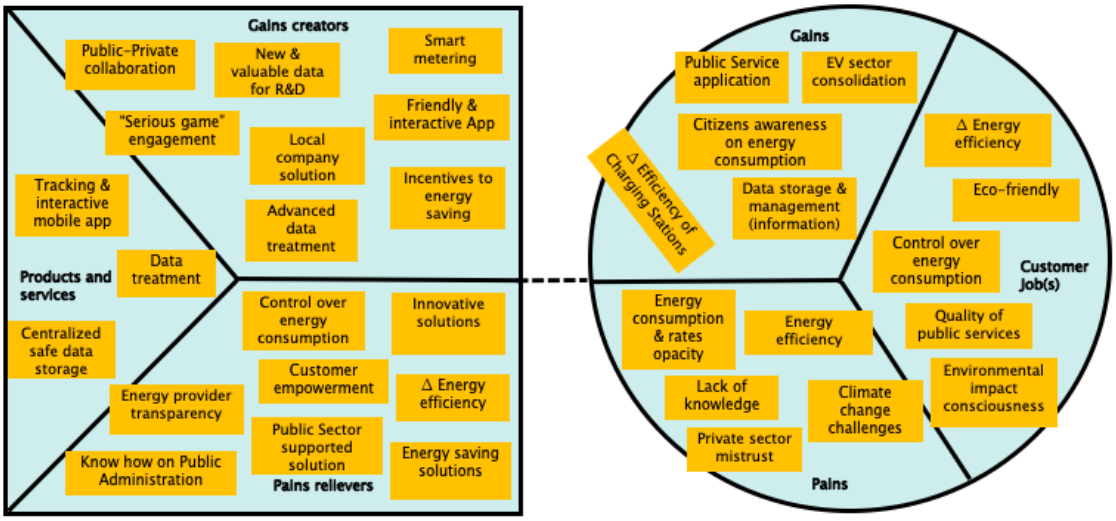

Figure 64.- Value Proposition Canvas of Mathema

The GoalGreen app is addressed to these needs by offering to the user the possibility to have a detailed curve of consumptions – with higher granularity and also clarity with respect to the ones usually made available by the energy providers in their bills – and to empower the consumer awareness through an integrated view of his consumptions (i.e. water + gas + electricity) and fostering the propension to a regular check, being a step forward to similar apps which offer a lower details and are monothematics (e.g. presenting only one type of energy or resource consumption).

Furthermore, the app includes an Energy Signature of dwellings – based on an algorithm developed by Italian National Research Center (CNR) – which can be used with very limited qualitative data. This Energy Signature can be used as a pre-energy audit to highlight general problems therefore raising end users' awareness.

These customers' tasks are directed at dealing with current frustrations or the desire of something new to improve a sector or activity. Regarding the current frustrations, that would be the pains in figure 64, we could sum them in three aspects: energy efficiency, the climate change challenges and partial lack of knowledge and control over energy bills. There is a

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widespread concern about the global climate change, mainly due to the lack of information of the energy users of how the industry provides energy and how they consume it.
On the other hand, we have the gains, which are the customers' preferences and attitudes towards new activities and features. The consolidation and development of the electromobility industry is key for the customer, as it is a new and innovative sector that could enable the city to deal with its traffic congestion issues, while being eco-friendly and sustainable. This, along with increasing the efficiency of charging stations and availability of electric taxis, constitutes a boost for the electric vehicles industry that could substantially improve the customer quality of life. Another key gain for the customer are Public Service applications, in this case directed towards the management and treatment of data from energy consumption, in order to be able to give citizens an energy demand-side platform which is protected by the public administration.
On the left side of figure 64, we can see the product or service Canvas, which should be well-positioned in order to deal with the Gains, Pains and Jobs from the customer. As stated, Mathema's intervention consists of: the deployment of an app to manage the fast charging stations for electric vehicles taxi drivers, another app for families to track their own energy consumption and be able to improve it and the management, storage and treatment of all data derived from the apps. We divide the products features and characteristics in two, depending on whether they solve customers' current frustrations – the pain relievers – or it deals with the customer desire of something new – the gains creators.
After seeing the customer pains towards the product offered by Mathema, we can see that the intervention deals with most of them. The app destined to track and improve the energy consumption would empower the customer in terms of control over energy consumption and the costs associated, as well as giving them energy saving solutions through an interactive game. This type of games, called "Serious Games", engage users to improve their energy efficiency and consumption through a series of games, based on the data from the user. Furthermore, this app gives much more transparency to the energy provision through an innovative solution, that would be supported by the public administrations. This could deal with the lack of transparency in bills perceived by the customer, in addition to giving the customer a trustable service, as it is supported by the public administration and driven by the public interest and not business-related interests.
On the other hand, the gains creators are those features that deal with the customers' desire of new products and services. The implementation of the apps is possible thanks to the smart metering devices installed in the electric grid by the DSO although it can be used also by the users not equipped with smart meters by manual input of data. Mathema is therefore capable to extract data from the users' energy consumption, as well as from the EV charging stations, and use this data for several purposes, such as further research and development of the energy services or the use of advanced technology to extract valuable information about the users'

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energy consumption patterns. Therefore, with the availability of new and valuable data for R&D, Mathema can give valuable insights about the energy industry.
Furthermore, Mathema is a Florence-based company. The customers, as stated, have a feeling of mistrust against Private companies' applications, in this case mainly because of the sensitivity of the user's data. Thanks to a Public-Private collaboration, between the Municipality of Florence, the EU Commission and Mathema, a local based company, this mistrust is no longer a problem, as the apps are fully supported by public administrations.

8.7.3 Business model

The Business Model for Mathema's intervention is fully supported by the public administrations, in the REPLICATE pilot. Mathema usually works with public administrations and big institutions, that is why they have to ensure an economic feasibility from the project in order to be able to undertake it and also keep up with their competitors, by prioritising their own growth as a company. That is why the public administrations must ensure a well-adapted and defined public budget, capable of supporting Mathema's intervention as well as making it feasible economically and ensure the projects sustainability.
In figure 65 we can see Mathema's intervention Business Model Canvas. It is based on the Value Proposition that Mathema has developed, consisting on an app designed for energy saving depending on the users' energy consumption, and another one for electric Taxis' fast charging stations, to reduce waiting times in charging stations and improve their efficiency. The deployment of these two apps should help the city to reduce the overall carbon footprint, both for energy users' that have the app to track their energy consumption and for the increased use of electric vehicles (EVs). This electromobility sector boost can help deal with the traffic congestion in Florence, which is an important issue, and could also bring valuable data and information to address this issue in a better way, as well as for other issues.
As stated above, Mathema's key partnerships to undertake the REPLICATE pilot are public administrations. In this case, the Municipality of Florence, as well as other Florentine bodies, and the European Commission, act as an umbrella for the whole REPLICATE project. Then, partnerships with Energy companies, Taxi drivers' associations, electromobility providers and technology manufacturers are crucial for the correct development of the intervention. These partnerships are the ones that could bring important synergies to the project in terms of shared knowledge and the processes' optimization. These partnerships are directly associated with the key infrastructures and resources needed for the intervention. Mathema ought to access the electric grid infrastructure, managed by E-Distribuzione in this case, to use the installed Smart Metering devices to facilitate monitoring of the user's energy consumptions. So, it is important to create alliances with local distributors, as well as with ICT Technology providers, to ensure the correct functioning of the applications developed, as well as the public administration support, financially but also legally, as they are dealing with sensitive data that is protected by the EU GDPR (General Data Protection Regulation).

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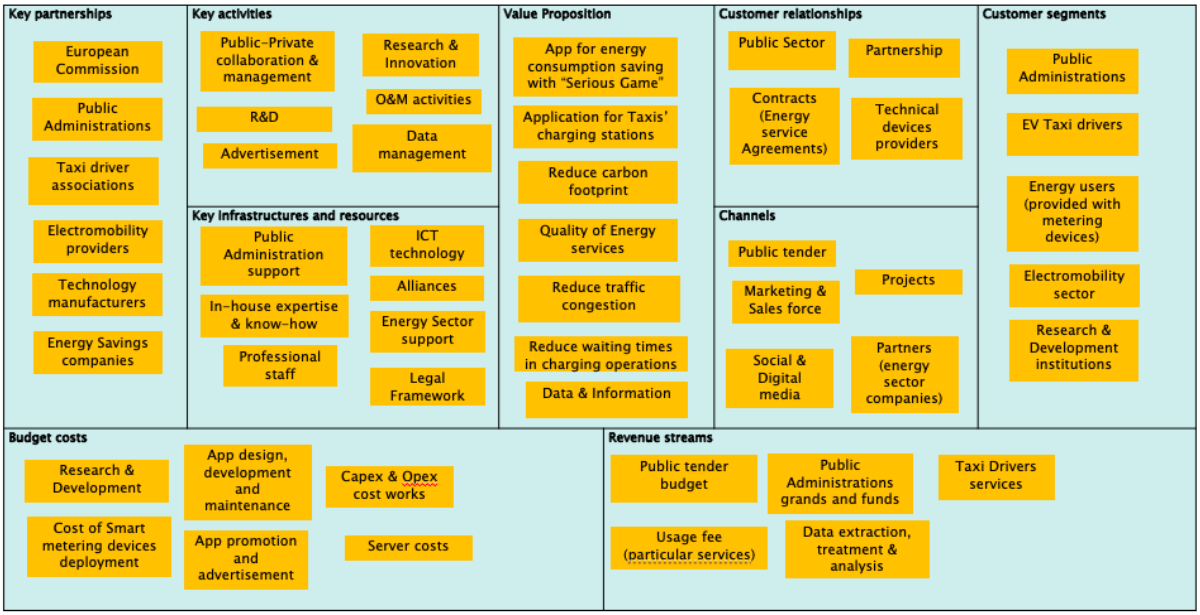

Figure 65.- Business Model Canvas of Mathema

However, the most important key resources and infrastructures reside in Mathema, as they have the concrete know-how and in-house expertise to develop the apps and extract valuable knowledge from data. Mathema's know-how and in-house expertise are the cornerstone of the accomplishment of the intervention's goal, for the success of the platform's development and the data flow management. In addition, the key activities for the intervention revolve around the research & development, thanks to the availability of new and informative data from users' energy consumption and the fast charging stations, besides the Public-Private collaboration needed for the intervention and the operative and maintenance activities needed for the platforms. Data extraction, treatment and analysis is crucial for the intervention as it shows how valuable and relevant this information could be. Mathema's intervention, in terms of data management or data science, has a great replicability potential in many other public services. Furthermore, advertisement of the apps is also important to inform of all the advantages and functionalities of the platform, as well as give confidence to users, advertising the app as a Public Service.

In terms of customer relationships, we should emphasize again the importance of the Public Sector as Mathema's main customer, as well as the technical services and products providers and the energy services companies, whose agreements and partnerships are essential for Mathema's intervention. Due to the particular character of these apps the Channels in which Mathema works consist mainly in public tenders, in order to get the needed funding and

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additional grants or funds, and partnerships with Energy industry distributors and providers. Besides, to get to communicate with the customer, other valuable channels are Marketing & Sales and Social & Digital media, which are useful to advertise their intervention and reach the desired customers.

Overall, Mathema's intervention is directed at the customer segments we have already mentioned: public administrations, so that they give Mathema's product as a Public Service; EV Taxi Drivers, with the fast charging stations platform; the energy users, provided with smart metering kits; the electromobility sector; and, last but not least, the Research and Development Institutions such as public universities, with whom Mathema has strong ties.

In terms of the financial feasibility, we should look at figure 65, at the balance between budget costs and revenue streams. The correct compensation of this two is crucial for Mathema's intervention, as it should be a profitable project for Mathema to grow and show its profitability. Budget costs consist mainly in the design and development of the demand platform and the fast charging stations management platform for the electric taxis and the maintenance of these apps, as well as the cost of the server to store huge amounts of data that will be useful for further research and development, and the cost of the further research itself to improve the existing technologies and get lots of valuable knowledge. The servers are essential for the correct functioning of the platforms and to ensure an optimum data flow.

There is also an important part of the Budget costs regarding the technical devices to make it possible, as we are talking about advanced technologies, in addition to the costs related to the capex & opex works involved and the continuous app promotion and advertisement.

These budget costs are only feasible if the public administration supports Mathema's intervention with a fulfilling public tender budget, or concedes Mathema complementary grants and funds through public institutions. This is crucial, both for the development of the intervention and for further partnerships, to establish a benchmark to ensure Mathema's survival and growth. In addition, if the app includes some particular and charged services, such as premium services for detailed analysis of consumption (for instance), it is also a valuable revenue source, as well as the revenues from the taxi drivers app, as Mathema is an important provider and partner for the electric taxi industry. These are Mathema's main revenue streams for the intervention; however, we could also highlight as another remarkable revenue stream the research extracted from new data, that could be very valuable information for any company involved in the sector or for further partnerships.

8.7.4 Strategy

In terms of competition, there are many applications, both national and international, developed by energy providers to measure consumption. In general, these applications focus on verticals of different types of energy and resources, such as electricity, gas, water, electrical appliances, home automation, etc. Regarding the e-taxi fleet and fast recharging

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infrastructure, there are also applications from companies, energy operators, Electric Mobility Providers and Charging Provider Operators with similar characteristics.

At a strategic level, we can highlight important aspects of differentiation in Mathema's business model. A key aspect is its customer-focused strategy. In this sense, Mathema develops both solutions attending, as we have indicated, to the needs of its customers, the Municipality, which offers a service of public value, both in aspects of public mobility and in aspects of energy efficiency for citizen. This strategy is key. Often, similar solutions from different providers are already built and are based on an adaptation, on a very specific ad-hoc strategy that is not usually generalizable or usable for other purposes. Furthermore, in addition to this strategy focused on the customer needs, Mathema's solutions in the REPLICATE pilot are easily replicable. For example, the structure on which the "serious game" has been built is generic. It is made with the aim of going beyond REPLICATE to host many more scenarios.

Mathema's differentiation strategy is clearly linked to the public good. Mathema's business vision is not based only on a direct exploitation of the solutions in the REPLICATE pilot, on the contrary, it is based on a clearly environmental objective, such as awareness, evangelization and empowerment of its customer on the issue. To this end, Mathema's philosophy focuses on collaboration and co-creation with the public administration itself to generate impact. Mathema works in B2B and its product is not for mass consumption. Therefore, its philosophy does not focus only on aspects of economic profitability. Furthermore, Mathema's goal is to become a reliable partner, as has been demonstrated in the REPLICATE project, of public institutions that work in the line of social and environmental awareness through this type of applications.

In addition, the applications developed by Mathema are characterized by their simplicity of use, learning through games, the transformation of environmental awareness and obviously, the reduction of the environmental impact, aspects that are clearly sought by the Municipality and the beneficiaries.

Finally, it is important to highlight the effort in research, development, and innovation of the state of the art and technology of Mathema. The company has very good specialists in the field. In addition, they constantly evaluate its solutions through experiments in its laboratory. At this aspect, the company is very strong. For Mathema, innovation through collaborations is key. For this reason, Mathema has a very strong line to lead and/or participate in many projects, both local, regional or European.

8.7.5 Final remarks

As we have highlighted, the solutions developed by Mathema are easily replicable. Furthermore, the solutions are based on a generic construction that can be easily replicated and can scale to different scenarios. To this end, Mathema's participation with public institutions is key to launch official applications.

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The collaboration with the Municipality of Florence has been a success and the Municipality itself represents a key prescribing channel for scale-up and replicate these types of solutions in other public institutions. At this point, it is important to remark that the city of Florence is considered by Mathema as a smart city. The Municipality is very open, advanced, and is committed to many smart initiatives. In this sense, the charging stations app needs a clear commitment from public institutions to be replicated.

Instead, the "Serious game" app., based on energy efficiency, can focus on other relationships, not just with the public administration, to scale or replicate. To this end, as Mathema argues, it would be interesting to obtain strategic agreements with companies that install meters to be able to directly record consumption. Mathema offers blockchain technology to generate security and traceability of data and offers confidence to energy companies if their clients can directly record consumption. These are two important aspects for a selling proposal to reach agreements with these companies.

Having said this, Mathema, as a local company, must consolidate itself with the public client and companies from the Florence environment, such as those that are dedicated to building management, through strategic agreements and generic/standard developments to monitor any device through interfaces, such as the city platforms.

Finally, Mathema's future is to reach strategic agreements with strong and consolidated companies that require its solutions, as would be the case with multinationals. By contrast, it is important to point out that not all these companies are committed to innovation as Mathema does. In this sense, it seems that public administrations could represent best partner to innovate. That said, Mathema should make a strong commitment in sales force to reach these strategic agreements and introduce its solutions to the market in a broader manner.

8.8 Thales

8.8.1 Company's presentation

Thales Italia is the Italian subsidiary of the Thales Group, a French multinational company. The Thales Group is dedicated mainly to the design and development of electrical systems and provides services to diverse markets, such as transportation, aerospace or security markets. They develop Information and Communication Technologies (ICT) solutions and services in various business sectors, including Security, Transportation and Critical Information Systems. As they claim, they serve five key sectors that we could sum up with: Aerospace, Space, Ground Transportation, Digital Identity & Security and Defence & Security[80]. They have a very strong

[80] Source: https://www.thalesgroup.com/en/global/about-us

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international presence, with undergoing operations in 68 countries and employing 80.000 employees worldwide, as well as being an acknowledged international Competence Centre for large-scale projects and products.
Thales has been present in Italy, with Thales Italia (Thales), since 1988 and has now 450 employees in Italy, besides the 2.800 employees that Thales Alenia Space has in the country. Thales' solutions include advanced ICT platforms and services to implement information & security control centres, on-board systems, mobile broadband communication, video management and analytics, IT systems administration, maintenance and outsourcing, and ICT security management. Thales mastering of large scale, great complexity systems of systems integration is recognized in international markets, and particularly in the sectors of airports, metros, tramways, railways stations, smart transportation, oil & gas and other critical infrastructures. The constant innovative and competitive efforts made internationally have allowed Thales to export many solutions from the group and be present in more than 20 countries with critical projects in several sectors[81]. Furthermore, Thales is the Thales Group's internally worldwide recognized Competence Centre for Tramway and smart urban solutions and product development and within this context it has gained strong experience in implementing turnkey business projects for its customers.
In the matter at hand, Thales is responsible for the REPLICATE project intervention concerning Cybersecurity in the Florence's pilot, based in the evaluation and diagnosis of the cybersecurity of the data registered by the Municipality of Florence. To this end, they have undergone several security tests, such as validation and penetration tests, to evaluate they security of the data and its flow, so that they know where to reinforce security and where are the most relevant risks, in the form of a Risk Analysis along with a Cost/Benefit Analysis. Thales philosophy is based in the focus on innovation, research and development. They cooperate with highly qualified Universities and Research Centres, and they have had a significant and successful participation to EU, national and regional calls for R&D funding. In the light of the above information, Thales represents a key partner for the REPLICATE project and its success.

8.8.2 Customers and value needs

Thales' intervention for the REPLICATE pilot in Florence is based on data cybersecurity evaluation, diagnosis and testing for the Municipality's infrastructure, as well as the provision of cybersecurity consultancy services and cybersecurity-related products. To this end, Thales' intervention is divided in four phases. The first one is aimed to give a full evaluation of the infrastructure cybersecurity. As Thales has not been involved in the infrastructure's set-up, it is needed a general and previous diagnosis and evaluation of the whole infrastructure in order to know its technical features and capability. Second, the compliance of the GDPR (General Data Protection Regulation) and ISO, which are crucial for the legal proceeding of the

[81] [REP Resum Firenze]

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infrastructure, such as the correct treatment of public data. Then, the third phase is based on a more exhaustive and expeditious analysis of the vulnerabilities and weaknesses of the infrastructure's security, by deploying a security testing analysis from a mass data collection. This analysis is divided in the vulnerabilities and weaknesses test, which is a simple test to evaluate the main flaws, and the penetration test, which is more invasive as it tries to penetrate the detected vulnerabilities. Finally, the fourth phase, which consists on a final remediation plan that, where Thales proposes all the solutions available for the improvement of the cybersecurity. This remediation plan is based on a risk analysis, along with a cost/benefit analysis. The risk analysis consists in classifying the detected vulnerabilities in terms of the associated risk they have, based on statistical analysis and the sensitivity of the vulnerability. Then, after ranking the weaknesses upon their risk, a cost/benefit analysis is done to decide which vulnerabilities will be fixed, depending on their risk and their cost (usually, vulnerabilities with a lower risk tend to be expensive to fix).

Thales' intervention is essential for the digital security of the REPLICATE pilot in Florence, as well as for the benchmarking to set standards for the future smart city cybersecurity. In figure 66 we can see Thales' intervention Value Proposition Canvas (VPC), that we can divide in two sides: the customers' side (circle on the right) and the product or service's side (square on the left). It will be useful to map and explain how the Thales' value proposition is well-defined and aligned with customers' needs, values and preferences.

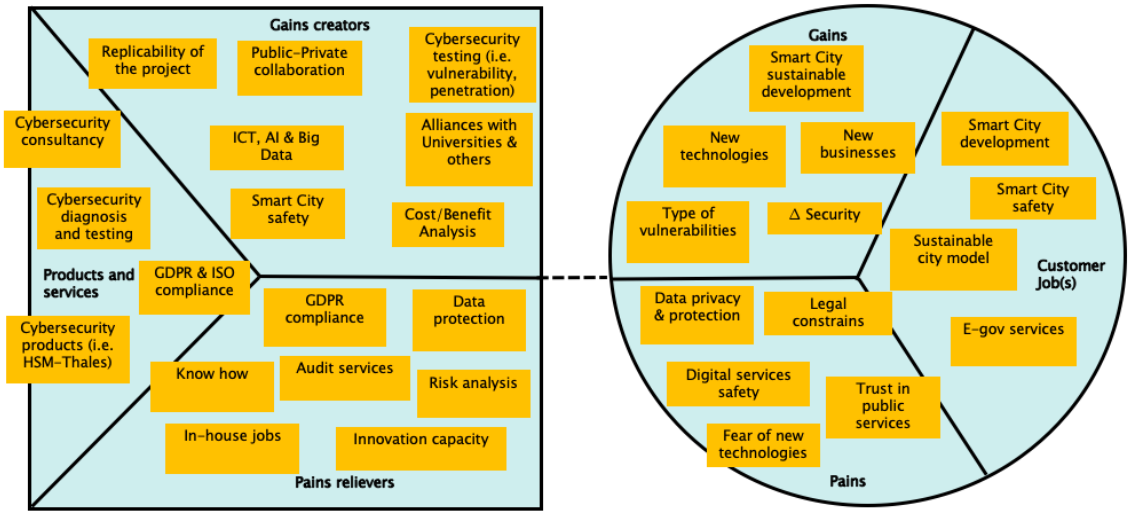

Figure 66.- Value Proposition Canvas of Thales

On the customers' side in figure 66 we can see the customers' pains, gains and jobs to do, that are related to Thales' intervention. In this case, customers' pains are the most relevant due to the sensitivity of the matter, as the Municipality of Florence is dealing with all the

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citizens data. Therefore, the Municipality has to ensure the public data privacy and protection, along with all the legal constrains around data exploitation, both in Italy and in the EU, as well as secure all the digital services involved. Such advanced technologies, like Big Data or Artificial Intelligence, are usually unknown for the average citizen and in many cases, they can cause fear or reluctance, that is why the customer needs to know that these 'new' services are secure and useful for the community. Furthermore, the low trust of the customer in the public services, compared for instance with the private sector, is another pain that has to be dealt with.

The customers' jobs, which are the tasks that customer wants to do in relation to the product or service proposed, mainly revolve around the development of the Smart city. The development of the smart city services in Florence will bring new opportunities and businesses to the city, with a high scalability potential, as well as help to tackle the current and upcoming climate change challenges. The sustainability of the city is one of the most important issues for the city, as they have shown with the recent smart city projects or REPLICATE itself. In addition, the development of the e-government services should be more aligned with the private services rapid development. That is also why customers struggle to deal with public-related paperwork, which lowers down their trust and good opinion about public services.

Customers' gains are directly related to the jobs they want to do, in terms of the smart city development, because of all the new technologies and businesses that it allows, as well as the sustainability it brings to the city model and the community. Furthermore, customers' security is crucial as we have already stated, but having a reliable partner and the public administration involvement is a plus for customers' sense of security.

On the product side in figure 66 we can see the opposite side of the VPC, which are all the features and characteristics of the Thales' value proposition, aimed at dealing with the customers' alignment with the intervention. As stated, Thales' intervention focuses on the cybersecurity diagnosis and testing of the infrastructure, the services related with cybersecurity consultancy and the products they offer cybersecurity-wise, as well as the compliance with the GDPR and ISO. As we have highlighted, customers' pains in this case are highly sensitive. Thales' intervention is well-defined in terms of data protection and privacy. As they have specialised in cybersecurity for large institutions and companies for many years, they have the required know-how and in-house expertise. This, along with a risk analysis of all the potential vulnerabilities of the infrastructure, the related audit services and ensuring the GDPR compliance, represent the main features of Thales' intervention to deal with the customers' current frustrations. On the other hand, the intervention's gains creators are those features that deal with customers' attitudes and preferences towards progress and innovation. The main gain creators are the advanced and innovative technologies applied for the cybersecurity testing, that revolve around ICT technologies, Artificial Intelligence and Big Data analysis. These are the technologies that enable the smart city safety management, as well as ensure the replicability of the project once it has to be applied to different sectors or markets.

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Along with the cybersecurity testing, a cost/benefit analysis is crucial for the service to deal with the important vulnerabilities in an efficient way. Finally, another important characteristic is the intervention's public-private nature, bringing Thales and the Municipality of Florence together.

8.8.3 Business model

The Business Model for Thales' intervention in the REPLICATE pilot in Florence is fully supported by the public administration, in this case by the EU Commission and the Municipality of Florence. Due to the interventions' low return on investment and its great impact on the community, the project has to be funded by public bodies, in order to ensure an economic feasibility that otherwise would be unsustainable for Thales in the long-term. What's more, public funds in pilot projects such as REPLICATE are essential as they will be the benchmarking and base for future projects, enabling these projects to be much more replicable from the already set standards and, therefore, much more affordable. Thales' experience through all their active years, both with large institutions and companies, proves their ability to be a reliable and strong partnership for Italian public administrations for the research and development of smart city services, such as cybersecurity services in this case.

In figure 67 we can see Thales' intervention Business Model Canvas (BMC). It is useful to plot the most important characteristics of the project, such as the key partners and activities of the intervention, as well as all the financial constraints and the value they give to customers and how. The Value Proposition of the Thales' BMC, as highlighted before, consists primarily on the deployment of cybersecurity diagnosis & testing of the Municipality's infrastructure that treats and exploits the citizens' data. Thales also provides cybersecurity products, such as the HSM-Thales, and cybersecurity consultancy services, that are useful for the cost/benefit analysis when deciding the infrastructure vulnerabilities that should be fixed. In addition, Thales' value proposition is also aimed at dealing with all the legal constraints of the intervention, such as the General Data Protection Regulation in the EU or the quality standard stablished by ISO, to ensure the Public data protection and privacy, as well as the smart city security. The value proposition also aims at creating a new cybersecurity paradigm, to point at the need of being more aware of the dangers of digital services while creating a sustainable and secure cybersecurity culture.

For Thales' intervention, as highlighted, the key partnerships are the European Commission and public administrations, mainly on the funding for the project. Then, other alliances such as those with other innovative SMEs from Italy, public Universities and key customers and companies from the sector are crucial for the correct development of the intervention, as well as for the correct deployment, as Thales' is dealing with components and features developed by other private companies. Considering the key activities of the value proposition, we could highlight: the already mentioned cybersecurity testing and diagnosis, with vulnerability & penetration tests, and cybersecurity consultancy services; and the cost/benefit analysis

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associated with the risk analysis from the previous diagnosis, which is essential to deal with the most important vulnerabilities of the system in an efficient way.

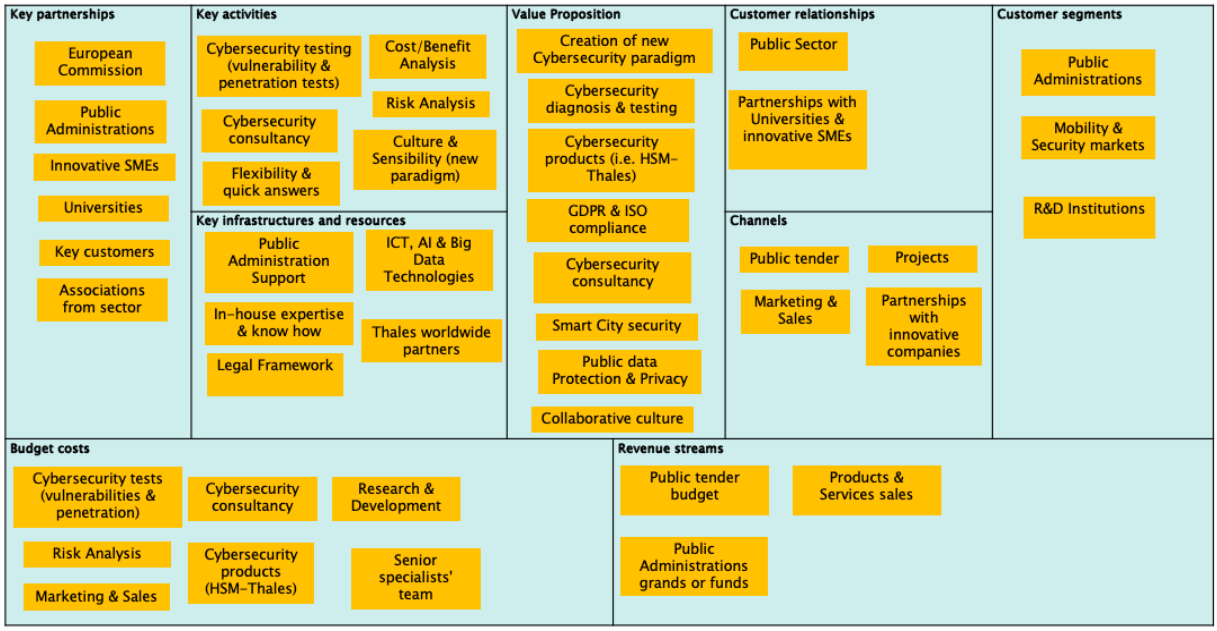

Figure 67.- Business Model Canvas of Thales

Along with the key activities of the intervention, the public administration support is a must for the project to ensure Thales' access to key public infrastructures, such as ICT of the city. Other key resources are Artificial intelligence and Big Data technologies, deployed by Thales to ensure an advanced analysis and gathering of information. This is thanks to Thales' in-house expertise and know-how, nurtured throughout all their years of experience, and represents one of the main strengths of the company, along with the worldwide partners they have thanks to the Thales Group. Furthermore, as mentioned before, the legal framework is also a key resource of the value proposition, as there are many legal constrains when dealing with public data.

In this intervention, the most important customer relationships needed are the public administrations and partnerships with other innovative SMEs, Universities and other research & development centres. They represent both the key partnerships and customers for Thales' intervention. Having said this, the customer segments that the intervention is directed at are the public administrations and citizens of the city, as well as the agents from Mobility & Security markets, that want to replicate the same processes or just help stablish the present one. R&D institutions are also a potential customer segment, as the information extracted by Thales in the setup of the intervention is highly valuable. The channels that Thales uses to

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deploy their value proposition are mainly based on the Public tender provisioned by the public administrations for the project, besides the Thales Marketing & Sales efforts and their partnerships with other innovative companies.

Finally, in the bottom part of figure 67, we can see the financial side of the intervention BMC. This balance between the Budget costs and the Revenue streams must ensure the financial viability of the intervention for Thales. On the budget costs, the costs revolving around the core of Thales' value proposition are the most substantial, as they represent the costs of the Cybersecurity tests, consultancy services, and all the analysis involved. For these activities, the most important asset that Thales provides are the senior specialists teams and experts. Thales, besides having senior engineers' teams and specialist, has a lot of partnerships with other research institutions, such as Universities, with whom they share knowledge and participate together in many projects and in the research and development of new features and technologies. Along with these costs, the marketing & sales efforts are also an important part of the budget costs, as they represent the main tool for Thales to advertise and sell their services, as well as their cybersecurity products. On the other side we have the revenue streams. As we have stressed out throughout the article, the Public tender budget is essential for the intervention's viability and success and, above all, in a pilot project that will be the baseline reference for future developments that can be highly scalable. Besides the public tender budget, other additional public administrations grants or funds, which are mostly complementary to the public tender budget, and revenue from other products and services sales are also important revenue streams for Thales' intervention.

8.8.4 Strategy

Thales' strategic positioning in Cybersecurity services with respect to the smart city market segment obeys a new paradigm, based mainly on collaboration between stakeholders in the value chain and the creation of networks. Based on the analysis of Thales' vision and business model, the company guides its smart city services towards a Data-based delivery networks model.

As shown in figure 68, authors have placed several items to compare different theoretical business models regarding data. This is an exercise based on the interview with Thales and secondary sources from each business model.

As observed, the business models reflect the strategy positioning of a company according to each model. The items have a score of 1 to 5, where 1 means less weight compared to other business models (disadvantage) and 5 greater weight compared to them (greater advantage) when facing the market.

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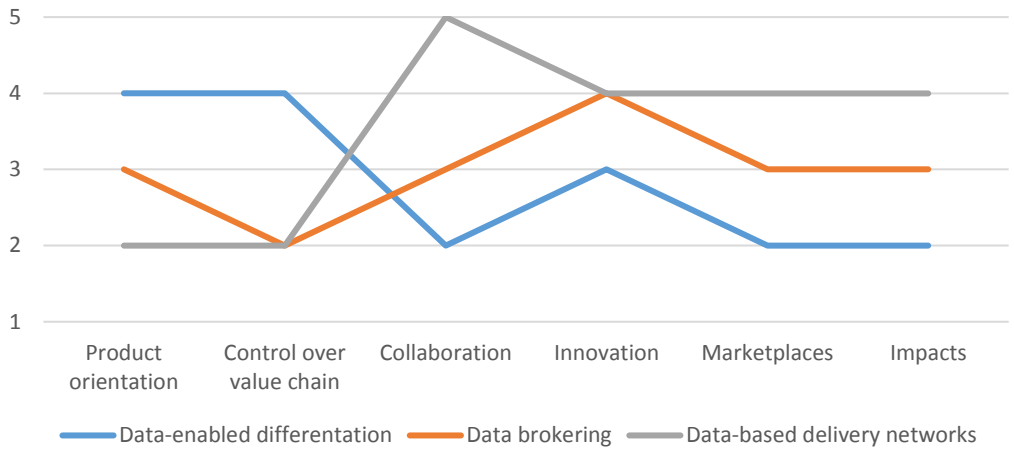

Figure 68.- Strategy Canvas of Thales

The figure presents three categories of business models. The Data-enabled differentiation focuses its value on the product and the service. It uses the data to improve the product and the service to its customers and to position itself against the competition. Its business opportunity is in the product or service itself - in its improvement. Data brokering focuses its value on the exchange of data to deliver value to its customers. It is a model of greater collaboration, where stakeholders tend to buy and sell data among themselves to offer their value proposition that, by themselves, they could not. Finally, Data-based delivery networks focuses its value on sharing data as well but seeking mutual benefit to improve the value chain or networks and enhance markets. All stakeholders participate in an ecosystem where the benefit is mutual.

Thales' strategic vision focuses on collaboration, innovation, creation of marketplaces and impacts, aspects that clearly obey the third model. Obviously, Thales solutions also focus on the first and second models to sell directly to the customer, but its strategic vision on smart city solutions regarding data goes further.

Collaboration is essential in several ways. On the one hand, Thales identifies that without aggregation of adjacent segments in smart city, the market is not attractive for large companies. The key is to seek synergies and complementarities between actors. On the other hand, Thales bases its business on innovation, through collaboration in multiple innovation projects with different partners. From its point of view, in addition to promoting public-private collaborations to deliver public value, Thales considers that a new culture of collaboration must be created where users, both the public administration and citizens, participate in the evolution of services to improve the accessibility and sustainability of models. In addition, Thales considers that those impacts and benefits generated by smart initiatives should be

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monetized, undoubtedly those impacts on environmental and social aspects that are key to offer public value.

Obviously, Thales seeks a go to market with its cybersecurity solutions for the public customer, through the first and second models, but it perfectly recognizes that the production, delivery and creation of value, as well as the creation of new market niches, are based on collaboration and mutual benefit, where solutions share risks and benefits for all stakeholders. From this point of view, the value of the business model is not only found in data to improve solutions, but also in collaboration and exchange to make the market grow.

8.8.5 Final remarks

Considering the third model – Data-based delivery networks –, one of the most important aspects for scale-up and replication of Thales intervention is public funding. Right now, returns from smart city projects without public funding are very low and therefore not very attractive as an investment market. To develop this market, it is important to work on a standardization of services. If there is no common ground between city specifications, projects often start from cero and are not viable.

To this regard, another important barrier is that every country has decided to adopt different digital transformation and digital approaches – for instance, the so-called e-government services –. This aspect impacts on many procedures and processes of public administration and operators of public services (mobility, utilities, …), forcing them to activate programs to comply with it. At this point, should be interesting to foster European guidelines to be adopted by all countries to standardize approaches, facilitate reuse of solutions/platforms, procurement procedures, etc. as well as new regulations to extract value from new technologies and data related (for instance the FFNPD).

The public administration represent a great stakeholder to enhance the market. Its overall market dimension is estimated in EUR billions just in Italy and there is a huge potential to replicate solutions. On the contrary, programs often delayed; there is an uncertainty in budget availability; a difficulty to set up a cooperation approach due to legal constrains; and a lack of common reference models and approaches which entails a wide fragmentation of the ecosystem.

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8.9 Telecom Italia

8.9.1 Company's presentation

Telecom Italia (TIM) is the largest Italian telecommunications operator, with over 45,000 employees in Italy and more than 9,800 employees in Brazil, which is their main market presence abroad. TIM was founded in 1994, as a result of the merge of all the telecommunications companies that were state-owned. Therefore, the company has ever since been closely supervised and managed by the Italian government in the case there were strategic public interests at stake, although being owned by private companies. In 2015, TIM undertook a rebranding process to put all their services and products under the TIM brand. TIM has an extended international background, with owned companies all over South America (Peru, Bolivia, Venezuela, etc). However, due to financial problems, nowadays their main and only international company is TIM Brazil, with headquarters in Rio de Janeiro. As the largest Italian telecommunications company, they provide mobile, fixed telephone and internet services throughout the country, with an extended 4G network that covers 96% of the country. Their role in the REPLICATE project consists on the implementation of the smart city ICT platform to manage the Florence pilot, providing an end to end systems integration with a cloud platform for data storage, as well as the integration of the networks, related to networking sensors and capillary networks within the pilot. TIM is a known key European partner in terms of strategic ICT, being involved in the European Union Framework Programmes since it was stablished, and having participated in diverse EU-funded projects for research and development, such as ESPRIT in the late '90 and in many projects for EU's H2020 besides REPLICATE, such as the set-up and integration of 5G networks[82]. Their vision is driven by technological innovation and a commitment to service excellence, as well as a devoted duty towards sustainability and eco-efficiency, with initiatives such as TIM Green[83].

Although the technologies of the intervention represent a completely new service for TIM as they specialise mainly in telecommunications, their ability and resources to innovate are key for the development of the project. They have several labs in the most important Italian cities, called Open Labs[84], that employ Open Innovation methodologies for research and development and, what is most important, for real-life testing of all the newly developed

[82] Source: https://cordis.europa.eu/project/id/856709

[83] Source: https://www.gruppotim.it/en/sustainability/strategy/sustainable-future/sustainable-products-services.html#tab1

[84] Source: https://www.gruppotim.it/en/innovation/open-innovation/tim-open-labs.html

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devices and technologies. Furthermore, these Open Labs are centres to collaborate with universities, research centres and other innovative companies.

8.9.2 Customers and value needs

The intervention deployed by TIM in Florence is based mainly on the end to end integration of all the systems, both the network and all the ICT platforms, into a unique smart city platform that allows to centralize all the data in a cloud platform as well as manage the smart city itself. This value proposition, on one side, is aimed at dealing with all the technical issues rising from the heterogeneity of the previous systems, that made difficult the centralisation of the data collection, the implementation of new technologies such as ICT or Internet of Things (IoT) technologies, or the replicability of the processes, for instance. On the other side, regarding the final user preferences and needs, the value proposition is aimed at developing the smart city services, to boost the growth of associated activities, and protecting the customer in terms of data privacy and protection, as well as using this data for research and development purposes.

In figure 69, we can see TIM's Value Proposition Canvas (VPC). The VPC is a useful tool to show how the product or service delivered by TIM (left side of figure 69) copes with the concerns and needs of the customer (right side of figure 69).

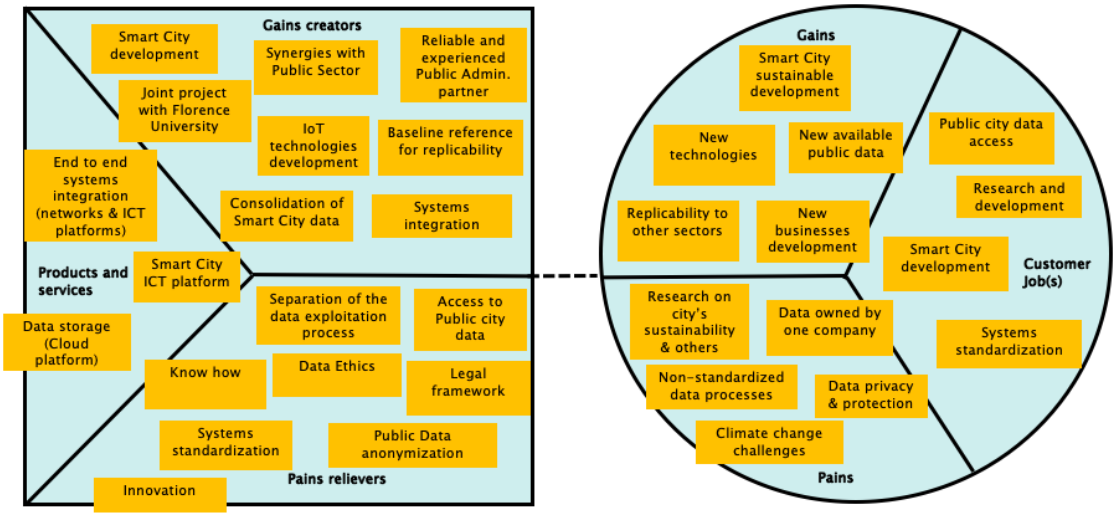

Figure 69.- Value Proposition Canvas of TIM

On the customers' side (right side) of figure 69, we can see that it is divided in three parts: customers' jobs, the tasks that customers want to perform in relation to the product/service delivered, in functional, social or emotional terms; the gains, customers' preferences related to new and innovative things; and the pains, customers' likings and attitudes related to the

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current frustrations. These are related with the product side of figure 69, that form TIM's value proposition, which is respectively divided in the products and services provided, the pain relievers, that are directed at dealing with the customers' current frustrations, and the gain creators, conceived as the factors that offer something new.

On the customers' side, the pains are focused on the data treatment and ownership, the current and upcoming climate change challenges and the standardization of processes. Data protection and privacy is essential for the user, as all the new and innovative technologies related to the user's data must operate under the legal framework, guaranteeing the privacy and anonymisation. In this sense, one of the fears of customers is related to the ownership of the data by one only company. This would mean giving all data's value to only one company, that would have too much power from the point of view of customers, that feel more confident if the value chain is divided in several companies. Regarding the climate change challenges, one of the customers' current frustrations is the sustainability of the city, and so the research and development associated with the city's plan to tackle the environmental challenges. If we focus on the gains of customers, we will see that they revolve around the development and implementation of new businesses and services related to smart city technologies, that could boost many sectors performances due to their universal replicability, and the availability of new and valuable data. This new public data is incredibly useful for the customer to get more insights from the city's sustainability, performance and evolution throughout the time. Finally, customers' tasks, similarly to the gains and pains, are based on the public city data access, for R&D purposes or others, the smart city development and the systems standardization, to enable the access to many more agents while cheapening the processes' costs.

On the other side of figure 69, the product or service side, we see the products and services developed and deployed by TIM and their gains creators and pain relievers directed at dealing with customers' values and needs. As we have already highlighted, the products and services provided by TIM are based on the end to end systems integration of the network and the ICT, with a smart city ICT platform and a cloud platform for data centralisation and storage.

If we focus on the pain relievers, we can see that they fully cover customers' pains. TIM is only responsible for the integration and centralisation of the data, guaranteeing the separation of the data exploitation process as well as the public access from all the agents interested. Regarding data privacy and protection, TIM has defined the project to be data ethical, by anonymizing all the customers' data and fulfilling all the legal constrains, as well as high quality standards. Furthermore, the standardization of the processes is also essential, as TIM will allow with their intervention the replicability and scalability of many more processes and services of the city. Besides, their known reputation as an innovative company is a source of trust for customers' confidence. On the other hand, the gain creators, aimed at offering new features desired by customers, are based on the smart city development with the integration of the city's systems, and the Public-Private nature of the intervention, as TIM will be working along the University of Florence. This intervention will be incredibly useful for the future

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replicability of other services and products as baseline reference, and the consolidation of the smart city data is needed for the development of associated businesses or technologies, as well as the availability of centralised public data. The systems integration will allow all this, besides the IoT technologies development for further improvement. Furthermore, TIM has shown to be a reliable and experienced public administrations partner along their history. Working together with the University of Florence, they are able to share valuable knowledge to create synergies that are extremely valuable for the implementation of such advanced and innovative technologies.

8.9.3 Business model

The business model for the intervention is based on the needed public funds, included in a public tender budget, as well as on the coordination between TIM and the public bodies involved, such as the University of Florence and the Municipality of the city. The financial sustainability of the intervention must be ensured by public funds, as the ROI (Return On Investment) of the intervention would not be feasible otherwise. In figure 70 we can see the Business Model Canvas (BMC) for the TIM's intervention in the Florence pilot, where we can see a map of all the stakeholders and agents involved, the critical and key factors for the intervention success and the financial needs and revenue streams.

TIM's value proposition consists on the end to end systems integration of all the networks and the city's ICT platforms, to create a unique ICT platform along with a centralised data storage. The main goals are the smart city data consolidation, centralising all data in a unique and accessible repository and the systems standardization, as well as the access to all public data for research purposes.

As we have mentioned, the key partnerships for TIM are: the European Commission, the public administrations in Italy, such as the Municipality of Florence, the University of Florence and all the technical devices providers & manufactures and the utilities sector companies. The intervention affects many agents due to its impact, as it integrates many processes of different fields (e.g., energy providers, ICT and network technologies). These partnerships are also crucial for the key activities, resources and infrastructures needed for the intervention. The key activities consist mainly in the coordination and co-management of the project with the University of Florence, besides the data exploitation processes. As the TIM's know-how and in-house expertise combined with the University specialists on the matter is crucial for the correct technical development of the project. These synergies with the University's R&D is essential when dealing with such advance technologies, and it helps to set a baseline reference for the replicability of the project. Regarding data exploitation, the key activities are the centralisation and integration of all data in a single cloud platform, with anonymized data for customers' protection and privacy.

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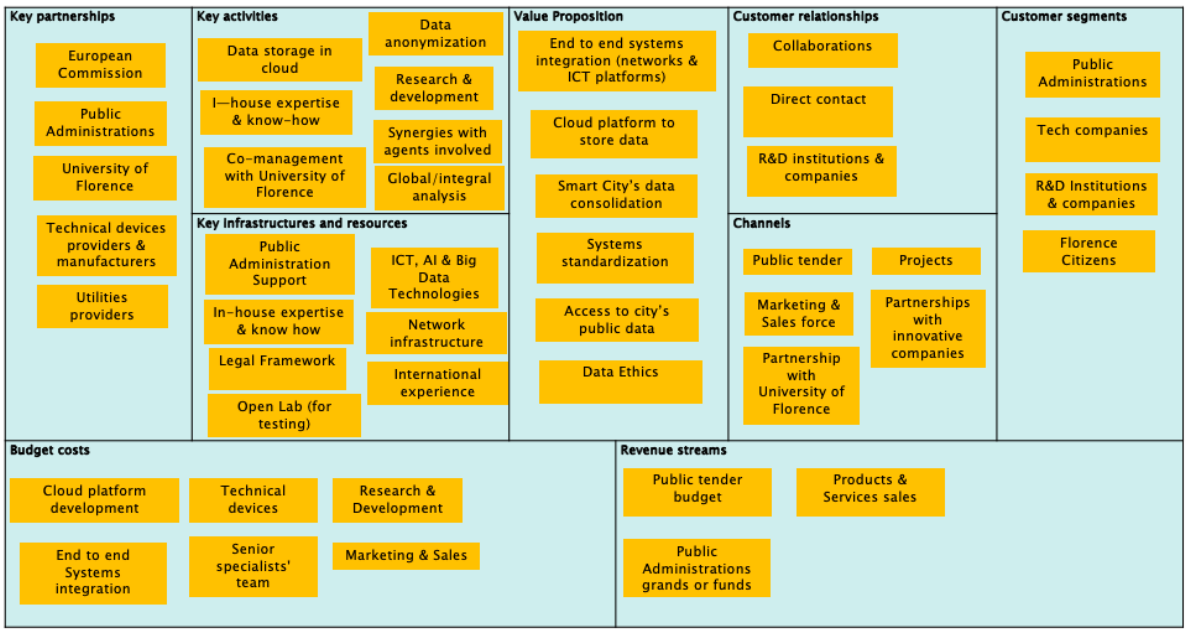

Figure 70.- Business Model Canvas of TIM

In terms of the key infrastructures, the public administrations support is crucial for TIM to intervene in the needed public infrastructures, such as the network infrastructure or public ICT, for the implementation of the new ICT platform. For the data treatment, artificial intelligence and big data are the main technologies used to both extract data and make informative analysis, as well as make useful and accessible data repositories visualizations; and regarding data protection & privacy, the EU's legal framework in terms of GDPR are fulfilled. And the last, but not least, key infrastructure is the TIM Open Lab for research and development testing, that is useful for pilot tests in real life situations. In addition, their international experience and background is another important resource for the project's success.

The intervention is directed at the customer segments formed by public administrations, all the tech companies whose products or services are related to ICT or IoT technologies, the R&D institutions and companies that could benefit from all the new available data and, finally, the Florence citizens, as their city has a centralised data repository and is able to make decisions that are data-driven, as well as to improve the city's sustainability. The customer relationships needed are all the collaborations with the companies involved that we have already mentioned, as well as the R&D institutions and companies involved, in addition to direct contact with the final user, to improve the functionalities or features needed.

The channels, which are TIM's channels used to deploy the intervention, are mainly based on the public tender, as it is financially crucial for the intervention success. Furthermore, the

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already mentioned partnerships with the Universities involved and technological companies, as well as TIM's in-house projects and their marketing and sales force, needed for the product promotion and acknowledgement.
Finally, in the bottom part of figure 70 we can see the financial side of the intervention: the budget costs and the revenue streams. As we have highlighted, for the success of the intervention is essential the public tender budget (in form of revenue stream), in addition to other grants or funds, as the ROI of the investment is too low for TIM to assume. The associated products and services sales are also an important revenue stream. In terms of costs, the end to end systems integration and the cloud platform development are the most important costs, along with all the technical devices, R&D and senior specialists' team required for the correct technical development of the project. Finally, in the last stage of the intervention, the marketing and sales force are also an important cost to consider for the product promotion.

8.9.4 Strategy

The IoT services that are the object of TIM's intervention in the REPLICATE project are new services for the company. In this sense, the company does not have experience in the exploitation of these services, which imply a new line of business different from the classic services it offers as a telecommunications operator, where it is very well positioned.
On the contrary, TIM has always given a fundamental role to innovation, specifically to technological innovation from a collaborative point of view to get holistic solutions- between agents and types of knowledge: knowledge of its ICT as a company and knowledge of utility-type of services of the Administration - which is reflected in the project itself. The reason is that in the world of IoT there are many actors that are part of the same solutions or even the same ecosystem. For this reason, TIM tries to avoid using the IoT for a specific reality and create ad hoc services for each sector. Its objective is to create standards that serve multiple actors and that are complementary to avoid a parceling of the market.
This vision follows a key strategic position for TIM, in which technology should not be an end, but rather a means to achieve greater ends. In this sense, there must be an awareness of public customers to avoid filling cities with sensors. The important thing is not the sensor itself, but the management and outcomes of the solutions. To manage correctly, it is important to rethink cities from urban planning and decentralize them to protect citizens and the environment.
To this regard, the public administration itself must look for those intangibles that offer public value and transfer them to its supply and contracting requirements of the private company. The key is that in the smart city environment there is a social and environmental role that goes beyond the classic profitability returns set by low paybacks to return investments. The public administration must consider intangibles such as quality of life, crime, pollution, etc. which are fundamental to the business model.

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To this end, TIM considers that REPLICATE-type projects are medium and long-term investments that should not generate short-term returns. They are strategic projects that allow them and cities to test, innovate, and construct prototypes for pre-commercial phases.

8.9.5 Final remarks

TIM's strategic vision on smart city IoT solutions for public administration has a very important collaborative component to help cities that are willing to develop smart ecosystems, such as Florence. Furthermore, ICT solutions have a very great replication potential. ICTs are based on standards that go beyond borders, such as the technological platform, which, beyond specific adaptations to the environment, is based on standard technology.
On the contrary, although there is the dynamic of carrying out many actions of smart nature, the problem is that there is no money to consolidate these actions and take them to the market if there is no external contribution from organizations such as the EU. The point is that the cost that municipalities must bear are not linearly proportional to their size. There is a fixed part of technological development that is independent of the characteristics of the city. In this sense, it would be interesting to seek economies of scale between cities in the same region so that investment and solutions can be consolidated.
This is a key factor. Public financing and investment in these solutions, as well as common pattern regulations, is necessary to develop, test, implement and consolidate them. The smart vision does not focus on the technology itself, but on public-private collaboration between agents, where some - such as TIM - have the knowledge of IoT, while others - the public administration - have the knowledge of the cities. Therefore, the smart key to delivering public value towards sustainable business models is focused on collaborating and building solutions together.
Therefore, scale-up and replication strategies, based on the consolidation of interventions, need public funding so that the public administration itself can develop these services hand in hand with the private sector, and maintain them over time. Furthermore, this would serve to enhance a comprehensive vision of IoT solutions with public value and prevent operators from developing sector-biased solutions.

8.10 UNIFI

8.10.1 Company's presentation

The University of Florence (UNIFI, short for *Università degli Studi di Firenze*) is one of the most prestigious Italian public universities, as well as an historical institution in the academic field,

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with a solid background of national and international collaborations with major research centres and companies. They work along together with the National Research Council (*Consiglio Nazionale delle Richerce*) – the largest public research institution in Italy – and have been a reliable partner for the Technology Research and Development Framework of the European Union. Scientific research and Applied research are the main focus of the university, supported with external funding from public institutions, such as the Ministry of Education or the European Commission, or private sector companies that partner with the university for joint research projects.

UNIFI is the responsible for the set-up and integration of the Smart City control room, providing an infrastructure for cloud and distributed computing, for all the city's data integration and centralization in one only platform: the smart city's control room as a service platoform. In figure 71, we can see UNIFI's smart city control room dashboard.

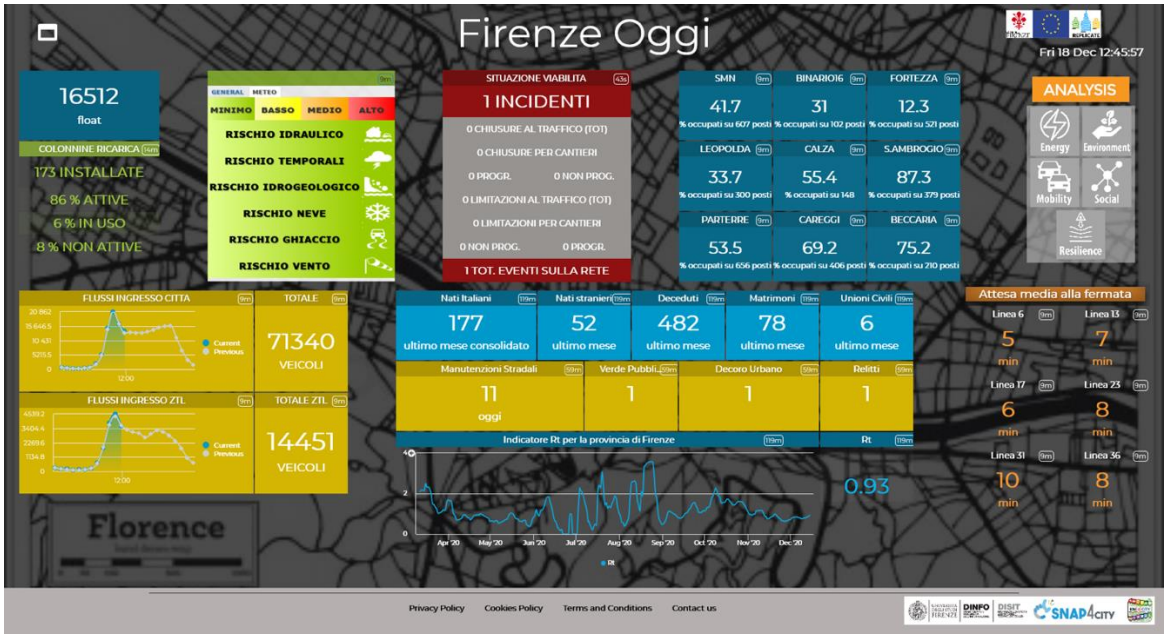

Figure 71.– Smart City Control Room Dashboard

More specifically, UNIFI takes part in REPLICATE's pilot with two different departments: DINFO (Department of Information Engineering), responsible for the cloud and distributed computing infrastructure; and DIEF (Department of Industrial Engineering), in charge of the energy systems involved in the intervention. All the data gathering procedures have been deployed by UNIFI DISIT Lab (Distributed Systems and Internet Technologies Lab) by using ETL modules and tools. An important part of UNIFI's intervention is the collaboration with the agents involved in the intervention, as they have to integrate several services/processes provided by

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other companies and institutions from the REPLICATE project, such as data and cloud providers like Telecom Italia, energy providers like E-Distribuzione, or the Comune di Firenze and its services managers. In figure 72, we can see all the integrated services' resilience dashboard, used to evaluate all the assets risks and dependencies.

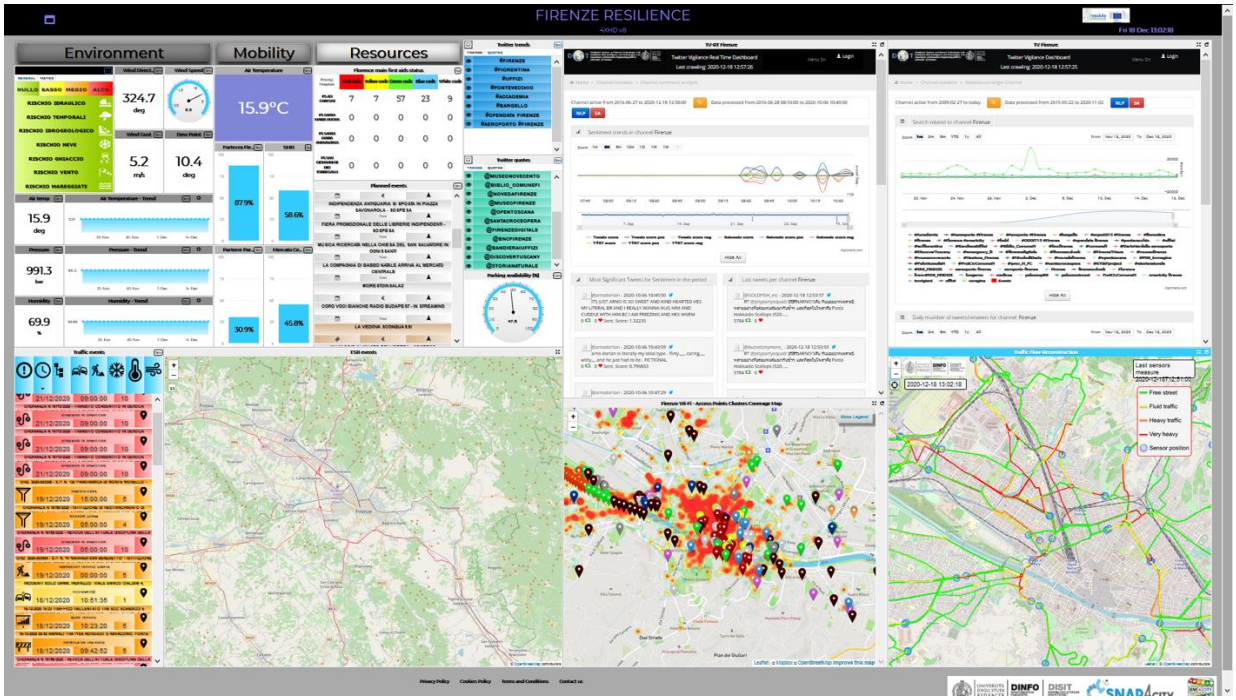

Figure 72.- Smart City Resilience Dashboard

The university is primarily in charge of the development of the cloud platform, which is developed with open-source components for Internet of Things (IoT) technologies. This is why the project will be a baseline reference for the replicability of the intervention to other cities, sharing public knowledge and developing all the needed software in open-source.
Public administrations play a key role in the intervention success, as they must ensure the financial sustainability of the project, as well as the technology and knowledge transfer to other institutions and research centres. However, this investment represents a key resource for the Municipality of Florence to reach their environmental and sustainability goals.

8.10.2 Customers and value needs

UNIFI's intervention in Florence has a great impact on the community and its citizens. To show how UNIFI's intervention is defined and positioned around the customer's preferences, attitudes, and values, we can see in figure 73 the intervention's Value Proposition Canvas (VPC). On the right side in figure 73, we can see the customer's profile in terms of the customer

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jobs, the tasks that the customer wants to perform economically, socially or just for functional reasons; and the gains and pains of the customer, which are the customer's preferences, attitudes and values towards current frustrations (pains) and new features or services (gains). On the left side, we can see the company's profile, in terms of the products & services they develop and offer to the customer, and the gains creators and pain relievers, the features of the value proposition aimed at dealing with the customer's current frustrations or desires for new products or services.

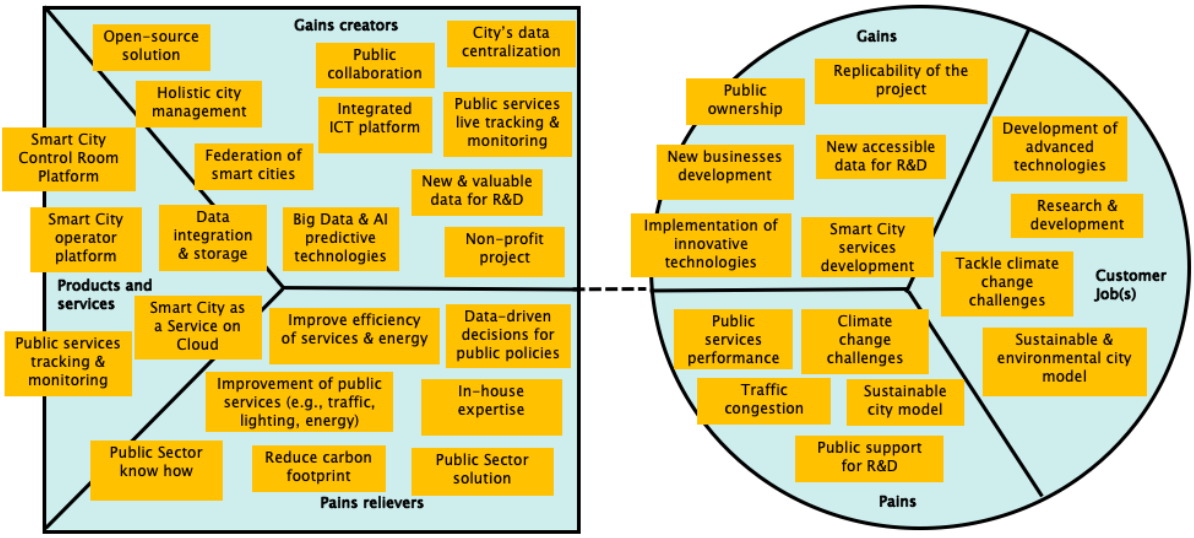

Figure 73.- Value Proposition Canvas of UNIFI

On the customer side in figure 73, the customer's jobs revolve around the city's sustainability in environmental terms and the development of innovative solutions for the community development. The rising awareness on climate change issues is crucial for the customer, as it represents the main environmental thread, that can be tackled by transforming the city's model (e.g., mobility services or energy consumption). To this end, research and development in all fields related with the smart city is another task that the customer wants to perform for the development of advanced technologies, both for the improvement of public utilities and to tackle the current and upcoming climate change challenges.

That is why the main customer pains are the already mentioned climate change challenges, the city's model sustainability and the poor or suboptimal performance of the public services, as well as the desire for more public support for research and development. Furthermore, traffic congestion is a real issue in Florence that directly affects the customer's life quality. On the other hand, the customer's gains, the intervention represents a huge improvement for the smart city services development, that for the customer is translated in new businesses opportunities, due to the implementation of new and innovative technologies, access to new

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and valuable data of the city for research and development in diverse fields (e.g., social, economic or environmental issues). Moreover, the open-source based solution and its public ownership guarantees the replicability of the project to adjacent services or to other cities and regions of the country.

On the other side of figure 73, the company's side, we can see the intervention features and characteristics. UNIFI's value proposition is based on the set-up and integration of the smart city control room platform, with cloud and distributed computing, to provide the city with a unified tool for the public services tracking & monitoring. To do so, an essential part of the intervention consists of all the data gathering procedures developed by UNIFI for the platform's data integration and storage, which are centralised in the smart city as a service on cloud. To deal with the customer's pains, the intervention enables the public sector to improve widely all public services, such as traffic or lighting, with the access and analysis of the smart city's data, through the developed and integrated smart city operator platform.

The Municipality of Florence, thanks to the cloud platform, is able to make data-driven decisions for public policies with specific goals, such as the improvement of the efficiency of services and energy and the reduction of the city's carbon footprint. Furthermore, another important pain reliever of the interventions is the public nature of the project, as UNIFI represents a trustable and prestigious agent in the city of Florence. On the other hand, the value proposition gain creators, we have all the intervention features that offer new and innovative things to the customer. The intervention brings many improvements for the city's development with the new integrated ICT platform: access to new and valuable data for R&D, the city's holistic management; the public services life tracking and monitoring for improved and fast responses; and the implementation of Big Data and AI technologies to make predictions. Furthermore, the university works as a non-profit organisation, guaranteeing the customer their involvement in the community development, and their intervention represents a baseline reference for further replicability. The replicability of this intervention is crucial as it could be implemented in other cities, escalating the already set-up services and creating synergies with other cities in a new paradigm of federation of smart cities.

8.10.3 Business model

The business model for UNIFI's intervention is supported by public funds to ensure its financial sustainability, in this case from the allocated REPLICATE grand from the EU Commission. The university works as a non-profit organisation along with the public administrations and all the private companies involved, which ensures the project public nature and its commitment with the community development, as well as lowers down the costs of the project itself and guarantees the public ownership of the research and development and the public technology transfer. It should be highlighted that UNIFI's research activities are also supported by private companies, in the so-called "third mission" of the university, aimed at creating associations and partnerships with innovative companies, start-ups or industry key players, for knowledge

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transfer and research purposes. Despite the great social, economic and environmental impact that the intervention has on the city, the business model for UNIFI's intervention is in the form of a Business Model Canvas (BMC), as the university competes with other technological an R&D companies, with the same competitive conditions and legal framework. Nevertheless, we should highlight that UNIFI, as a public education and research institution, is able to offer better rates and costs due to their commitment with education, research, and development. In figure 74 we can see UNIFI's intervention BMC.

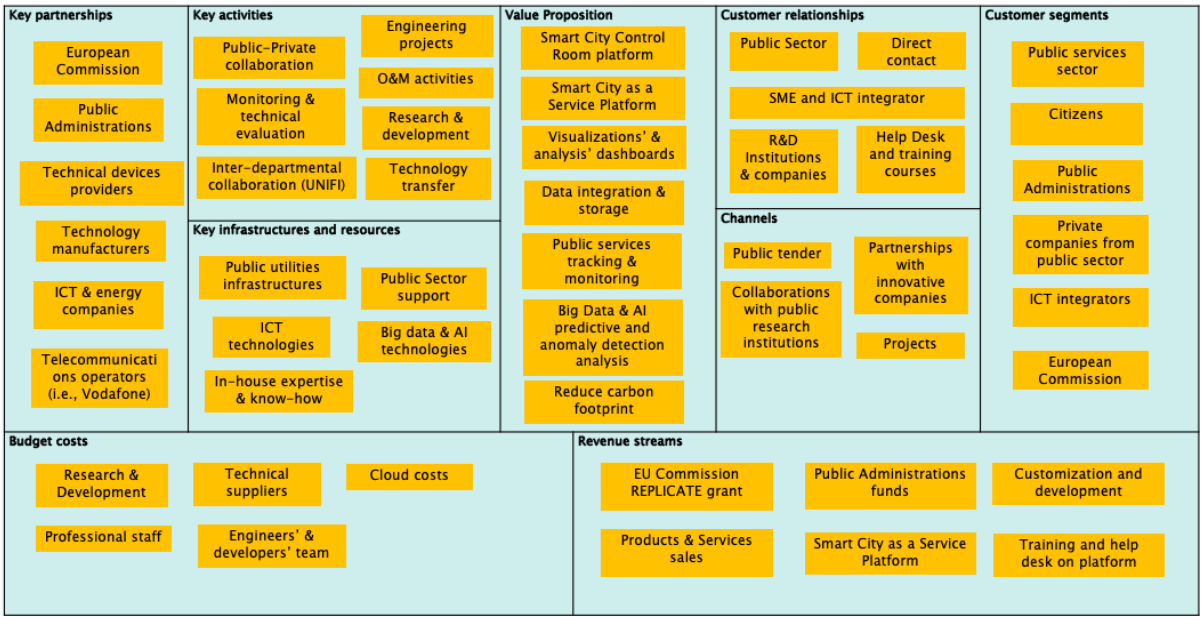

Figure 74.- Business Model Canvas of UNIFI

As we have stated above, the value proposition of UNIFI is based on the smart city control room platform set-up and integration, and the smart city as a service platform, which involves the management of all data gathering procedures for data integration and storage, the development of dashboards for visualization, tracking and analysis purposes, and the use of Big data and AI to compute predictive and anomaly detection analysis for the better management of the public services. The implementation of this platform enables the city to have innovative tools in order to reduce the overall carbon footprint of the city and track and monitor all the public services for a better response and management. Therefore, the intervention's goals are: reduction of CO_2 emissions, improvement of energy efficiency and the public utilities management and access to new and valuable data, for research and development purposes and making data-driven public policies, related with the

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electromobility sector development or the implementation of new useful technologies, for instance.

Therefore, the main customer segments of UNIFI's intervention are the Florence citizens and all the municipality whose services can be integrated in the platform, in addition to the European Commission itself. This new tool will have a great role in the future design and management of all the public services, improving and adapting them to the community's needs thanks to the new data available. Furthermore, private companies that participate in the public services sector, such as energy providers, telecommunications operators, or ICT integrators in general, also benefit from the project by sharing knowledge and resources, as well as providing technical devices that are crucial for the intervention. However, the customer segment at which UNIFI's intervention is directly aimed, is based on the public services sector, as these will be able to get valuable information from the monitoring and tracking of their own services to improve their performance, as well as to be able to give fast responses to new or current issues. Hence, the main customer relationships are the ones related to the public sector – all public services involved in the intervention – and to the research and development institutions and companies that have a stake in the new public data available, as well as the new opportunities that the intervention enables (e.g., electromobility sector, city lighting, energy efficiency) for innovative SME & ICT integrators. It is also important to highlight the direct contact between UNIFI and their customers, as they work closely with them in the development and integration of the platform. Furthermore, for the customers relationships, UNIFI has deployed a help desk for the smart city platform and training courses for its use.

The main channel for UNIFI's BMC intervention is the EU Commission grand allocated for this part of the REPLICATE project, besides the collaborations and partnerships with other innovative and technological private companies and with public research institutions. These partnerships with innovative technological companies is crucial for the intervention as they provide the needed technical devices and infrastructure, such as smart meterings or the electrical grid; while the continued collaboration with other national research centres, such as the National Research Council, helps the university to get all the available and needed research, as well as research and technical resources. Furthermore, the intervention is deployed by different projects. As there are diverse technical fields involved, coordination in between different departments of the university and/or other companies – in different projects that form the whole – is essential for the success of the project.

The intervention's key partnerships are the public administrations themselves, as well as the European Commission, in addition to the technical devices providers already stated, the technology manufacturers, ICT and energy companies and the telecommunications operators. These partnerships allow the university to access the public utilities infrastructures, such as the telecommunications network or the electrical grid, as well as all the needed ICT technologies, in which private companies take an important role.

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The engineering projects deployed by the university, by the mentioned departments, as well as with the coordination of all different agents involved (ICT companies, telecommunications operators, energy suppliers, cloud providers, etc), are the key activities of the business model. The public-private collaboration is key to create synergies that ensure the intervention success in terms of quality and innovation. Moreover, the technologies implemented are pioneer in the smart city are, so all the research and development associated with the development of the project is indispensable. Being the university a public body, the posterior public technology transfer of the intervention represents a highly valuable asset for its replicability and development in other regions of Italy. In addition, the operative and maintenance activities and all the monitoring and technical evaluation processes associated with the project are also key activities of the intervention.

UNIFI's in-house expertise and know-how is a key resource for the success of the intervention – the DINFO and DIEF researchers, as well as the DISIT Lab, represent the most valuable resource in terms of innovation and R&D. However, UNIFI also needs access to the public utilities infrastructures to be able to develop the intervention (i.e., set-up of smart metering or sensors), as well as all the implicated ICT technologies. Therefore, the intervention needs the support from public administrations, as well as the access to the public infrastructures from the involved companies, such as energy or telecommunications companies. Once the smart city control room has been set-up and integrated, Big Data and AI technologies are also a key resource and represent one of UNIFI's main goals: implement Big Data & AI technologies for predictive purposes and the automatic management of the public services.

Finally, regarding the intervention's financial balance (bottom part of figure 74), the budget costs are mainly based on the research and development associated with the development of the intervention, and the engineers' and developers' teams and other professional staff involved. The university's researchers, senior specialist teams and research facilities are a substantial cost of the intervention. Furthermore, the costs of all technical suppliers and the usage and acquisition of all needed cloud services also represent a significant cost, as the technical side of the project is based on the smart city as a cloud serviced and advanced and innovative technologies. On the other side, the main revenue streams are the EU Commission funds allocated for the project, as it has to ensure the pilot project feasibility for the university in economic terms, and the revenue streams coming from the provision of the smart city as a service platform, in addition to the needed upcoming customization and development of the platform and its associated training courses and help desk service on-platform. However, UNIFI's intervention sets a baseline reference for further replicability by other public administrations. Thanks to the open source-based solution, the project has a great replicability potential. The intervention could be replicated in other regions at a much lower cost, with the needed municipalities' support and public tenders. Furthermore, another key revenue stream is the one coming from the product & service's sales to other private companies, as the university has access to valuable research for associated or similar services.

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8.10.4 Strategy

UNIFI's solution operates in a highly competitive industry. There are several companies that offer similar solutions, such as IBM, CISCO, Siemens, Indra, etc. They are large companies that have business lines in smart city and industry 4.0. In a highly competitive market, UNIFI focuses on certain aspects to differentiate itself from the competition, although it also has significant barriers to deal with.

Figure 75 presents a comparison through the Strategy Canvas tool between UNIFI and its competition. This is an exercise based on the information gathered from UNIFI's interview, which reflects points of similarity and difference between competitors.

As it is shown, we have chosen ten indicators that reflect the strategic position of UNIFI and the competition. The indicators have a score of 1 to 5, where 1 means the worst possible score and 5 the best in terms of the market valuation.

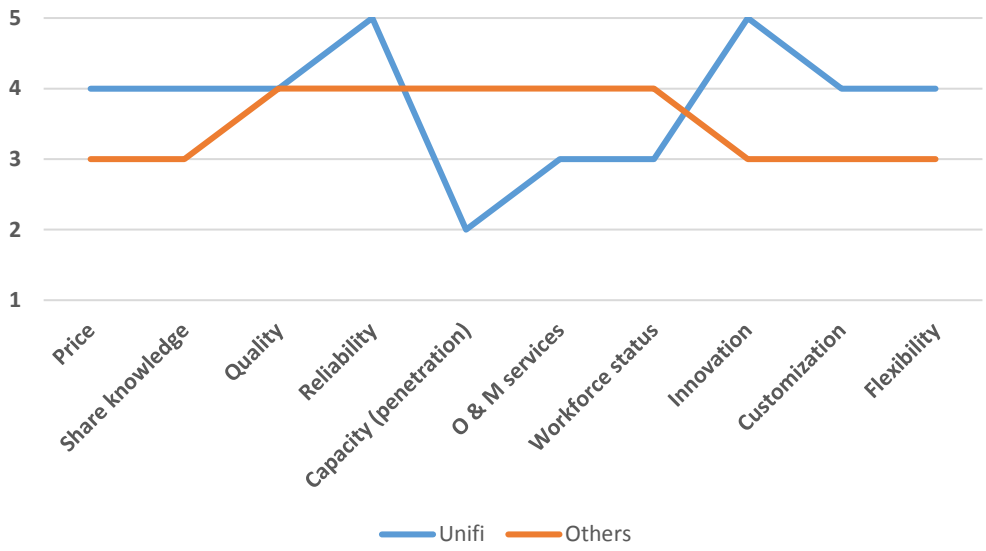

Figure 75.- Strategy Canvas of UNIFI

In contrast with competitors, UNIFI focuses on a broad platform concept. UNIFI develops a platform – control room – that integrates all the verticals of a smart system for a public organization. On the contrary, most competitors tend to offer their own or vertical solutions.

The first item is price. One of the key advantages of working with the university, as opposed to competitors, is that the university is non-profit. In general, this position of the university means that prices are approximately 30% lower compared to private companies, and that everything that is entered for a project is reinvested in the system. In this sense, the university works at additional costs, that is, it only charges additional costs that can be generated by the adaptation of the previously developed solution. This is a key aspect, especially for public

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administrations. In addition, there is a re-use law for universities, with which everything that is paid with public money can be re-used by other administrations. This situation, as well as the fact that the solution is open source, makes greater UNIFI for the second item, share knowledge. UNIFI's solution is characterized by being open source. There are other competitors that can also offer open source solutions, but it is not usually a trend in the market because license revenues are lost. Also, the fact of working in open source allows the customer not to mortgage in the future.

The point is that UNIFI develops an open source solution with the same quality guarantees as a private company, but by reinvesting everything in the university and being non-profit, they can offer tighter margins. In this comparative sense, it is important to note that UNIFI's solutions are highly reliable, with very high percentages around 99% compared to the competition.

On the contrary, UNIFI score lower regarding the item of capacity (market penetration) compared to competitors. This fact is quite linked with some significant barriers for UNIFI when competes that impacts items such as operation and maintenance services and workforce status. In general, administrations prefer to work with private companies because they consider that these offer them more guarantees in terms of 24/7 maintenance, due to the fact that they have higher personnel structure than the university or the ability to outsource. An important barrier to compete regards to contracting regulation in university. At this point, it is difficult to maintain workforce beyond specific projects. The regulations do not allow long-term contracts for workforce to work in university. That is the reason why UNIFI does a huge effort to maintain a structure for getting and attracting projects, both at regional, national and supranational. These projects are a source to contract, although workforce is linked to projects lifetime in general. This is an aspect that limits UNIFI's capacity to access the market.

On the other hand, UNIFI does a great job regarding innovation, which is key for them and comes from a great in-house know how and continuously boosted thanks to projects and collaborations with companies where it acts as an innovation creator. At this point, UNIFI is 3-4 years ahead of the competition and faster in comparison to them. Also, the fact that the university has a long-term relation with the city, offers them an important knowledge about the Council, the citizens and the city itself. In this sense, the solution that UNIFI offers considers the needs, pains and gains of the customer and it is properly customized. The result is due to a close collaboration between the university and the city, where there has been a very high degree of involvement on the part of the city, politicians and technicians.

Finally, UNIFI's solution is of great value compared to competition because of its flexibility. Thanks to its interoperability systems, UNIFI's solution allows working with multiple typologies and data sources, and is open to new developments and applications. It is an open, flexible system that offers the customer the possibility of adding, integrating, and adapting multiple systems and future solutions. In fact, the platform developed can be the basis for micro platforms that can be developed at specific times for specific purposes.

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8.10.5 Final remarks

UNIFI's solution has great public value. Its consideration as a non-profit organization - although it competes in public tenders with private companies - allows it to seek a common good beyond the short returns typical of a private company. In this sense, UNIFI can incorporate non-economic returns to its solution that the customer values highly and does not have to justify them in the short term. In addition, it must be considered that the university is a historical agent in the city and there is a close relationship between them. This aspect is important, not only for reasons of mutual knowledge, but also because in addition to the development of the solution and the technology transfer, UNIFI provides continuous support to its customer.

Furthermore, as we have mentioned, the public customer opted for UNIFI because as a non-profit organization it worked with open-source and interoperability concepts. These aspects are very important because they allow the public customer not to depend on their provider for future developments. Furthermore, knowledge and technology transfer are clearly replicable and can be used by other administrations by law.

On the contrary, there are significant barriers to competing on equal terms in public tenders, as well as in the market. Although UNIFI can lower prices, it is subject to strict regulation regarding hiring, which affects its workforce. Although they play an important role in innovation, staff turnover can be a major barrier to maintaining their solutions long-term. Therefore, UNIFI must base its strategy on maintaining a significant pool of projects annually. Finally, few municipalities - individually or jointly through regional groupings - propose or have the capacity to develop these types of projects. There are external factors, such as financing, regulation, etc., that do not allow them. In this sense, it is important to try at the supranational, national, and local levels to push these initiatives in smart city on a common and regulated framework, which are crucial initiatives for cities. This push must work to manage barriers and act faster, just as the private market does in Industry 4.0. There is a clear need, as evidenced by the impacts of a city control room type solution, to promote research on such topic because of great benefits, but above all to promote implementation and consolidations of these solutions.

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8.11 Enel-Distribuzione

8.11.1 Company's presentation

E-Distribuzione S.p.A. (formerly Enel Distribuzione S.p.A.) is the main energy distributor of electricity in Italy, providing electricity to more than 85% (over 31.5 million customers) of the Italian energy users and with over 1.1 million kilometres of electricity grid across the country[85]. The company carries out its activities under a concession regime and is subject to obligations of continuity and quality of service in compliance with standards set by the Italian Regulatory Authority for Energy Networks and Environment (ARERA).

E-Distribuzione belongs to the Enel Group, the Italian-founded global leading player in power and gas markets, therefore it is subject to legal and functional unbundling obligations which guarantee independence and neutrality towards all market operators.

We will put the spotlight on E-Distribuzione, as it is the Replicate partner in charge of the Smart Grid implementation in the 'pilot area' of Florence. This project is essential for the development of the electrical grid in terms of energy efficiency, sustainability and infrastructure improvement. The consistence of electricity distribution network in the Municipality of Florence is: 5 HV/LV (Primary) Substations and 487 MV/LV (Secondary) Substations. A subset of Primary (HV/MV) Substations (n.2) and Secondary (MV/LV) Substations (n.60) constitutes the Pilot area of Florence involved in the Replicate Project. The Smart Grid implementation is focused on new technological solutions that enable advanced functionalities for the remote monitoring and control of equipment in HV/MV and MV/LV substations, improving grid performances in terms of reliability, resilience, continuity and quality of service. The project has also tested customers' energy awareness, through the distribution of the so called 'smart info+' kit[86].

Furthermore, the Smart Grid implementation is the enabler to develop the Electric Mobility. In particular, E-Distribuzione has installed six new Fast Recharge Plus 1G charging stations, for exclusive taxi use, in public areas. These locations were identified together with the Municipality and with the taxi drivers' association in crucial points of the city such as the main station or the airport[87].

[85] Source: https://www.e-distribuzione.it/

[86] Replicate D7.3 Report on technical solutions, p. 87

[87] Replicate D7.3 Report on technical solutions, p. 39

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8.11.2 Customers and value needs

As stated, the smart grid implementation is the cornerstone of the E-Distribuzione and Replicate partnership in Florence. The Smart Grid will bring many benefits such as[88]:

- Reduce operative and management costs, which will ultimately lead to lower consumers' power costs
- Increase the efficiency of electricity distribution and accelerated restoration after power outages
- Improved operational flexibility suitable to deal with active demand response practices, which will also contribute to lower electricity rates
- Enhanced resilience
- Increased capacity to host and integrate customer-owned distributed power generation and storage resources
- Improved security

In particular, Smart Grids are crucial to increase the power generation originating from renewable energy sources (RES), able to reduce CO_2 emissions according to the environmental goals set by the European Commission (EC) in Horizon 2020 Programme.
E-Distribuzione is already widely experienced in Smart Grids development, having implemented its first smart grid in 2011 (one of the first Smart Grids in the UE) in Isernia, with an investment of €10 million[89].
This intervention will need the public administrations support due to its strong public-related interests, at the expense of its economic feasibility. In order to sum up this challenges, we will focus on the Value Proposition Canvas (VPC) model in figure 76, which is a useful tool to understand the customer's needs[90], concerns and preferences in order to give a well-fitted response in the shape of a product or service.
Even if the distribution activity is fully regulated and not open to competition, the Company runs its business through a Customer Centricity approach. With this meaning the VPC can be applied and we know that the customer is increasingly keen on using new smart products and services to satisfy its needs, as well as to become a prosumer/producer. If we focus on the customers' side (right side of the figure), we can see that their most important pains are related to the continuity of supply i.e. their main requirement is to be reliably supplied with the energy and services they need. Moreover, in the whole energy framework, other pains concern the

[88] Source (mainly): https://www.smartgrid.gov/the_smart_grid/
[89] web.archive.org/web/20150417094737/http:/www.enel.it/ewcm/salastampa/comunicati/1648105-4_PDF-1.pdf
[90] The study done in this report is related only to the deliverables implemented by E-Distribuzione in the Replicate Project.

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consumption 'opacity', in other words the inability of the consumer to manage its own energy consumption, as the information provided by the service provider is not suitable for the user to improve energy efficiency and save money by changing consumption patterns. In addition, another relevant pain for customers that own (or want to own) an Electric Vehicle (EV), is the few charging stations availability and the few incentives for the use of an electric vehicle.

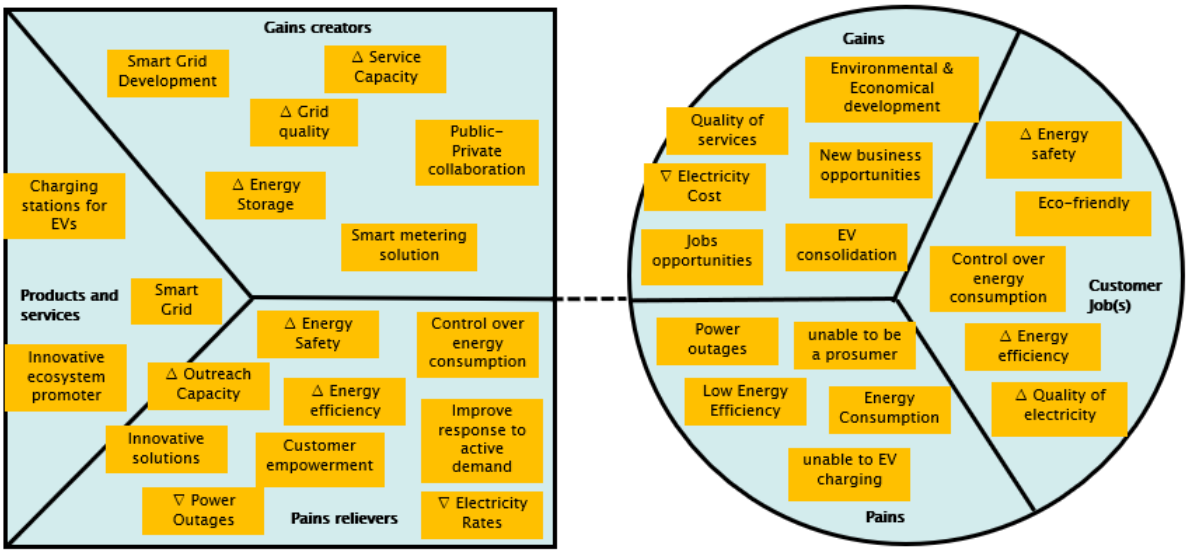

Figure 76.- Value Proposition Canvas of E-Distribuzione

However, in the customers' gains we can highlight the implementation of incentives for the use of EV's as a Replicate project action of Municipality of Florence, responsible for regulating the public mobility service. For instance, more accessible areas, discounts in electric vehicles prices or in the use of the charging stations, for the consolidation of the EV sector in Florence, dealing also with the city's traffic congestion which is an important issue in the city. This, together with the Smart Grid implementation, will bring a substantial environmental & economic development in terms of energy efficiency, sustainability, and knowledge, as well as for the development of new business opportunities. As regards Customers' jobs and tasks, we record that the customers are highly worried about energy efficiency, as means to reach higher goals such as money saving and being eco-friendly, through the increase of their control over energy consumption and the use of renewable energies. This could be possible thanks to the intervention of implementing the Smart Grid and the Smart Info kits.

On the left side of the VPC in figure 76 we can see the Product canvas, which theoretically, should respond to the challenges, issues and preferences that rise from the customer side, with the Products and Services, in this case provided by E-Distribuzione: the Smart Grid is the fundamental enabler to provide the solutions to power electric vehicles and smart services.

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First, the pain relievers respond to the "pains" that communities and businesses have with reference to the service provided by E-Distribuzione. In this sense, the REPLICATE pilot for the Smart Grid intervention deployed by E-Distribuzione is crucial to meet customers' needs. It will improve the service in terms of energy safety and efficiency, additional capacity, demand peaks response, electric rates and quality information provided. The Smart Grid intervention will also bring resiliency to the grid increasing capacity of the distribution infrastructure to withstand unpredictable events (floods, fires, heat waves, etc) by the development of new engineering designs and management strategies, such as measures of remote control and automation of the electricity distribution network, allowing to empower the existing grid as "Smart Grid".

The gains creators in the service side in figure 76, meant to respond to customers' preferences that shape their purchasing decisions, also revolve around the Smart Grid intervention. One of the most important features of E-Distribuzione's Smart Grid intervention is its Public-Private nature. In other words, the public intervention of the Municipality of Florence and the UE in the REPLICATE pilot is essential for the public opinion and trust in the service. In addition to the Smart Grid features that we have already highlighted in previous sections: improvement of hosting capacity, quality and efficiency of service, along with smart metering systems useful to monitor the electric grid enabling the automation of several operating processes and to enhance the customer awareness.

The smart meters will allow to collect huge amounts of data related to the grid performance and users' consumption. The analysis of these data performed by e-distribuzione, subject to a strict legal framework that guarantees security and confidentiality, is highly valuable for research activities aimed to improve energy distribution. For instance, to give a much better response to demand peaks and to a highly changing electric demand. Overall, the Smart Grid allows to enable new innovative services for citizens (data access, RES connection, EV recharge) and the data availability will positively influence user's consumption behaviour.

8.11.3 Business model

E-Distribuzione runs R&D activities with the aim to constantly improve its digital and smart technologies ensuring an advanced automation and control system for the network able to guarantee high quality of service levels. E-Distribuzione is the distribution system operator with exclusive granting of distribution network management in the Municipality of Florence, a necessary condition to participate in this project where its intervention is focused in a pilot area of Florence (Cascine, Novoli and Le Piagge districts). The main goal of the intervention is to set up, develop and integrate a Smart and resilient Grid along with the deployment of Fast Charging Stations for electric Taxis.

This value proposition is mainly aimed at develop new and innovative technologies thanks to the knowhow and data obtained from the research project. Given that E-Distribuzione is a concessionaire with the exclusive granting of distribution network management subject to a

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strict regulatory framework, to map the intervention's main stakeholders, activities and goals, we will use a Mission Model Canvas, as seen in figure 77, as the core of the project resides in the mission achievement, instead of earning money.

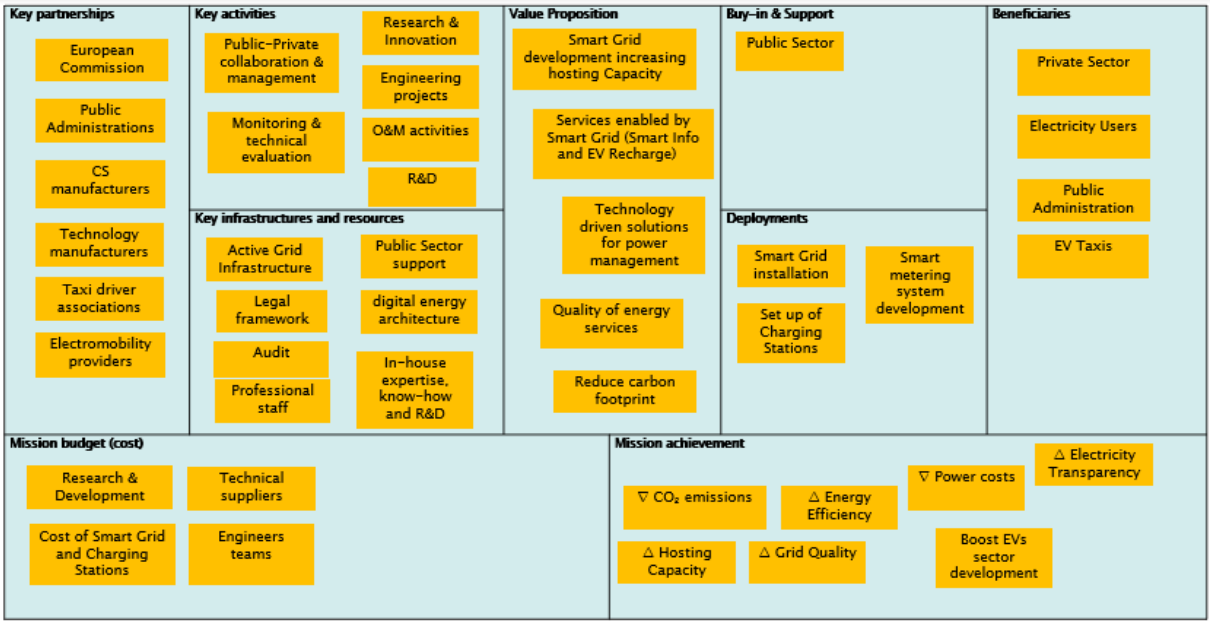

Figure 77.- Mission Model Canvas of E-Distribuzione

In figure 77 we can see E-Distribuzione's intervention Mission Model Canvas. The intervention Value Proposition is mainly aimed at increasing hosting capacity and therefore to achieving national and European decarbonisation goals. Besides, the remote-control technology implemented allows the reduction of interruption, giving citizens a better quality of service. With a more flexible and resilient grid it is possible to enable new innovative services for citizens, fostering green energy and sustainable supply chains exploitation.

The beneficiaries of the mission are all the "electricity users" in the selected district and electric taxis, on one side. In the last years the customers have evolved from consumer to prosumer/producer. These 'actors' will be the main beneficiaries in terms of opportunities by enabling new active demand services with a quality service improvement.

Meanwhile, on the other side of the beneficiaries we have the private sector, all the companies that are directly or indirectly affected by this intervention, and the public administration. These two different sides correspond to whether the beneficiary is the final user, for the first, and whether the beneficiary "owns" or participates directly in the set-up, development, integration and further maintenance of the project.

The commented 2nd side of the Beneficiaries are also the key partnerships that E-Distribuzione faces in the REPLICATE pilot. As stated before, all the public administrations in Florence are

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key for the development of the Smart Grid, for instance in terms of permits to build: they are the key partners for the success of the intervention, as well as for further improvements. Along with the public administrations, the European Commission also plays a key role as is one of the main partners when developing Smart City projects in the European Union, in projects such as REPLICATE or STEEP[91]. Afterwards, the key partnerships rely on all the providers and agents involved in the Smart Grid industry, such as technical devices providers, or software companies. Last but not least, regarding the Fast Charging Station for Taxis, the Taxis associations and the electromobility providers are also key partnerships of this project. This part of the intervention is perfectly aligned with the city's policies, as in November 2011, the City of Florence, together with Florence Parcheggi and all the main players involved in the Electromobility industry, presented the Masterplan of the Electric Mobility, a document defining a roadmap of systematic implementation of an electric mobility strategy (one of the first Italian cities)[92].

The mission key activities rely on a smooth and coordinated Public-Private collaboration, mainly between E-Distribuzione and the Municipality of Florence, as well as with the European Commission. A strong collaboration is needed to show the community the major implications of the Smart Grid intervention and all its advantages, as well as for the project to be feasible economically, with the combination of the public funds and private resources. These private resources are the know-how for the project, as E-Distribuzione will deploy Smart Grid experts and engineering teams for the project, guaranteeing a constant monitoring and technical evaluation of the pilot and, in the future, research and development for further innovations. The Smart Grid can provide a huge amount of helpful technical information. Once this operational data will be available, in a secure and aggregated form compliant with the European privacy and data protection regulation, they will be crucial for further development of energy technologies, research from private companies or public institutions, such as universities, but will also be valuable for those sectors that can be directly or indirectly affected by energy consumption or management (such as socioeconomic or ecological studies).

As seen in figure 77, the deployments of the intervention are based on: Smart Grid implementation, Smart metering system development and the set-up of the charging stations. These activities are crucial and linked to the core competences of E-Distribuzione. First, the active grid infrastructure is needed to install the smart metering devices and other devices to make the grid smart. These smart devices and softwares are developed and managed by E-Distribuzione's specialists and experts in the matter, leveraging on their know-how and all the accumulated R&D over time. This represents the most important resource needed for the intervention. Second, the legal framework is of vital importance in a sensitive topic as the users' energy consumption data. The Public Sector is the agent that could enable the

[91] Source: http://www.smartsteep.eu/

[92] Source: REPLICATE D7.5 Report on management models v2 – Annex 1, p. 121

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intervention's activities, such as the Smart Info kits implementation. And third, for the correct development of the devices, ICT Technology providers are vital for the correct technical functioning and maintenance of such advanced Information and Communication technologies. When looking at the balance between the mission costs and achievements in figure XX, we see that the achievements represent a high reward in terms of the community development and sustainability. The costs concern mainly the activities carried out by E-distribuzione, such as the engineers deployed for the project, the cost of all the technical devices used for the intervention or the research and development efforts needed for the projects. The Smart Grid represent the biggest part of the costs, as the technical devices needed are leading-edge technologies, as well as for the specialised engineers teams and Smart Grid experts, that can be E-Distribuzione personnel or can belong to other partners or other institutions. Furthermore, the charging stations provided by E-Distribuzione, and their set-up, represent a considerable cost of the intervention, too.
However, as stated, the focus on the intervention is on the mission achievement rather than the economic feasibility. Its achievement relies in the core of the goal of all REPLICATE interventions: improve the city's energy efficiency in order to reduce CO_2 emissions, renew the electric grid, towards a Smart Grid, to increase its hosting capacity and favour renewable generation, and to integrate new and advanced technologies, such as Smart Metering devices improving customer awareness. This would ultimately lead to lower the power costs and finally, give a boost to the Electric Vehicles' sector development by providing the city with new charging stations for electric vehicles and taxis.

8.11.4 Final remarks

The intervention is of great public value. As already highlighted, the Smart Grid intervention provided by E-Distribuzione has many positive impacts such as the reduction of operation and management costs: increase of the hosting capacity, higher resilience, improvement of the infrastructure, etc. We also highlight the valuable information about energy consumption patterns, as well as the empowerment of customers thanks to additional informative activities. Complementary, the development of innovative and technological energy solutions provides also fast-charging stations for EV which clearly consolidates and develops the use of EV in the city.
Despite these important and valuable impacts, this type of intervention presents some important barriers to be developed on a large scale. The most important barrier is financing. Currently, a project of this type only works if there is public funding. Smart grid projects that are developed in a research phase like REPLICATE, are usually 70% funded. Without this funding, the projects would not be viable: smart grid projects are considered as a way to pursue national and European decarbonisation goals by encouraging the development of new energy services which are out of the traditional DSO scope. For this reason, smart grid

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interventions should be considered 'on-top' to the ordinary investments the DSO must carry out to perform its public service duty.

In this sense, in order to scale-up and replicate these types of interventions that represent a clear example of a paradigm shift, smart grid projects must be fully funded and incentives or rewards should be provided to encourage distributors to invest in this field. Also, these aspects should be done at the state level.

These aspects are of great value, as well as crucial, to be able to continue advancing in these projects. In fact, REPLICATE-type projects are very important. The REPLICATE smart grid intervention has been implemented in Brazil, and the know how developed by E-Distribuzione in REPLICATE has been also the basis, together with other similar projects, to strengthen technologies that will be implemented to realise large-scale smart grids in different territories of the network of national distribution.

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9. LESSONS LEARNT

As it has been shown throughout the different organizations analyzes, the interventions carried out in the REPLICATE project are of great value. Although there are differences, cities, as well as organizations and companies with which they collaborate, present a very high level of knowledge and experience, and have first-rate technological developments.

To summarize, it is interesting to highlight common aspects that can favor the implementation and development of these types of interventions in other cities and regions:

- Ensuring political buy-in and support of the public administrations at all territorial levels to ensure the interventions' sustainability and future consolidation, in addition to the supranational support and funding needed to undertake the first stages of this type of interventions.
- Stablishing strategic city plans focused on the smart city services' sustainable integration.
- Fostering public-private-people partnerships (PPPP), not only to develop and test high-end technologies, but also to set standards in terms of the business models deployed, that will serve as a baseline reference for further replicability and associations.
- Consolidating public-private financing schemes territorially aligned and sustainable in the long term.
- Evaluating and monitoring systems for constant assessment of interventions performance
- Introducing a real holistic monetization of environmental and social benefits in business models.
- Promoting the advantages of the services deployed to increase public awareness and engagement.
- Developing collaborative and open methodologies and processes to ease the interventions' replicability.

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10. INNOVATIONS, IMPACTS AND SCALABILITY

An innovation is the application of creative ideas or new technologies that improves a product or service that is accepted by the market and this can only happen when the innovation is feasible (it is possible from a technical point of view), desirable (the society wants the novelty) and viable (the cost-benefit analysis is positive from the owner of the innovation point of view), as it can be seen in figure 78. Bearing this in mind, deliverable 9.4 main objective is to support partners on analyzing and improving their business models to introduce their innovative interventions into the market beyond REPLICATE project. This is the reason why this section just refers to the viability of the interventions, since the feasibility and desirability has already been tested and demonstrated in pilot work packages (WP3 WP4 and WP5). Nonetheless, desirability aspects regarding environmental and social impacts are constantly referenced and explained in business models.

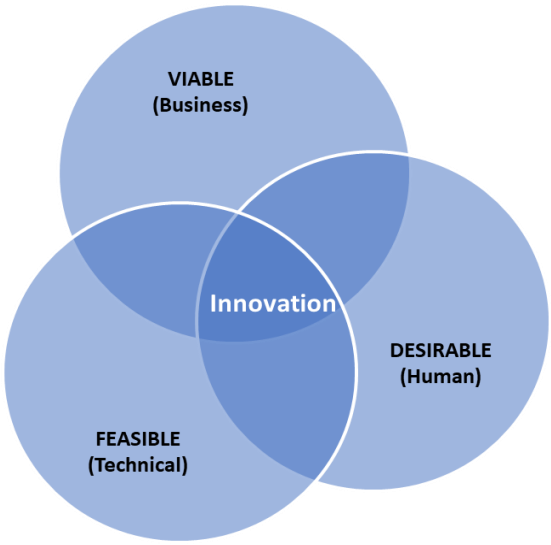

Figure 78.- Key components of innovation

To this end, this section summarizes different key points related to impacts, innovation and scalability of the interventions from their business models perspective, making especial emphasis in this last concept. Due to the fact that the nature of the interventions is diverse, the text follows the same sectors' section presented in the analysis of companies and organizations: energy efficiency, mobility and ICT.

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Energy efficiency

Regarding energy efficiency interventions, as the deliverable has presented separately the organizations involved in retrofitting and those involved in the District Heating ones, these sections follow the same approach.

The retrofitting interventions have shown many similarities despite using different models of provision according to the ownership of the organizations. Giroa Veolia, a private company that acts as an ESCO company, leads the intervention in San Sebastian / Donostia with a high support and collaboration from the Municipality through FSS, mainly in the management and engagement process; Florence uses Casa Spa, a public company that manages its public social housing stock to develop the works; and Bristol uses Warm up Bristol, an in-house brand from the Council to offer retrofitting works, to run the retrofitting intervention with the support of the Knowle West Media Centre (KWMC), which is an arts centre and charity organization that manages the households' engagement.

Table 4 shows a summary of retrofitting interventions in terms of business models, presenting the key points in terms of replication and highlighting its main drivers and barriers.

Value Propositions emphasizes on savings, both in energy bills and CO_2 emissions, as well as on comfort for owners and tenants due to the fact that the majority of the interventions' housing stock is very old, being the apartments not energy efficient and having a clear impact in fuel poverty. These similarities between value propositions demonstrate that answers to retrofitting issues are similar and tackle these environmental and social problems.

There is a clear focus on low-income household – although not all interventions involve this customer segment – who cannot afford retrofitting works on their own and, as stated, could suffer from fuel poverty. In fact, the issue of fuel poverty is a priority in Florence and Bristol and it is underlined in their business models, both the CMC and the MMC.

To this end, when cities deal with private owners, most of them need to get finance and funding to retrofit their homes and apartments, which is something to be understood by public administration as they must offer their support in this issue.

As observed in table 4, the replicability of the intervention needs to foster new models of provision which are based on ESCO schemes. This means either to work with ESCO companies – such is the case of San Sebastian – or to work under an ESCO philosophy – as in the case of Florence – with the objective to monitor and evaluate energy consumption as main factors to recover the investment. According to the results of the pilot interventions, this type of approach is achieving very good results. However, the results could be improved in a long-term action plan if this provision model incorporates customer engagement strategies as it has been tested in Bristol.

On the other hand, we must highlight drivers such as: the public-private collaboration in San Sebastian, where FSS sets up the whole strategy, coordinates and facilitates the intervention with an ESCO company who does the retrofitting and energy efficiency works; or "The Bristol Approach", as a manner to really make active customer engagement.

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Table 4: Retrofitting interventions' summary

Organization	Value Proposition	Customer Beneficiaries	Replicability	Drivers	Barriers
Giroa Veolia	Energy management solution and traditional retrofitting works (savings, comfort)	Public Administration infrastructure; Private/Industrial companies; and Community buildings	Understand the new energy model and foster ESCO business model schemes	Public-Private collaboration	Public funds for traditional retrofitting works
Casa Spa	Retrofit owners' and tenants' dwellings to tackle domestic energy issues (savings, comfort)	Municipalities from the area of Florence	Management model of the housing stock (i.e., rentals)	Casa Spa as an operator of the housing stock; and urban planning	Economic resources for extraordinary investments
Warm up Bristol	Empowering citizens to achieve neighbourhoods want to live in	Households (owners, private landlords and tenants)	Foster ESCO business model schemes	The Bristol Approach	Savings are estimated rather than guarantee
KWMC	Achieve social engagement and introducing technologies with a clear environmental impact	Public Administration; NGOs; Universities; private companies; communities	Engagement and easy deployment of technology (data measurement)	Know-how of customers and The Bristol Approach	Funding & go to market (technology)

Unfortunately, there are many types of barriers to tackle retrofitting of the housing stock, but it should be highlighted, as it has been already mentioned, the need of public funds to encourage beneficiaries, as well as councils or companies to offer engagement solutions. It is quite difficult to engage low-income households in retrofitting interventions because they cannot afford integral energy efficiency measures. Even for companies such as Giroa, which works under strict return parameters, it is very difficult to offer attractive value propositions to their potential customers if they do not include public finance and funding schemes from the public administration. The case of KWMC is quite similar in terms of the organization's sustainability. In order to maintain their programmes and activities, such as the engagement one from the REPLICATE project intervention, those have to be linked to funding programmes, that otherwise would be difficult to be committed.

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In summary, from a business model point of view, besides funding aspects, the main impacts of these interventions rely on the organization model, that is the types of collaborations and empowering models between partners to achieve the interventions goals. In this sense, the public-private collaboration in San Sebastian between FSS and Giroa Veolia, using an ESCO model, and the collaboration between the Council of Bristol and KWMC, an organization focused on social neighbourhoods' engagement, should be highlighted. It is also remarkable the role that public organizations play in these interventions, which would not have been possible without FSS, Casa Spa and Warm Up Bristol, although each one assumes very different responsibilities.

Regarding the District Heating interventions, table 5 shows a summary of DH interventions in regard to the business models, presenting key points in terms of replication and highlighting its main drivers and barriers. It is important to remind that San Sebastian deploys a public private collaboration for the producing and delivering of the intervention between FSS and UTE TXOMIN-ENEA, while Bristol deploys it in-house through Energy Bristol. The San Sebastian model for developing and implementing DH is an example of innovation in public management. In addition, the model establishes a win-win relationship with which all the parties involved could have an economic benefit, as well as other key aspects such as the social and environmental benefits of a smart project focused on energy efficiency. Furthermore, this type of management model should incorporate innovative engagement strategies using organizations such as KWMC.

Table 5: District Heating interventions' summary

Organization	Value Proposition	Customer Beneficiaries	Replicability	Drivers	Barriers
FSS - DH	Green energy and reduction of energy costs	The city itself, owners, and tenant from buildings	Public management model	FSS itself and Public-Private collaboration (i.e., competitive dialogue)	Regulation, urban planning, and public resources
BCC - DH	Provide low carbon and affordable heat (reduce energy costs)	The city itself and social housing tenants	Set up conditions by the BCC	Public involvement	Public funding, raising quality standards for operators, and stakeholders' engagement

Value Propositions emphasizes on energy costs, both economic and environmental, although FSS remarks the production of green energy too. Similar to the case of retrofitting, the value

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proposition shows similar answers to tackle energy costs, as a main impact in an economic and environmental way, to deliver interventions to owners and tenants.
As depicted from table 5, the replicability of the intervention in San Sebastian relies on the public management model based on a public private collaboration where there is both public and private investment and the overall risk is shared. This formula should be promoted in future DH interventions. The competitive dialogue established for the public procurement process has been a successful tool to find a viable technical solution at a viable cost and to share benefits and risks between stakeholders. Otherwise, private companies would not enter the project. Furthermore, the role of public administration in leading these types of management formulas is an important driver for scalability and replicability. On the contrary, such scalability of DH interventions must count on ambitious urban plans and favourable regulations, as well as on investment capacity from the cities' side.

Mobility

Regarding mobility interventions in the REPLICATE pilots of San Sebastian and Bristol, the analyses have shown how different types of organizations – public, social and private – are setting up the strategy for deploying sustainable transport and mobility networks. The promotion and roll out of interventions from different perspectives have a clear impact in public efficiency resources and environmental matters but also considers social issues such as citizens' inclusiveness.
Table 6 shows a summary of mobility interventions in terms of business models, presenting the key points in terms of replication and highlighting its main drivers and barriers.
Value propositions focus their attention on mobility management and its related nfrastructures, energy efficiency to decrease GHG and CO_2 emissions, as well as on reducing air pollution, environmental noise and fuel consumption. The reason is that these aspects contribute to manage cities mobility, while increasing urban healthiness and citizens' quality of life. Furthermore, it must be highlighted the great social value provided by Bristol companies in their business models.
The business models of each organization deliver interventions to a wide variety of customers, such as citizens without vehicle or with difficulties to get public transport, EV owners, car club members, companies and local authorities. Although the beneficiaries of interventions are citizens, it must be highlighted the importance of the local authorities in supporting –playing different roles– business models from innovative companies dealing with mobility.
The replicability of the interventions varies depending on their nature. The urban mobility platform implemented in San Sebastian by Ikusi has a high potential for public councils because it is an open-source solution that offers the integration of diverse systems and services in one management tool. However, it has to be highlighted that this integration is sometimes difficult in public institutions because it is a novelty that confronts traditional public management models.

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Table 6: Mobility interventions' summary

Organization	Value Proposition	Customer Beneficiaries	Replicability	Drivers	Barriers
Ikusi	Mobility management platform development & data collection	Urban Public Sector & urban services' companies	High potential - open-source solution	Efficient public mobility management (monitoring & tracking)	Integration of diverse systems and services & Public funding required
BCC – Transport Infrastructure	Promote & enable the use of EVs for energy efficiency	EV owners, car clubs, companies & local authorities	Set up conditions by the BCC	Council as a promotor and car clubs	National funding, attractiveness for companies & incentives for purchase
Co-wheels	Rool out of EVs for accessible, flexible, affordable & sustainable transport	Car club members, public administration, Universities, companies	Tested solutions & management models	Know-how, experience, sustainability & independent business	Locations, go to market & awareness
Esoterix	Provide "transport for purpose" for accessible, flexible, affordable & sustainable transport	Citizens, public administration, transport operators, companies	Complement to transport gaps	Data & information about mobility issues	Funding to subsidies tickets, traditional transport & prices

The interventions linked to EVs ecosystems should be based in a long-term strategy that sets up attractive conditions for the market, citizens, buyers, operators and private companies. BCC is constructing this strategy and the city has already tested solutions and successful management models that complement the traditional transport system. In this regard, the BCC is an important promotor of these solutions and collaborations, with organizations such as Co-wheels or Esoterix, that bring important drivers for scale-up and replicability strategies such as know-how and experience and create crucial data and information to understand the reality of mobility in the city. Unfortunately, nowadays these interventions still have to face some important barriers. There is a clear need to obtain national funding to promote and enlarge sustainable transport, as well as local funding for supporting initiatives that could not be profitable in terms of cost/revenue streams but imply a clear impact in inclusiveness.
The solutions presented are innovative in terms of the products and services offered, but their economic sustainability is directly linked to public support, not just in terms of funding, but also in terms of the political buy-in needed to set up city strategies to engage stakeholders, customers and beneficiaries.

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ICT

Regarding ICT interventions in the REPLICATE pilots of San Sebastian and Florence, they all revolve around the setup and implementation of new and advanced technologies – in the smart city ICT context – aiming to integrate, monitor, and manage the cities' public services (i.e., public lighting or mobility), and the centralization of the data generated in and for these services. This is an enormous step for cities, as these interventions enable ICT in the management of public services as well as the availability of new and precious information about the city's performance to make data-driven decisions.

These interventions use different models for the provision of the interventions due to the titularity of the organizations involved in each city. However, the results of these interventions are very similar and aim at the same issues.

Table 7, shows the essential features from all interventions in terms of business models, presenting the key points in terms of replication and highlighting its main drivers and barriers.

Table 7: ICT interventions' summary

Organization	Value Proposition	Customers Beneficiaries	Replicability	Drivers	Barriers
Leycolan	Installation of smart public lighting system	Public Administrations & Private Companies (associated devices)	Baseline reference to extend the system & synergies with related services	Public lighting energy efficiency & smart management of public services	High cost - Public funding required
Sistelec	Set-up & integration of Wireless Broadband network	Citizens, Public sector & Municipal services' companies	Easy deployment & integration for other services	Improve network security and coverage & smart city management	Public funding required; unknown and advanced technology with low ROI
Eurohelp	Development & implementation of linked data & citizen participation modules of Smart City platform	Public Administrations & related-services private companies	High potential & allows other services to be implemented	Efficient public data management, real-time public systems data & increase citizen participation	Atomized data from different systems
Euskaltel	City's urban mobility data aggregation, collection, monitoring & tracking	Public Administrations, Urban managers & private companies associated	Allows new services & features to be introduced in the centralized data	Efficient and integrated urban mobility management & real-life DM	Atomized data from different systems

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Organization	Value Proposition	Customers Beneficiaries	Replicability	Drivers	Barriers
Mathema	Development of EV taxis charging stations app & energy efficiency "serious game" app for energy users	Public Administrations, EV taxis, electromobility companies & energy users	Baseline reference for energy consumption tracking & saving app	Consumer's control over energy usage & boost electro-mobility sector	Cost of smart metering devices for user's energy consumption
Thales	City's data cybersecurity evaluation and diagnosis & cybersecurity consultancy	Public Administrations, Mobility & Security markets, R&D institutions	Baseline reference for further implementation of e-gov services	Smart city's data privacy & protection and safe digital public services	Cybersecurity culture not developed; public administration funding required
TIM	Smart city ICT platform implementation and end to end systems integration in cloud for data storage	Public Administrations, Technology companies, R&D institutions & Florence citizens	Allows new services (IoT, data) & research to be developed	Public city data accessibility for R&D and systems' standardizatio n	Advanced and new technologies, high degree of innovation
Silfi	Refurbishment of public lighting infrastructure, adding sensors for new services	Urban managers, public administrations & data users	New services' implementation enabler (video surveillance, traffic control)	Public lighting efficient management & smart city development	High cost of devices; Public funding required
UNIFI	Set-up & integration of the smart city control room and data integration & centralization	Public Administrations, citizens & public services companies (public & private)	Open-source solution & baseline reference for other regions	Climate change challenges, efficient & holistic smart city services management	Integration of atomized data & systems
ENEL-Distribuzione	Set up, develop and integrate Smart and resilient Grid along with deployment of fast Charging Stations	Public Administration, Electricity users, EV drivers	Public-private collaboration, know-how & monitoring / technical evaluation	Reduction of O&M costs; hosting capacity; resilience	Funding & rewards for large scale implementation

As it has been shown along the analysis, Value Proposition presents the need to be efficient in data gathering, management and implementation, as well as eco-friendly in energy solutions, while improving the public service's quality and the development of smart city services. These aspects are closely linked, on one side, with the concern of the current and upcoming climate change challenges, the atomization of the public services' systems, and the

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low quality of public services; and, on the other side, with the development of new businesses and related services, due to the replicability of the interventions, and with the availability of new and precious data for research and development purposes.

The most innovative aspects of the business models that cities are implementing are the integration of the cities' systems in a centralized platform; the installation of new metering devices and sensors for data collection; the centralization of these systems in a cloud repository; the development of new services for energy management and electromobility; and, last but not least, the security and privacy of the city's data.

It should be also highlighted the stakeholders and relations importance in these projects, where there are many and different parts involved that thrive thanks to the synergies they generate. Therefore, the replicability of the ICT interventions represents a cornerstone for these projects, as they are the baseline reference for further development and, at the same time, they allow many new associated services to be developed. This is why these interventions' know-how must stay in the public sector, allowing the technology transfer to other public administrations while being developed in open-source when possible, and enabling other complementing services and modules to be integrated.

Nevertheless, as depicted from table 7, there are significant barriers to implementing these new technologies. The most important one is the need for public funding, as these technologies are usually expensive – such advanced technologies require many R&D efforts – and the ROI for these interventions is meagre. Moreover, the current atomisation of the cities' systems and the high degree of innovation required for such interventions hinder the implementation of smart city services.

In summary, the products and services developed are of great novelty, as well as of great value for public policy management in different areas such as mobility, security, lighting, participation, etc. Even though, the ICT sector solutions evolve very fast and change constantly because of new developments. To this end, the role of city councils is a key aspect to promote ICT solutions in different aspects, such as setting up city strategies, engaging stakeholders, setting data collection and exploitation standards, and providing contracts. At this point, their buy-in is crucial to set up all internal and external changes that ICT companies solutions imply. On the contrary, it is critical for city councils in order to promote and consolidate such solutions in their cities and regions to have stable and long-term programmes of funding and lines of financing. This is a reality for city councils as well as for companies.

Many of the novelty solutions presented by companies need these programmes to do research, consolidate business units and lines, and introduce solutions into the market. Furthermore, it should be highlighted that important benefits and impacts from REPLICATE project interventions, such as cooperation and synergies between partners and stakeholders' relations, are of great value for cities and must continue being supported to develop, enlarge and consolidate ICT ecosystems in cities and regions.

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Finally, it should also be highlighted that the consolidations of ICT solutions and their scalability depends also on the search of an economic value for the new data gathered. From an economic sustainability point of view, many of the business models' interventions of public services rely on savings, but the potential of the data should be considered beyond just these savings and try to search for its profit in terms of revenues. This is a controversial debate due to privacy and security issues but must be considered by the public administration and their ICT supplier companies to consolidate business models, both public and private.

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11. CONCLUSIONS

The analysis carried out in this deliverable has served to reach the following general conclusions:

- The collaboration between public administration, social enterprises, public operators, big companies, SMEs and the citizenship is crucial to develop successful business models, which promote economic viability, environmental sustainability and social inclusiveness.
- Business tools, such as Value Proposition Canvas (VPC), Business Model Canvas (BMC), City Model Canvas (CMC), Mission Model Canvas (MMC) and Strategy Canvas, are very useful to identify rigorously how councils, organizations and companiescan create, capture and deliver intervention of great public value in a smart and sustainable manner.
- Business analyses highlight key aspects in order to take-up strategies for scaling up and replicate the interventions. Partners from San Sebastian, Florence and Bristol share common patterns and are facing similar barriers, although comparisons should be taken carefully.
- The value propositions, social and environmental impacts, and mission achievements have shown that benefits from interventions are greater than the cost of producing them. In particular, environmental and social benefits clearly overcome risks.
- Nowadays, the economic viability of many business models for energy efficiency, mobility and ICT interventions are highly dependent on the public administration resources and infrastructure.
- Public administrations are crucial players to set up the conditions for smart and sustainable ecosystems in each field. They play a key role in promoting this type of interventions, offering financing schemes, fostering public-private collaborations and being important customers for many of the partners. Municipalities and local public operators need regional, national and EU funding support to implement and scale-up smart solutions.
- Finally, the deliverable has shown that there are real and validated drivers to scale-up and replicate several solutions. To this end, it must be highlighted again the public-private-people collaborations as one of main drivers to this end, because they can benefit from know-how, experience and technology of different actors involve in the definitions, implementation and exploitation of the solution.

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