IRIS

Integrated and Replicable Solutions for Co-Creation in Sustainable Cities

Project Acronym:	IRIS
Project Full Name:	Integrated and Replicable Solutions for Co-Creation in Sustainable Cities
Grant Agreement:	No 774[1]99
Project Duration:	5 years (starting 1 October 2017)

Deliverable 3.2

Sustainable Business Model Dash-board tool

Work Package:	WP3: Development of Bankable Business Models and Exploitation Activities
Task:	T3.1: Adapting innovative business models to city district specific context
Lead Beneficiary:	UNS
Due Date:	30 September 2019 (M24)
Submission Date:	25 October 2019 (M25)
Deliverable Status:	Final
Deliverable Style:	R
Dissemination Level:	PU
File Name:	D3.2 Sustainable Business Model Dash-board tool.pdf

This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 774199

Authors

Surname	First Name	Beneficiary
Attour	Amel	UNS
Baudino	Marco	UNS
Boiocchi	Felix	UNIBS
Bourdier	Jibryl	UNS
Cimiterra	Martin	UNS
Guerroud	Yassine	UNS
Hueber	Olivier	UNS
Knuts	Mauritz	VASEK
Krafft	Jackie	UNS
Lazaric	Nathalie	UNS
Norrman	Jonas	IMCG
Pezzoni	Michele	UNS

In case you want any additional information or you want to consult with the authors of this document, please send your inquiries to: irissmartcities@gmail.com.

Reviewers

Surname	First Name	Beneficiary
Leendertse	Jip	UU
Schade	Jutta	RISE
Tsarchopoulos	Panagiotis	CERTH

Version History

Version	Date	Modifications made by
0.1	28/09/2019	Version submitted by Jackie Krafft
0.2	30/09/2019	Comments made by Jip Leendertse
0.3	07/10/2019	Revised version submitted by Jackie Krafft
0.4	21/10/2019	Comments by Jutta Schade
0.5	23/10/2019	Revised version submitted by Jackie Krafft
1.0	25/10/2019	Final version to be released to the EC

Disclaimer

Executive Summary

The aim of the report D3.2 is to help cities in the replication process of Integrated Solutions (IS), by providing a dashboard tool in the form of a spider graph for assessment and guideline of actions and all related materials behind the dashboard tool (business model canvas, Technology Innovation System questionnaire) that could help cities in evaluating their achievements and potentialities on the way to replication. Preliminary versions of this dashboard tool have been tested in D6.1 to assess the strengths and weaknesses of LHs, but we extend here the analysis by focusing on the replication process occurring from Lighthouse cities (LHs) to Follower cities (FCs). For cities, the objective is to rely upon this dashboard tool and related materials in view of identifying the conditions for the emergence of a Sustainable Business Model (SMB), defined as a long-term plan for the sustainable development of solutions in a smart city, involving all the actors acting in the ecosystem of the smart city.

In the Grant Agreement, T3.1 gives a strong emphasis on the Technology Innovation System (TIS) approach as a framework for all Deliverables attached to the task, and D3.2 will conform to that by considering TIS as a reference frame. This has some implications on the way D3.2 has been built and developed. When considering the cornerstones for the IRIS SBM given by three pillars (type of innovation, technology readiness level (TRL), and regulatory context), the framework provided by the TIS involves that we approach these pillars by focusing on 3 TIS functions: Entrepreneurial Experimentation and Production (F1) as a proxy of the first pillar, i.e. type of innovation; Market Formation (F5) as a proxy of the second pillar, i.e. TRL, with the added value of relating closely technology maturity with the development of corresponding market opportunities as this is a key dimension in the assessment of the SBM; Resistance to Change (F7) as a proxy of the third pillar, i.e. regulatory context. This also has the advantage of providing a direct correspondence with the IRIS Key performance indicators (KPIs), allowing for complementary monitoring and benchmarking based on indicators like: i.e., technical performance, economic performance, environmental performance, social performance and legal performance.

As exposed in D6.1, TIS is a general framework able to analyse the conditions for letting new business models to emerge on the basis of an exhaustive questionnaire, structured into 7 sections corresponding to the 7 functions of the TIS analysis. Within D3.2, we carefully performed our extended analysis on replication by focusing on the questions in F1 (Entrepreneurial experimentation and production), F5 (Market formation) and F7 (resistance to change) that were mostly representative of the SBM pillars. The first pillar, type of innovation, was captured in F1 by questions referring explicitly to the degree of innovation, technological breakthroughs, opportunities of technological development, large scale production, and related uncertainties. The second pillar, technology readiness level, was covered in F5 by questions on market size, expected market size, exploration and long-term opportunities, exploitation and short-term opportunities, barriers to development. The third pillar, regulatory context, was captured in F7 by questions on 'soft regulation' like ethics, standards and behaviors, as well as legal issues or 'hard regulation', such as legislations, intellectual/property rights. In addition to frame D3.2 closely in line with the description of T3.1, capturing the SBM pillars with the TIS functions also has the advantage of providing a direct correspondence with the IRIS KPIs technical performance, economic performance, environmental

performance, social performance and legal performance. Finally, grounded on the IS, as this is one of the first information respondents needed to fill in with reference to Table 10 of the Grant Agreement (joined to the TIS questionnaire), TIS also has the great advantage of generating spider graphs that provide a dashboard tool.

With this dashboard tool, cities are able to position themselves: the LHs can do it based on their past and current smart city achievements, while the FCs can identify their position based on their expectations of current and future smart city achievements. At the ecosystem level, i.e. all transition tracks and IS solutions included, the dashboard tool indicates for each pair of cities considered (i.e., Nice and the FCs, Gothenburg and the FCs, Utrecht and the FCs) where is the technical, economic, environmental, social or legal advantage to be replicated by FCs, and which dimension should be improved in creating the conditions for the emergence of a SBM, scaling up in districts before proceeding to replication. The dashboard tool can also be applied at the transition track level where we produce another series of results for the same pairs LHs – FCs, each transition track and related IS being analysed apart from the others. To get into the diversity of FCs expectations, and also considering that many respondents of our TIS questionnaire defined themselves in reference with transition tracks rather than IS, we further list a series of Integrated Solutions (IS) that are of more interest for each of the FCs (Alexandroupolis, Santa Cruz de Tenerife, Vaasa, Foscani) and that can be related to the TIS functions on which the dashboard tool is based.

Last, F1 results to be a key function that guides the performance in developing, scaling up and replicating IS in all smart cities. Therefore, we further elaborate on a successful example of entrepreneurial experimentation, called the PEPITE scheme which stands for “Pôle étudiant pour l'innovation, le transfert et l'entrepreneuriat”, i.e. “Student Pole for Innovation, Transfer and Entrepreneurship”, that has been developed in the LH of Nice and discuss the potentialities of replication in FCs.

Table of Contents

List of Figures

List of Tables

List of Abbreviations and Acronyms

Abbreviation	Definition
CEEI	Centre Européen d'Entreprises et d'Innovation
CPB	Consortium Plenary Board
D3.1	Deliverable D3.1 “Learnings from innovative business model adaptation tool”
D3.2	Deliverable D3.2 “Sustainable business model dashboard tool”
D3.3	Deliverable D3.3 “European cities and district market analysis”
D3.4	Deliverable D3.4 “SCUIBI programme 3.0 and book for implementation in IRIS cities and beyond”
D3.6	Deliverable D3.6 “IRIS City innovation management performance and roadmaps”
D3.7	Deliverable D3.7 “Financing solutions for cities and city suppliers”
D3.8	Deliverable D3.8 “IRIS exploitation plan and operations”
D3.9	Deliverable D3.9 “IRIS beyond business plan”
D5.1	Deliverable D5.1 “Baseline, ambition & barriers for Utrecht lighthouse interventions”
D5.2	Deliverable D5.2 “Planning of Utrecht integration and demonstration activities”
D6.1	Deliverable 6.1 “Baseline, ambition & barriers for Nice lighthouse interventions”
D6.2	Deliverable D6.2 “Planning of Nice integration and demonstration activities”
D7.1	Deliverable 7.1 “Baseline, ambition & barriers for Gothenburg lighthouse interventions”
D7.2	Deliverable D7.2 “Planning of Gothenburg integration and demonstration activities”
D10.9	Deliverable 10.9 “Communication and dissemination tools and material”
DoA	Description of the Action
EU	European Union
EV	Electric Vehicle
FC	Follower Cities
F1	Function 1 : Entrepreneurial experimentation and production
F5	Function 5 : Market formation
F7	Function 7 : Resistance to change
IS	Integrated Solutions – IRIS Solutions
KPIs	Key Performance Indicators
LH	Lighthouse
LH1	LH City Nice
LH2	LH City Utrecht
LH3	LH City Gothenburg
LR	Likelihood-ratio test
MS4	Milestone 4
PEPITE	Pôle étudiant pour l'innovation, le transfert et l'entrepreneuriat (i.e., Student Pole for Innovation, Transfer and Entrepreneurship)

SBM	Sustainable Business Model
SDI	Sustainable Development Indicators
TIS	Technological Innovation System
TT	Transition Track
TRL	Technology Readiness Level
UNIBS	University of Brescia
UNS	University of Nice Sophia Antipolis
V2G	Vehicle to Grid
WP	Work Package

1. Introduction

The objective of this report (D3.2) is to provide a dashboard tool where Lighthouse (LHs) and Follower Cities (FCs) can position themselves, in view of helping them generating a Sustainable Business Model (SBM) in the process of replication from LHs to FCs. This tool is intended to identify structural weaknesses in the replication strategy, and how to go beyond in reference with 3 pillars structuring the SBM. We proceed with synthetizing basic dimensions providing a framework - type of innovation, TRL, regulatory context – using patterns and attributes that facilitate categorization and operationalization in view of replication plans, namely using the functions that are developed within the Technology Innovation System (TIS) approach which is central in the description of T3.1 and as such structures the content of all related deliverables in the task (including D3.2).

1.1. Scope, objectives and expected impact

Together with D3.1 and D3.3 in T3.1, D3.2 provides input in understanding what forces in the local environment are creating conditions for developing new business models, and what factors are barriers to such business model development. The contribution of D3.2 is to help cities in the replication process, by providing a dashboard tool and all related materials behind the dashboard tool (business model canvas, Technology Innovation System (TIS) questionnaire) that could help cities in evaluating their achievements and potentialities on the way to replication.

The scope of D3.2 lies in identifying:

- The market conditions allowing Sustainable Business Models (SBMs) for solutions in the transition tracks to emerge in the considered lighthouse (LH) smart city, and
- The premises for a replication process from the LH cities to the follower cities (FCs).

In the context of IRIS, a successful SBM can be defined as a long-term plan for the sustainable development of solutions in a smart city, and which involves all the actors acting in the ecosystem of the smart city. Each solution encompasses specific elements which are present inside of the local ecosystem of a smart city and which refer to different aspects such as market formation, knowledge exchange among actors, entrepreneurial experimentation, and so on.

These aspects are well described by the TIS (Technology Innovation System) methodology, an analytical tool which categorizes through an exhaustive taxonomy all these aspects within the framework of seven different functions. The advantage of using the TIS methodology is that it allows to investigate the conditions for a SBM to emerge with reference to a set of different functions, where scores indicate strengths and weaknesses at the level of cities / at the level of transition tracks for each city.

This methodology has already been tested and updated within the context of IRIS Smart Cities in D6.1, where we noted that depending of the stage of development of the technology, some functions are more important than others (D6.1, Fig. 2, p. 21). Entrepreneurial Activities (F1), Market Formation (F5) and Resistance to Change (F7) appear as driving most of the concerns in the take-off/acceleration phases that correspond to scaling up/replication in the IRIS context. In this current

D3.2, we aim to show that the same methodology – focusing this time on both LHs and FCs, selecting the TIS functions and related questions that represent good proxies of the SBM pillars – enables to study the premises allowing the replication process of certain solutions from the LHs city to FCs, and this is especially the case when the LH city possesses a strength within a certain solution, or when a FC demonstrate a strong ambition in a particular solution. We conclude the analysis by discussing a specific solution implemented by the lighthouse city of Nice which could be replicated to follower cities. This involves the "PEPITE scheme", which stands for "Pôle étudiant pour l'innovation, le transfert et l'entrepreneuriat", i.e. "Student Pole for Innovation, Transfer and Entrepreneurship", a solution which has been proven to be a successful case of entrepreneurial experimentation, and which it frames into a key function where the LH city holds a major strength (F1). For FCs, it represents a key dimension where they can build their own absorptive capacities to absorb external solutions provided by LHs during the process of replication, especially by strengthening the quality of entrepreneurial projects under incubation.

Overall, based on this methodology, we are able to characterize a dashboard tool from which the LHs and FCs can position themselves and identify the key possibilities of replication as well as barriers to replication.

The objective of D3.2 is dedicated to the generation of a proper dash-board tool allowing to analyze and to evaluate the conditions for letting new Sustainable Business Models, and this tool is represented by the TIS methodology, according to the description of T3.1. Secondly, we define patterns and attributes that would facilitate categorization and operationalization to allow replication plans from the LHs to the FCs.

In this context, in synthesizing basic dimensions to provide a framework, special attention shall be addressed to the three pillars related to:

- Type of innovation
- Technology Readiness Level (TRL)
- Regulatory framework

These tree pillars represent the cornerstones for the IRIS Sustainable Business Model, as they provide the major contribution for the definition of the dashboard for local ecosystems. Within the approach we are developing here, innovation does not lie solely on the technical/novelty/research level as in D6.1, but more likely on the scale/size/level of how solutions can be extended from a LH to a FC, and eventually beyond.

Specifically, the first pillar (Type of innovation) defines the innovation type, from the more radical to the more incremental one, behind a solution. Both radical and incremental innovations can be replicated, but differences in the replication of radical or incremental innovations can be experimented in terms of timing, costs involved, and target location.

The second pillar (Technology Readiness Level) denotes the degrees of technological maturity in the ecosystem. Here different scenarios can be observed, but presumably the higher is the TRL, the easier will be the replication process. A high TRL is more likely to provide a common understanding of technology status, of the risk management, of the conditions of funding, of the key transition steps

to the technology, even though readiness does not always fit with appropriateness or technology maturity. Note that, while only TRL is mentioned in Grant Agreement T3.1 description, in line with the TIS analysis, it is implicit to associate the technology maturity to the corresponding formation of markets (see technology life cycle with the decomposition pilot, demonstration, replication we used in D6.1, Fig 4 p. 27). Market and technology development are two sides of the same coin and, considered together, they form a key dimension in the assessment of the SBM.

Finally, the third pillar (Regulatory framework) involves the strength of both "hard" and "soft" regulations present in the ecosystem. As a reminder, while "soft" regulation relates to barriers inherent standards and behaviours of the actors present in the ecosystem like social acceptance of new technologies and services for instance, "hard" regulation concerns legal issues, such as legislations, intellectual/property rights, etc. This third pillar is particularly important, since different degrees of strictness among regulatory frameworks in two different ecosystems could entail negative repercussions. Indeed, when the gap in the degree of strictness among regulatory frameworks of a LH city and a FC is too wide, this could pose significant barriers, hampering in this way the replication of plans from the LH city to the FCs. Equally, when consumers in various ecosystems have drastically different habits and inclination to change towards smarter solutions and services, replication plans might be affected, but some experience on how to better involve citizens and make them more likely to accept solutions can be transferred from the LHs to the FCs.

Our aim is hence to investigate the three pillars of the IRIS Sustainable Business Model in the context of the considered LH city, in order to identify structural strengths and weaknesses in the innovation ecosystem of the LH city from one side, and the expectations (in terms of replication) for the FCs on the other side. As stressed, to carry out such an investigation, we rely upon the TIS methodology, which will be discussed in detail in the methodology section.

The expected goal of the D3.2 is to contribute to the issue of Sustainable Business Model adaptation, *which* is fully described in the MS4 milestone report (lead beneficiary IMCG) - only a summary of which is intended to be reported here -.

When replicating IRIS Integrating solutions, the Business Model should be adapted to the market conditions of the targeted city for replication. The Business Model dash-board tool based on the TIS methodology describes the differences between the former (lighthouse) city and the replication (follower) city, and based on this, it provides an assessment of the conditions present in the FC which can allow the replication of the SMB from the LH city. During the replication process, local authorities shall also try to adapt to market conditions in the best possible way.

The process of Business Model Adaptation from LHs to FCs used in the IRIS based on the TIS methodology, aims at adapting in FCs the conditions for emergence of innovative Business Models for integrated IRIS solutions to city district specific context, primarily designed for a city-wide scale-up. The Business Model adaptation tool is useful for obtaining in particular three objectives:

- It will help the city partners to understand the process of scale-up of demonstrated IRIS solutions, within the IRIS district, and throughout the city.
- It will contribute to the process of producing roadmaps for scaling-up of demonstrated IRIS solutions, within the IRIS district, and throughout the city.

- It will help identifying the individual roles of city partners, and above all, the necessary support from city authorities.

The adaptation mechanism is simple to understand, and it has been made easy to apply, as it is designed as a workshop based on the business model canvas methodology and strengthened by including a discussion on Porter's Five Forces and Impact Mapping (see Annex 1 for full references on business canvas and related models).

It has been very useful to share business modelling experiences with Business Model managers for the other Lighthouse projects funded by the EIP-SCC (Smart Cities and Communities program). A major insight has been that the Business Model adaptation will benefit from being as simple as possible. It is important to make sure that all stakeholders understand and engage in the activity that has to take place when using the tool. The complexity can increase as the work proceeds. The Business Model adaptation tool was hence constructed from three well-known methodologies used together during a workshop in Gothenburg with all important stakeholders participating. The methodologies are:

- Porters five forces – to describe the market competing alternatives
- Business Model Canvas – To describe the value chain relations
- Impact mapping – to describe the scale-up process

The Business Model adaptation process is also useful to be added to the replication package. Replication of an Integrated Solution will in most cases be based on a model where a facilitator within the city leads a demonstration project to create a first local reference of a successful implementation of the solution.

1.2. Contribution of partners

Our work has been conducted over the time period ranging from October 01, 2017 until September 30, 2019. A first part of the period (from October 2017 to April 2019) was dedicated to the collection of data in LHs and FCs The second part of the period (from May 2019 to September 2019) has been devoted to the exploitation of data via different economic methods and tools (spider graphs based on the TIS methodology, descriptive statistics and econometric methods) and the production of results in line with UNS current academic protocols of research and related previous expertise.

The work combines quantitative and qualitative analysis, with strong contributions from all IRIS partners both in LHs and FCs, especially the ones involved in WP3 (especially IMCG as WP3 lead, University of Utrecht and Gothenburg University) and WP8, who gave us time and detailed information to carry out our study through the TIS questionnaire description and potentialities, and helped us in refining our conclusions through repeated interactions on the basis of questionnaires and interviews. Beyond the IRIS partners, we could also rely on actors from Nice (Laurent Masson, head of the Incubator Paca Est, Christian Gazquez, head of the Incubator CEEI) that helped us to frame a more global picture of the forces and weaknesses of the PEPITE Scheme.

We are particularly grateful to Mauritz Knuts (VASEK), Jonas Norrman (IMCG), Olivier Hueber (UNS), Felix Boiocchi (UNS) and Michele Pezzoni (UNS) for their inputs to D3.2.

1.3. Relation to other activities

The main target group for this report is represented by the IRIS partners, especially the city administration and the related governmental institutions, but also all the actors composing the ecosystem, such as: the general public, private companies (large and small), education, research, and supporting organisations. D3.2 sets conclusions not only at the sole ecosystem level, but also at the Transition Track level, and identifies fields in which the IRIS LHs/FCs could disseminate/receive expertise to build and strengthen over time their Sustainable Business Model, first in scaling up and second in replication.

Based on these different contributions, D3.2 is intended to have an impact on various deliverables, especially MS4 "Detailed report for the Innovative Business Model adaptation tool City available" on the issue of the sustainable business models adaptation, and a summary of MS4 is exposed in the current Deliverable; but also D3.1 "Learnings from innovative business model adaptation tool" which will be using an extended version of the TIS analysis structuring T3.1 and used in the current Deliverable. D3.2, in complement with D3.3 "European cities and district market analysis", contributes to identify efficient pathways for replication from LHs to FCs. Linking T3.1 and T3.2 within WP3, the added value of the PEPITE scheme which is presented in D3.2 is also an input to D3.4 "SCUIBI-programme 3.0 handbook for implementation in IRIS cities and beyond" on successful models of entrepreneurial experimentation. D3.2 contributes also to link WP3 with WP8, in line with what is exposed in D3.8 "IRIS exploitation plan and operations" and D8.1 "A road map for replication activities" on the issue of replicability of IS solutions from LHs to FCs. Especially, in relation to D3.8 'IRIS exploitation plan and operations' which sustains a temporal process in the deployment of IRIS solutions, first by scaling up in the LH districts and second by replication from the LH to the FC, it is noteworthy that a similar conclusion is drawn from (and can be grounded on) the TIS analysis used in the current Deliverable. In addition, one of the main lessons drawn from D3.2 is that if FC want solutions to be replicated in an efficient way, they need to develop inhouse 'absorptive capacities' to absorb external solutions provided by LHs. If FCs want to proceed smoothly, they need to develop their own entrepreneurial experimentation and production capacities, starting from students' education and their ability to join incubation programmes, using the lessons drawn from the PEPITE scheme as it turns out to be an important element in the SBM to stimulate the transfer of knowledge and its effective appropriation during replication. D3.2 is also an input to the other Deliverables in WP3, like D3.6 'IRIS City innovation management performance and roadmaps', D3.7 'Financing solutions for cities and city suppliers' and D3.9 'IRIS Beyond business plan'. D3.2 is finally connected to D10.9 "Communication and dissemination tools and materials".

1.4. Structure of the Deliverable

The rest of the Deliverable is organized as follows.

Section 2 presents the methodology on which the work in D3.2 is based. Specifically, it explains how the dashboard tool has been generated and can be operated by cities.

Section 3 characterizes the results given by the dashboard tool, first at the level of the cities (Nice and the FCs, Gothenburg and the FCs, Utrecht and the FCs), and second at the level of the Transition Trasks.

Section 4 describes the potential outputs for the other work packages, relying upon the results of the analysis performed in D3.2.

Section 5 concludes, and identifies recommendations emerging from our empirical analysis.

At the end of the document, a series of Annex reports all complementary information used in this work. Especially, in the Annexes 1 and 2, we report the full text of the TIS questionnaire, and the business canvas that can be appropriated by cities when a need for business model adaptation occurs. Finally, in Annex 3, we describe our analysis concerning the PEPITE scheme, also discussing the potential outputs of the PEPITE scheme for the other work packages. Considering that entrepreneurial experimentation is key in the development of a smart city, we present it as a successful example to be replicated in other cities, especially in FCs.

2. Methodology

In the following development, we explain how we proxy the SBM pillars with TIS functions.

As mentioned above, the TIS methodology is the analytical tool we utilize to analyse the pillar framework. Specifically, relying upon the structure of the questionnaire, we are able to derive both at the ecosystem level, and at the level of transition tracks, the positioning of the various actors with respect to the seven functions. Among the latter, the functions F1, F5 and F7 are the ones which we define "key functions", since they specifically capture the characteristics of the three pillars, allowing to quantitatively analyse the status related to type of innovation, technology readiness level and regulatory framework with a methodology which will be presented below.

In this regard, we document how we set scores for each relevant TIS function, both at the level of the ecosystem and at the level of each transaction tracks and related IS. We further describe how we generate strengths vs weaknesses characterizing SBM, as well as drivers vs barriers in replication. Finally, we exhibit that the type of innovation, proxied by function F1 "Entrepreneurial experimentation and production", somehow drives the success of generating a SBM and spurs replication processes, in all LH and especially in Nice. We thus investigate the factors that tend to increase the quality of entrepreneurial projects in Nice (the probability of being incubated), like the characteristics of the project holder, the characteristics of the team members, and the characteristics of the project. This investigation brings useful information for FCs that need to build inhouse capacities in view of absorbing external knowledge, when replication of IS occurs from LHs to FCs.

2.1. A Sustainable Business Model Dash-board tool: Spider graphs based on the TIS methodology

The analytical tool we utilize in order to design the dashboard is represented by the TIS (Technological Innovation System) methodology. The latter is a tool developed by the University of Utrecht (Hekkert et al., 2011), largely familiar to the University of Gothenburg and the University of Nice (Hekkert et al. 2007; Bergek et al., 2008; Krafft, 2004), and dedicated to the analysis and evaluation of the development of a particular integrated solution in terms of the structures and processes supporting or hindering the latter. One of the major tasks in this regard, involves the identification of the actors and rules that are key in the process of replication. The TIS is based on a set of seven different functions: Entrepreneurial Experimentation and Production (F1); Knowledge Development (F2); Knowledge Exchange (F3); Guidance of Search (F4); Market Formation (F5); Resource Mobilization (F6); Resistance to Change (F7).

As already stressed, among the seven functions, F1, F5 and F7 acquire the highest relevance, since they capture the three pillars of innovation, technology and market maturity, and regulation, constituting the cornerstones for the IRIS Sustainable Business Model (see Tab. 1, and TIS questionnaire in Annex 2, where each respondent is characterized by the IS in which he/she is involved). As a matter of fact, these three functions have been proven to exert a key impact in the evolution of the lighthouse cities considered in the IRIS framework (see D6.1).

Tab. 1 provides a synthetic description for each function, as well as the connection between the key functions with the three pillars.

Tab. 1: Description of the seven functions of the TIS methodology, and how SBM pillars are proxied by F1, F5, and F7 (elaboration from Hekkert et al., 2011).

Function	Noun	Definition	Pillar function
F1	**Entrepreneurial Experimentation and Production**	Dedicated to identifying the initiatives at the local level and the appropriate quantitative and qualitative efforts in respect to the objectives of the LH city. Basically, this function identifies the way in which the local ecosystem innovates and the degree of involvement of the major actors in this innovation process.	Captured by questions (F1 section in the TIS questionnaire) referring explicitly to the degree of innovation, technological breakthroughs, opportunities of technological development, large scale production, and related uncertainties.
F2	**Knowledge Development**	Focused on whether knowledge development is sufficient for the development of the innovation process, and whether the type of knowledge generated, fits with the targeted objectives.	
F3	**Knowledge Exchange**	Investigates if links between science and industry, or users and industry, are effective, and if knowledge exchanges are sufficient across geographical boundaries.	
F4	**Guidance of Search**	Evaluates the presence of a clear vision on how the industry or the market should develop, if the strategy is grounded on a clear policy goal, and if the expectations of the different actors are sufficiently aligned.	
F5	**Market Formation**	Assesses the current and expected size of the market, and if the different actors diverge or converge in future market appraisal	Captured by questions (F5 section in the TIS questionnaire) on market size, expected market size, exploration and long-term opportunities, exploitation and

			short-term opportunities, barriers to development.
F6	**Resource Mobilization**	Focuses on how resources can be included in the project of the ecosystem, and above all if key resources are available within the ecosystem or outside of it	
F7	**Resistance to Change**	Denotes whether there are limits in the development of the project, as this may entail a change of habits in consumption, development and production	Captured by questions (F7 section in the TIS questionnaire) on 'soft regulation' like ethics, standards and behaviors, as well as legal issues or 'hard regulation', such as legislations, intellectual/property rights.

The focus on these three key functions as a proxy of SBM pillars does not necessarily imply to neglect the remaining aspects of the TIS methodology, like F2 knowledge development, F3 knowledge exchange, F4 guidance of search and F6 resource mobilizations. Indeed, these pillars are necessary conditions or inputs that need to be present in view of performing well in terms of F1 entrepreneurial experimentation, F5 market formation, and F7 resistance to change.

With reference to the analysis of functions, in accordance to the TIS methodology, each of the system functions can obtain a score on a 5-point Likert scale range, with 1 representing the worst performance of the ecosystem in that function, while 5, at the opposite, representing the best performance in that function. Specifically, these outcomes reflect the response to the demands of a questionnaire by the various actors, whose response can vary according to an ordinal scale. The spider graph in Fig. 1 helps to visualize this framework for the ecosystem context, with in red an emphasis on the pillar functions F1, F5 and F7.

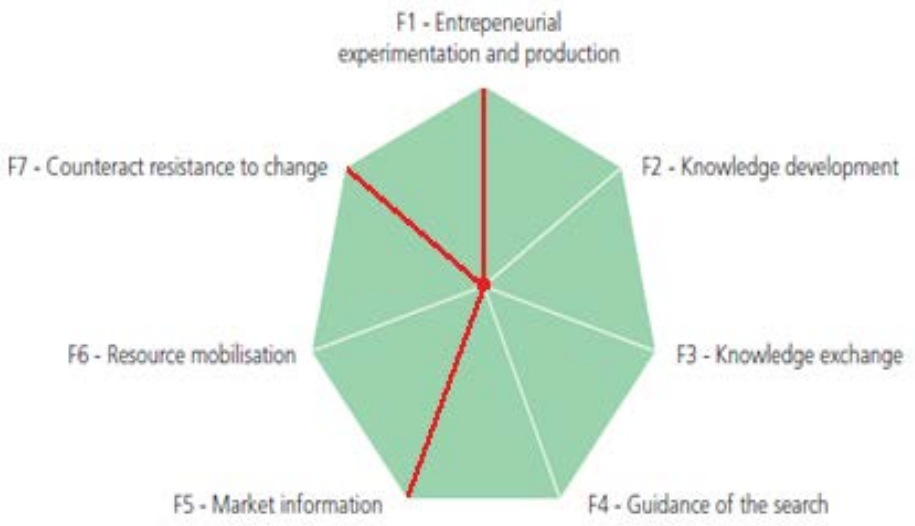


Fig. 1: Overview of functions fulfilment in a spider graph (source: Hekkert et al., 2011).

The KPIs defined in the IRIS project can be integrated in the methodology according to the following table of correspondence (see Tab. 2). It is noteworthy that while F1 Entrepreneurial experimentation refers to one KPI, F5 Market formation and F7 Resistance to change refer each to a pair of KPIs.

For the sake of simplicity, we keep all technical performance within F1, although strictly speaking entrepreneurial experimentation also infringes on economic performance in the TIS framework. As explained above, resistance to change includes indeed both regulatory and legal issues (hard regulation), as well as social issues (soft regulation). Equally, F5 Market formation can be based on a trade-off between bankable solutions and environmental preservation ones. One key example is the second life batteries which cost more than brand new batteries but are more environment friendly. Second life batteries can be profitable only when subsidies by public funds occur.

Tab. 2: Table of correspondence between TIS functions and IRIS KPIs.

TIS functions	IRIS KPIs
F1 – Entrepreneurial experimentation	Technical performance
F5 – Market formation	Economic performance Environmental performance
F7 – Resistance to change	Social performance Legal performance

2.2. Development of the methodology at the level of the ecosystem and transition tracks

Before proceeding with the TIS analysis, a threshold score is set for each function (see D6.1); based on the results obtained from the scores of the LH city emerging from each function in relation to the threshold score, it is possible to derive strengths and/or weaknesses for the local ecosystem of the LH city; subsequently, the related (and potential) presence of the conditions for the emergence of a Sustainable Business Model.

Strength vs weaknesses in LH: emergence vs limits in SBM

Specifically, whenever the LH city scores above the threshold in a certain function, it holds a **strength** in that function, and the conditions present in that function allow the emergence of a SBM. Vice versa, whenever the LH city scores below the threshold in a certain function, it holds a **weakness** in that function, and the current conditions in that function can hinder the SBM to emerge. Following the methodology adopted in the D6.1, we considered the significant thresholds for each function values: a strength will be detected whenever a score is above or equal to 3.5, whereas a weakness will be characterized by a score below or equal to 2.5. A difference of 1 point in the score thus sets the limit between a strength and a weakness.

High/low replication potential in FCs: driver vs barriers

Using the same procedure described above for the computation of the score in LH cities, we consequently derive the values of the scores for the FCs. Subsequently, the score of the LH city is compared to the score obtained by the control group constituted by the FCs in order to investigate the level of replication potential, which can either be expressed as high or low replication potential. Specifically, whenever the FCs have a score below the one of the LH city in a certain function, this means that FCs hold a **high replication potential** in that function, and therefore the premises for the replication process to be implemented from the LH city to the FCs are satisfied. In theoretical terms, FCs should have a high replication potential in one function, which entails a score for FCs not exceeding the magnitude of the score of the LH city for that function. In other words, the FCs may have great potential in a subject encompassed by a certain function, but due to the lack of experience in developing solutions in that field (especially smart solutions) compared to the LH city, the strength of the latter should remain greater than the potential of the FCs. Contrariwise, a **low replication potential** occurs when the control group (here the FCs) gets a score higher than the score of the LH city. This case may occur when the potential of FCs in a solution belonging to a function is reputed so great, that through collaboration with the LH city, the FCs could potentially implement and become better than the latter in developing and sustaining that solution, and therefore the replication process is less beneficial, since FCs are better-off than the LH city for the IS encompassed in that function. This is summarized in Tab. 3.

Tab. 3: Scores, meaning and implications.

Scores	Meaning	Scenarios
High sore of the LH	Strength	Conditions for emergence of a SBM satisfied
Low score of the LH	Weakness	Conditions for emergence of a SBM not satisfied
FC scores below the LH	Under expectation	High replication potential
FC scores above the LH	Over expectation	Low replication potential

The next step of the analysis consists of investigating the replication potential of FCs **at the level of Transition Tracks**. In order to accomplish such a task, we replicate the same methodology for deriving the scores, but here the latter are computed considering not all the responses of the questionnaire (which is the case when considering the overall ecosystem), but just the responses of the questionnaire which specifically address the topics of the five transition tracks. The latter

encompasses all the types of smart city solutions which a follower city will be able to adopt for replication, following the same logic described above. In detail, the five Transition Tracks are: Renewable and energy positive districts (TT1), Flexible energy management and storage (TT2), Intelligent mobility solutions (TT3), Digital transformation and services (TT4), Citizen Engagement and Co-creation (TT5).

Specifically, for LH cities which have already implemented smart solutions, to each TT corresponds a stage of development of technologies, which is identified from the questionnaire as a phase of Pilot/Demonstration/Replication. As for FCs, since the latter have not yet invested in smart solution (compared to LH cities) in the fields encompassed by the Transition Tracks, it is not feasible to talk about stage of development of technologies for TTs as it was performed in the D6.1. On the other hand, the collaboration with the LH cities is expected to allow FCs to get access to technology without developing it by themselves from scratch, with the subsequent aim of reaching a sustainable replication process.

2.3. Structure of the TIS

The implementation of the TIS methodology combines quantitative and qualitative analysis. The former encompasses the derivation of the scores through spider graphs, whereas the latter the attribution of questions to the different transition tracks when investigating the transition track level. As introduced above, with reference to the data source, we derive our information from a questionnaire addressed to the different actors of the ecosystem, which was utilized already in a previous analysis in the D6.1, comparing the local ecosystem of the LH city with the one of another control group[1]. This questionnaire is composed of 58 questions (questionnaire attached in Annex 2), structured into 7 sections corresponding to the 7 functions of the TIS analysis. For each question, the possible answers for each respondent are “Very low, Low, Average, Strong, Very strong” corresponding respectively to a 5-point Likert scale of “1, 2, 3, 4, 5”. After having derived the score for each respondent, the (total) score for each function is then derived as the mean score of the respondents’ scores. This hence gives us a quantitative appraisal of the forces and weaknesses of the local ecosystem under focus.

Specifically, we are considering two local ecosystems. The first one refers to a specific LH city, whereas the second one refers to the group of FCs, as being partners of IRIS they share similar characteristics in terms of replication of integrated solutions[2] we pooled all together. Compared to the analysis carried out in the D6.1 for the same sample of actors for the local ecosystem of the LH city in comparison to other LH cities, the sample for the FCs appeared more reduced. In the light of this, to facilitate the comparison with the sample of actors belonging to the local ecosystem of the LH city, the latter was reduced in size accordingly, although in a way which mirrored the background composition of the actors for the FCs ecosystem (henceforth labelled as the control group).

The analysis we implement consists of two steps. The first step in the analysis is to elaborate the sample and to delimit the structure of the ecosystem for the LH city and the FCs (the latter taken as the control group); this consists in identifying the actors active in it, whose background can either be: entrepreneurial (i.e., firms), academic (i.e., universities) or public (i.e., public agencies). Eventually, a well-balanced sample of respondents for these three categories for both the LH city and the control

group, ensures the robustness of results. The second step is dedicated to the analysis of the expectations, forces and weaknesses internal to the systems of the LH city and FCs, in order to examine the issues of replication and emergence of Sustainable Business Models, to provide guidelines for appropriate policy or strategy making.

Specifically, to go through these two steps, we exploit the information of the questionnaire, with the aim of producing an exhaustive appraisal for the ecosystems of the LH city and of the control group of the FCs. In the end, the comparison between the strengths, weaknesses, and expectations emerging from the analysis will help us to understand a strategy for letting new Sustainable Business Models to emerge, in view of replication plans from each LH city to FCs.

2.4. Description of the questionnaire

The initial quantitative analysis is based on the exploitation of the questionnaire provided to the actors of both the LH city and the control group. The questionnaire is accessible in Annex 2.

The quantitative analysis is generated from a large sample of respondents, according to the TIS standards: 44 in Nice, 19 in Gothenburg, 13 in Utrecht, 12 in FCs (Vaasa, Alexandroupolis, Foscani, Santa Cruz de Tenerife). The overall figures are distributed across the different transition tracks, and each respondent is defined according to his/her main activity with reference to Table 10 of the Grant Agreement.

With reference to the TIS questionnaire, as it was stressed above, the latter has been elaborated in view of collecting data from key actors in the ecosystem of both the LH city and the control group, composing a well-balanced representation of a series of different background.

To comply with an accurate approximation of the SBM pillars – type of innovation, market maturity and TRL, regulatory context – with the TIS functions, we proceeded as follows. We considered that the first pillar, type of innovation, was captured in F1 (Entrepreneurial experimentation and production) by questions referring explicitly to the degree of innovation, technological breakthroughs, opportunities of technological development, large scale production, and related uncertainties. Especially, questions 5 (degree of innovation), 6 (technological breakthroughs), 8 (opportunities of technological development), 9 (large scale production), and 14 (uncertainties) served as reference. The second pillar, technology readiness level and perceived maturity of the market, was covered in F5 (Market formation) by questions on market size, expected market size, exploration and long-term opportunities, exploitation and short-term opportunities, barriers to development. Here, questions 36 (market size), 37 (expected market size), 38 (exploration and long-term opportunities), 39 (exploitation and short-term opportunities), 40 (barriers to development) served as reference. The third pillar, regulatory context, was captured in F7 (Resistance to change) by questions on ‘soft regulation’ like ethics, standards and behaviours, as well as legal issues or ‘hard regulation’, such as legislations, intellectual/property rights. Here, questions 52 (barriers to regulation and legislation), 53 (legislation, industrial/intellectual property rights), 54 (ethics, behaviours) served in the analysis.

We circulated the questionnaire and used different ways to approach top representatives for different types of actors. To contact the actors, we firstly approached them by email and then we followed them up by phone in case we had not received complete information. In both cases, each participant was assured that all answers would have been kept confidential.

3. Dashboard tool

3.1. Results from the TIS methodology

The pillar functions, defined as the SBM pillars proxied by TIS functions we need to look at, and based on which we will elaborate the different scenarios, are F1, F5 and F7, for the both Ecosystem level and Transition Tracks (TT) level.

Based on the TIS methodology described above, the analysis is carried out into two steps; the first one takes the form of a comparison of both ecosystems (LH city vs FCs). The second step takes the form of a comparison, following the same logic, between the LH city and FCs with a focus on each Transition Track (TT) separately. We will consider in the analysis first the city of Nice (from now onwards labelled as LH1), second the city of Utrecht (LH2), and third the city of Gothenburg (LH3).

In absolute terms, as it was previously stressed, the function scores for the LH city represent strengths or weaknesses as a smart city, and the scores for FCs represent the replication potential towards becoming a smart city. Then, by comparing both scores for the same pillar function for each ecosystem, we can thus address different scenarios and identify whether there is a possibility for replication from the LH city to FCs. That said, two different cases can be observed: the case when there is high replication potential; i.e., for the same pillar function, the score for FCs is lower than the one for the LH city; or the case where there is low replication potential, i.e., for the same pillar function, the score for FCs is higher than the one for the LH city.

When aiming to assess whether there will be a replication given a certain level of replication potential, only the comparison of the functions' scores between LH cities and FCs is considered, while the threshold score is not taken into account. Nonetheless, the magnitude of the gap between each LH and the FCs scores and the threshold score can provide some insights on the strength and timing of the replication process. Namely, in case of high replication potential, when the LH presents a strength in a particular function, the replication process to the FCs for that function will occur easily and at a reasonable time; conversely, if for a specific function the LH denotes a weakness, the same replication process will still occur, but will result to be more difficult and more time-demanding, involving that scaling up in districts is a necessary prior step (before replication).

3.1.1. Dashboard tool at the ecosystem level

The application of the TIS methodology for the local ecosystems of the LH city and the control group represents one of the most important steps, since as it was stressed above, it allows to detect which are the crucial patterns enabling the replication of plans from the lighthouse to the follower cities, and hence the conditions allowing the emergence of Sustainable Business Models. Below, the empirical results in relation to each considered lighthouse city are reported.

3.1.1.1 – Nice ecosystem and the FCs

Based on the TIS methodology described in Section 2.1, we produced a dashboard comprehensive of a spider graph for the ecosystem levels (Fig. 2), with the LH1 Nice in blue and the control group comprehensive of the FCs in red. As stressed above, this dashboard designed from such methodology allows to evaluate in which functions the LH1 city presents strengths, and in which functions it presents weaknesses. The scores for the same functions are then utilized to see the level of replication potential in the replication strategy deriving from the control group. Specifically, a low replication potential materializes whenever the red line exceeds the blue line, and an high replication potential in the opposite case (blue line exceeding the red line).

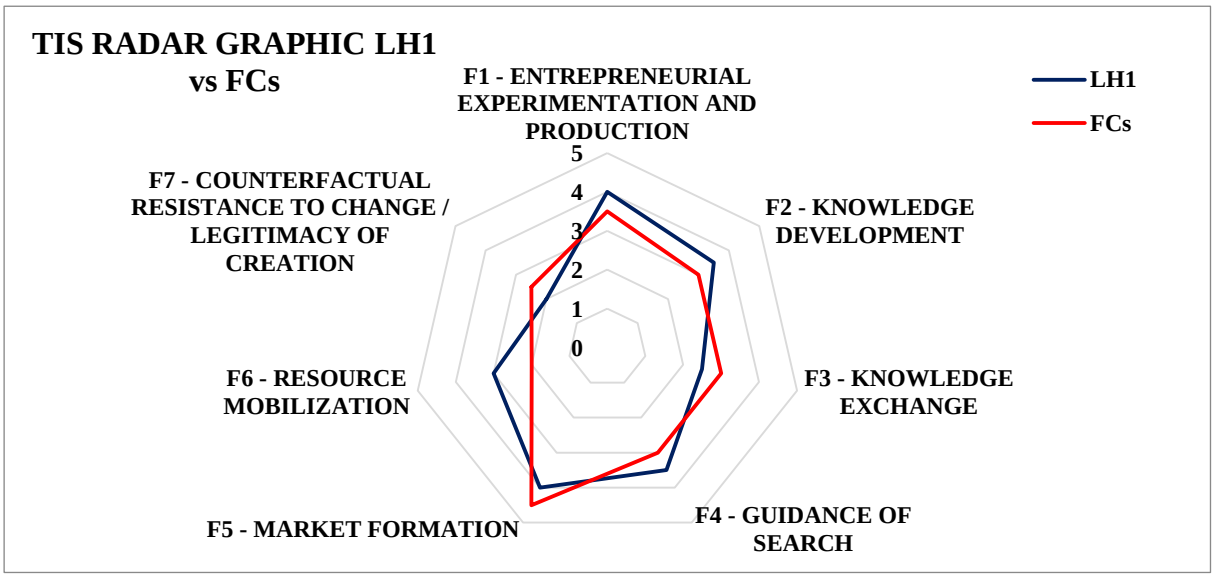


Fig. 2: Spider graph for ecosystem LH1 and the FCs as a control group.

Within this context, special reference is attributed to the functions F1 (entrepreneurial experimentation), F5 (market formation), and F7 (resistance to change), i.e. the pillars of a SBM.

Trying firstly to assess the strengths and weaknesses of the LH1 city, we compare the score thresholds to the score obtained for each function: a strength will hence be detected whenever a score is above or equal to 3.5, whereas a weakness will be characterized by a score below or equal to 2.5. A difference of 1 point in the score thus sets the limit between a strength and a weakness.

When we compare the respective scores of the ecosystems with the threshold for the functions F1, F5 and F7, we find that F1 and F5 represent strengths and F7 a weakness. Subsequently, by comparing both ecosystems, we assess whether there are opportunities for replication from the LH1 city to FCs, considering the level of replication potential within the FCs. By comparing both scores of the LH1 city and FCs for the same function, we find that for F1 there is an opportunity for a replication process from the LH1 city to FCs coupled with a high replication potential in FCs. Whereas for F5 and F7, there are less opportunities of replication from the LH1 city to FCs, as we observe low replication potential in FCs. Tab. 4 summarizes the main results of the pillar functions for both the LH1 city and FCs, with corresponding actions: replication (R), or prior scaling up in districts (S).

Tab. 4: Nice ecosystem pillar functions scores: possibility of replication in green, barriers to replication in orange.

Pillar Functions / Ecosystems	F1	F5	F7
LH1	4	4	2
FCs	3,5	4,5	2,5
Guidelines for action	R	S	S

Then, if we extend the scope of our observations to consider all dimensions in Fig. 2, it emerges how the LH1 city presents a strength in all functions, with the exception of F3, F6 and F7. This involves a strength in two (F1 and F5) out of three pillar functions. These results provide useful information that were already identified in the D6.1. The LH1 city can indeed be seen as a showcase of Entrepreneurial Experimentation (F1) and Knowledge Creation (F2) in the domain of Smart Cities, together with the LH1 city as having a solid vision of Market Opportunities (F5). The LH1 city also benefits of a strong alignment and coordination among actors and Guidance of Search (F4) from public actors in charge of the development of the Smart City. On the other hand, the LH1 city also exhibits weaknesses, as some limits may occur in the Mobilization of human and financial Resources (F6) whenever the expected entrepreneurial demonstration, market formation and knowledge stimulation are high. We also reported some Resistance to Change (F7) at the organizational level, as Smart City issues involve a transversal approach which may not appear in current vertical/silos structures of local actors. Resistance to Change can also echo a limited ability or motivation of consumers and end users to adopt new solutions in energy, mobility and ICT.

With reference to the control group, we observe a high level of replication potential for F1, F2, F4 and F6, but not for F3, F5 and F7. Specifically, FCs seem to withhold a great potential in the definition of Market Opportunities, as captured by the strong score of the pillar function F5. This actually appears as an interesting insight, since with proper collaboration with the LH1 city, a greater alignment in market formation should be generated, taking into consideration the plans of both LH1 and the FCs in the identification of market opportunities. The same result can be observed, even though in a minor extent, with reference to F7. In the end, these results involve useful information, since they allow to identify well in advance potential barriers in the replication process from the LH1 city to the follower cities, and thus possible limits to be removed in the definition of a SBM for LH1 through increased scaling up in districts. In addition, a perceived low replication potential in knowledge exchange (F3) emerging from this analysis, may further contribute to foster this result.

3.1.1.2 – Utrecht ecosystem and the FCs

Following the same logic adopted in the previous section, the graph in Fig. 3 comprehends the spider graph of both LH2 and FCs at ecosystem levels. The LH2 city is in green line, whereas FCs remain in red line.

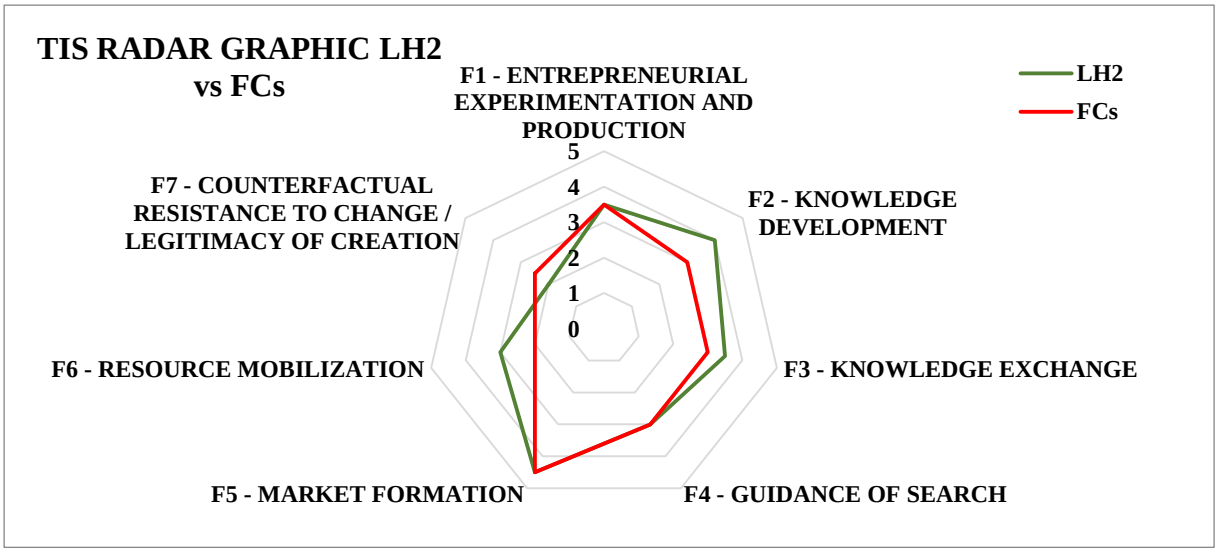


Fig. 3: Spider graph for ecosystem LH2 and the FCs as a control group.

From the graph above, when comparing the scores of the F1, F5 and F7 functions with the thresholds, we find quite similar results with respect to LH1. Indeed, we find that F1 and F5 represent strengths and F7 a weakness.

In a similar fashion, by comparing both ecosystems, it is possible to anticipate whether there can be replication from the LH2 city to FCs, considering the forces and weaknesses of the LH city and the level of replication potential in the FCs.

By comparing both scores of the LH2 and FCs for the same function, we find that the scores of LH2 and FCs for F1 and F5 coincide. The two scores, being equal and higher than the threshold for F1 and F5, respectively, denote in both cases a possibility of replication from LH2 to FCs, this process being more promising regarding F5. Conversely, with reference to F7, FCs denote a higher score than LH2; therefore, in this case, there is no immediate replication feasible from the LH2 to FCs, with a score representing a weakness for LH2 (scaling up in districts required for LH2) and given low replication potential in FCs.

Overall, LH2 seems to have potential for replication in the pillar functions F1, and F5, but at the same time, more potential for replication in other functions, especially in F2 and F3. The latter respectively capture Knowledge Development and Knowledge Exchange, which compared to LH1, appear to be significantly stronger and more developed, so to offer a greater potential for replication to FCs.

Tab. 5: Utrecht ecosystems pillar functions scores: replication in green, barriers to replication in orange.

Pillar Functions / Ecosystems	F1	F5	F7
LH2	3,5	4,5	2
FCs	3,5	4,5	2,5
Guidelines for action	R	R	S

4.1.1.3 – Gothenburg ecosystem and the FCs

For LH3, the graph in Fig. 4 always comprehends the spider graph for both LH3 and FCs at the ecosystem levels. The colour for the LH3 city is in yellow, whereas for FCs it remains in red.

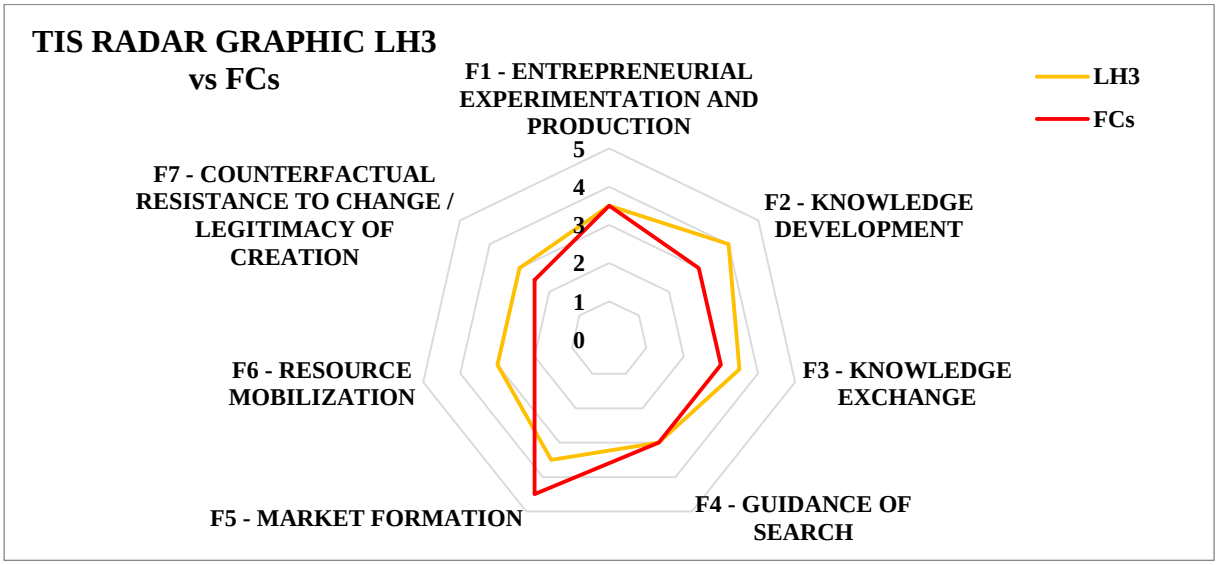


Fig. 4: Spider graph for ecosystem LH3 and the FCs as a control group.

From the graph above, when comparing the scores of the F1, F5 and F7 functions with the thresholds, we also find in this case quite similar results with respect to LH1 and LH2. Indeed, we find that F1 and F5 represent strengths and F7 a weakness. In a similar fashion, by comparing both ecosystems, it is possible to anticipate whether there can be replication from the LH3 city to FCs, considering the forces and weaknesses of the LH city and the replication potential in the FCs. By comparing both scores of the LH3 and FCs for the same function, we find that the scores of LH3 and FCs for F1 coincide. On the other hand, the comparison between the scores for F5 and F7 reveals that the score of F5 for LH3 is inferior to the one of FCs, while the score of F7 for LH3 is superior to the one for FCs. This denotes that there is a possibility for replication for F1 from LH3 to FCs, and a minor replication possibility for F7 from LH3 to FCs, since the score for this function represents a weakness for LH3. Finally, a no potential for immediate replication emerges regarding F5, given a higher score for this function for FCs than the one for LH3, in light of a high level of low replication potential in FCs. Tab. 6 summarizes the main results of the pillar functions for both the LH2 city and FCs, with guidelines on replication (R) and scaling up (S).

Tab. 6: Gothenburg ecosystems pillar functions scores: replication in green, barriers to replication in orange.

Pillar Functions / Ecosystems	F1	F5	F7
LH3	3,5	3,5	3
FCs	3,5	4,5	2,5
Guidelines for action	R	S	R

Overall, comparing the analysis at the ecosystem level between LH1, LH2 and LH3, it is possible to observe first of all how LH1 denotes a higher strength level regarding the entrepreneurial experimentation and production (captured by F1) with respect to the other LH cities. On the other hand, regarding Marker formation, captured by F5, LH2 seems to perform better than LH1 and LH3, posing the basis for the emergence of an SBM and a replication process to FCs. Finally, as for Resistance to Change, captured by F7, although the three function scores of the three LH cities represent weakness, LH3 seems to hold the highest value score compared to LH1 and LH2; nonetheless, this looks favourable to the emergence of a SBM only in the medium (to long) term with prior efforts in scaling up the solutions in districts.

3.1.2. Dashboard tool at the transition track level

3.1.2.1 – Nice Transition Tracks and FCs

The same methodology implemented at the local ecosystem level was implemented at the Transition Track (TT) level. Accordingly, five spider graphs (one for each Transition Track) were produced for each TT, identifying strengths and weaknesses for the LH1 city in terms of IS adopted in relation to each function (blue line), and the replication potential in FCs (red line). The same logic and structure of the previous analysis carried out at the ecosystem level hence applies. Below, the related spider graphs for each TT (Figs. 5 - 9).

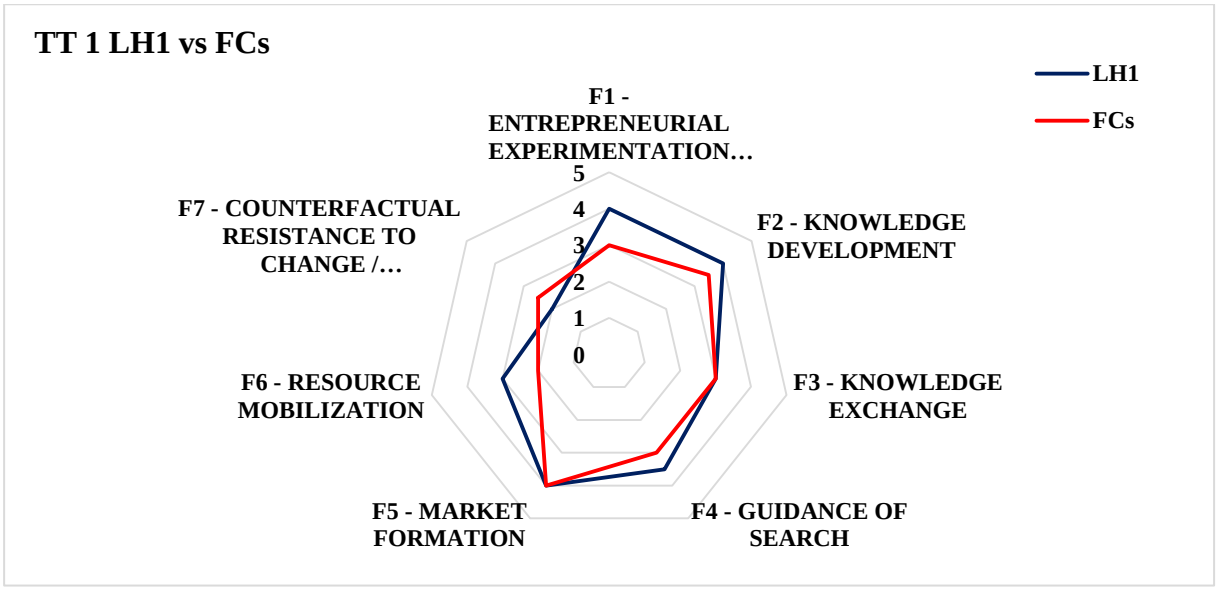


Fig. 5: Spider graph TT1 for LH1 city and the FCs as a control group.

By comparing the pillar functions' scores for each Transition Track of the LH1 city with the thresholds, we can identify, for the LH1 city, F1 and F5 as strengths and F7 as a weakness. Then, it is possible to observe how for F1 and F5 there are opportunities for replication from the LH1 city to FCs, with a high replication potential in F1 in FCs and a higher level of replication potential with respect to F5 (since with reference to F5, both scores are remarkably high but identical). As regard F7, there is conversely no opportunity for replication from the LH1 city to FCs (without prior efforts in scaling up) given a low replication potential for the latter. Tab. 7 summarizes the results of the pillar functions related to TT1 (Renewable and energy positive districts) for both the LH1 city and FCs.

Tab. 7: Nice pillar functions scores for TT1: replication in green, barriers to replication in orange.

Pillar Functions / Ecosystems	F1	F5	F7
the LH1	4	4	2
FCs	3	4	2,5
Guidelines for action	R	R	S

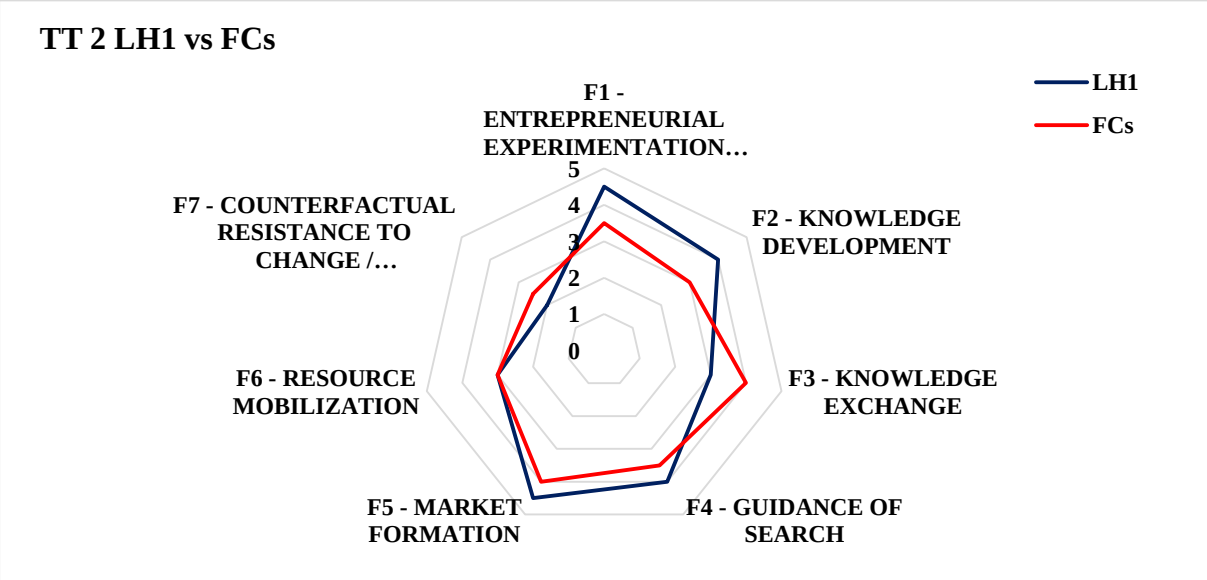


Fig. 6: Spider graph TT2 for LH1 city and the FCs as a control group.

By comparing pillar functions' scores related to TT2 (Flexible energy management and storage) of the LH1 city with the thresholds, we find that both F1 and F5 represent strengths, whereas F7 a weakness. Then, by comparing both scores for the same pillar function related to TT2, for both the LH1 city and FCs, F1 and F5 are identified as presenting opportunities for replication from the LH1 city to FCs with high replication potential for the latter (as the scores for the LH1 city are superior to the ones for FCs). Conversely, F7 does not provide good opportunities for replication from the LH1 city to FCs (scaling up is required as a prior step towards replication) given low replication potential in FCs. Tab. 8 summarizes the results related to TT2 for both the LH1 city and FCs.

Tab. 8: Nice pillar functions scores for TT2: replication in green, barriers to replication in orange.

Pillar Functions / Ecosystems	F1	F5	F7
the LH1	4,5	4,5	2
FCs	3,5	4	2,5
Guidelines for action	R	R	S

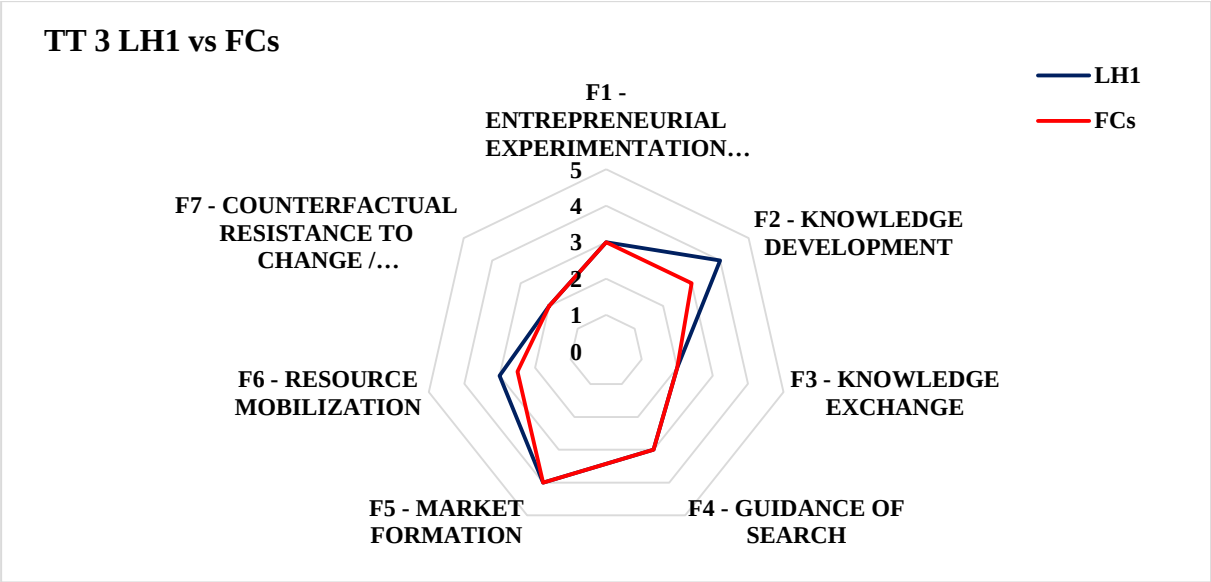


Fig. 7: Spider graph TT3 for the LH1 city and the FCs as a control group.

Regarding TT3 (Intelligent mobility solutions), by comparing the pillar functions' scores for the LH1 city with the thresholds, F1 and F7 are identified as weaknesses, while F5 as a strength.

By comparing pillar functions' scores between the LH1 city and FCs for TT3, F1 and F7 provide a weak opportunity for replication from the LH1 city to FCs. On the other hand, as for F5, there is a greater opportunity for replication from the LH1 city to FCs with a rather good level of replication potential in FCs, as both scores for this pillar function are equal and high.

Tab. 9 summarizes the results related to TT3 for both the LH1 city and FCs.

Tab. 9: Nice pillar functions scores for TT3: replication in green, barriers to replication in orange.

Pillar Functions / Ecosystems	F1	F5	F7
LH1	3	4	2
FCs	3	4	2
Guidelines for action	R	R	R

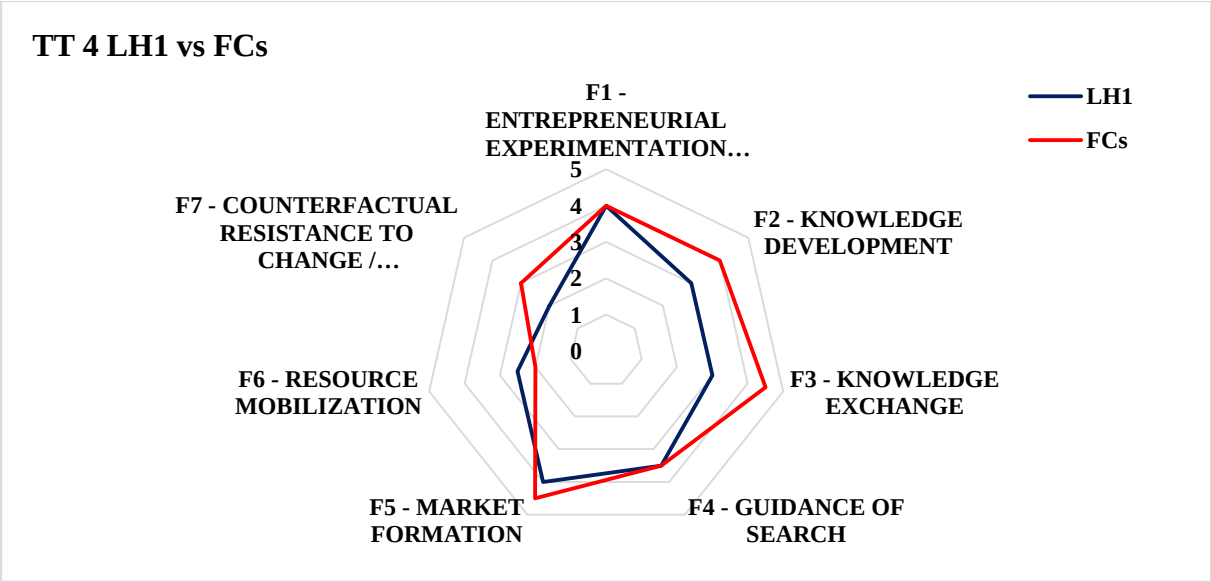


Fig. 8: Spider graph TT4 for LH1 city and the FCs as a control group.

For TT4 (Digital transformation and services), by comparing pillar functions' scores for the LH1 city with the thresholds, both F1 and F5 are identified as strengths, while F7 is a weakness.

Then, by comparing the pillar functions' scores for both the LH1 city and FCs, we find that F1 provides an opportunity for replication from the LH1 city to FCs, coupled with replication potential by the latter, as both scores of this pillar function are equal and remarkably high.

On the other hand, for F5 and F7, there is a weak opportunity for replication from the LH1 city to FCs, coupled with an low replication potential in both function scores by the latter, since the scores obtained by FCs for F5 and F7 are superior to the ones obtained for the LH1 city.

Tab. 10 summarizes the results related to TT4 for both the LH1 city and FCs.

Tab. 10: Nice pillar function scores for TT4: replication in green, barriers to replication in orange.

Pillar Functions / Ecosystems	F1	F5	F7
LH1	4	4	2
FCs	4	4,5	3
Guidelines for action	R	S	S

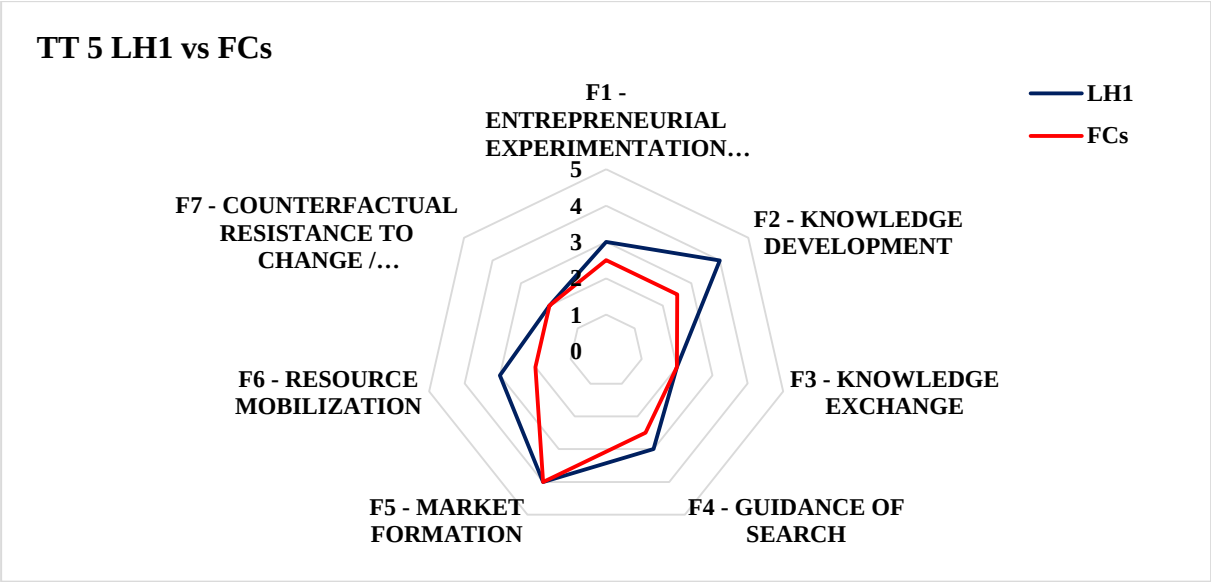


Fig. 9: Spider graph TT5 for the LH1 city and the FCs as a control group.

Regarding TT5 (Citizen Engagement and Co-creation), while comparing pillar functions' scores for the LH1 city with the thresholds, both F1 and F7 represent weaknesses, while F5 represents a strength. Then, by comparing the pillar functions' scores for both the LH1 city and FCs, it is possible to observe how F1 does provide an opportunity for replication from the LH1 city to FCs, coupled with higher replication potential by the latter, given that the F1 score for FCs is inferior to the one of the LH1 city. Regarding F5, there is as well a possibility for replication from the LH1 city to FCs, coupled with a high level of replication by the latter, as both scores for the pillar function F5 are equal and high. Lastly, F7 represents a particular case as both scores for this pillar function are equal and low, entailing a weak opportunity for replication. Tab. 11 summarizes the results related to TT5 for both the LH1 city and FCs.

Tab. 11: Nice pillar functions scores for TT5: replication in green, barriers to replication in orange.

Pillar Functions / Ecosystems	F1	F5	F7
LH1	3	4	2
FCs	2,5	4	2
Guidelines for action	R	R	R

To sum up, with reference to the LH1 city, it is possible to observe that Transition Tracks converge in displaying a notable strength in Entrepreneurial Experimentation (F1), Knowledge Creation (F2), Guidance of Search (F4) and Market Formation (F5), since these functions get 3 to 5 times, across the different Transition Tracks, a score above or equal to 3.5. On the other hand, the function Knowledge Exchange (F3) never obtains a score higher than 3, thus denoting a relatively widespread incapability, for LH1, to exploit its full potential in implementing IS with reference to activities involving knowledge dissemination. On the weaknesses side, a significant number of Transition Tracks tend to include Resistance to Change (F7) as a barrier, as this function gets less than 2.5 in score each time.

Finally, the two Transition Tracks of Knowledge Exchange (F3) and Resource Mobilization (F6) also score equal or less than 3 in most TTs, meaning that these functions represent notable weaknesses for LH1.

On the other hand, interesting results emerge when considering the control group of follower cities. Indeed, for the latter, the level of replication potential in FCs is bounded by the blue line of the LH1 city for mainly all the Transition Tracks with the exception of TT4. Particularly, for TT4, the level of replication potential of the control group exceeds the strength of the LH1 city in 4 over 7 functions, and in 2 pillar functions (F5 and F7, respectively). This trend provides an additional and useful source of information, because it entails that, on average, the perceived potential of FCs, for which they might have strong replication power for the emergence of Sustainable Business Models, involves the field of Digital transformation and services. Thus, it appears that the City Innovation Platform (an IT-driven domain) can represent a main source of potential for follower cities, for which the replication of IS and the emergence of Sustainable Business Models appears to be more feasible and likely to happen with respect to the other domains (related to the fields of energy and mobility). In fact, low replication potential also emerges with reference to one function (F7) for both TT1 and TT2, but these gaps with the LH1 city are relatively more reduced. Always for TT2, low replication potential emerges with reference to F3, thus denoting a substantial gap with the LH1 city. The wider gaps in terms of replication potential, however, emerge when considering the TT4, especially when considering, also in this case, F3. A similar trend to TT4 appears when considering the spider graph for the ecosystem level. Ultimately, these results eventually confirm the fact that follower cities seem to possess great potential in Knowledge Development strategies.

3.1.2.2- Utrecht Transition Tracks and FCs

The same methodology is applied in this section in order to compare LH2 and FCs, considering each transition track.

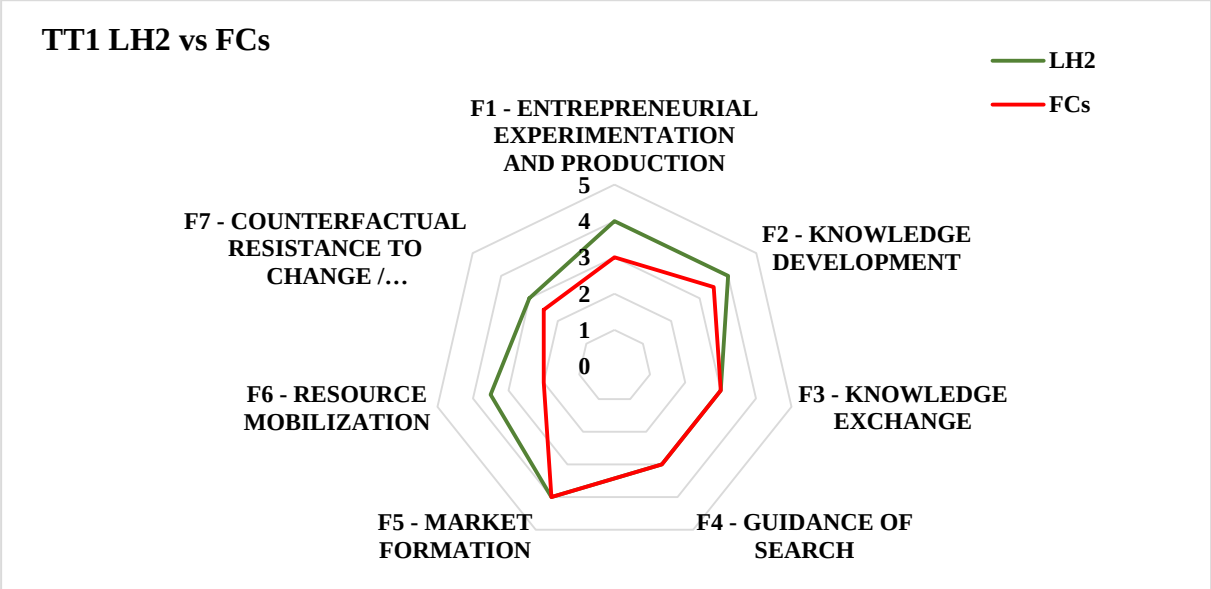


Fig. 10: Spider graphTT1 for LH2 and FCs as a control group.

Regarding the TT1 (Renewable and energy positive districts), while comparing the key functions' scores of LH2 with the thresholds, both F1 and F5 represent a strength, whereas F7 denotes a weakness. Subsequently, by comparing the scores of LH2 and FCs, it is possible to observe how the three key functions (F1, F5 and F7) represent opportunities for replication of the SBM from LH2 city to FCs. These opportunities of replication are particularly noticeable with regard to pillar functions F1 and F5, where the level of replication potential is remarkable for F1 and remains at a good level for F5, as both scores are equal and superior to the threshold and to the scores obtained for FCs for the same pillar functions. On the other hand, for F7 the replication possibility remains weaker, as the score for the LH2 city represents a weakness. Tab. 12 summarizes the results of the pillar functions' scores related to TT1, for both LH2 and FCs.

Tab. 12: TT1 pillar functions scores: replication in green, barriers to replication in orange.

Pillar Functions / Ecosystems	F1	F5	F7
LH2	4	4	3
FCs	3	4	2,5
Guidelines for action	R	R	R

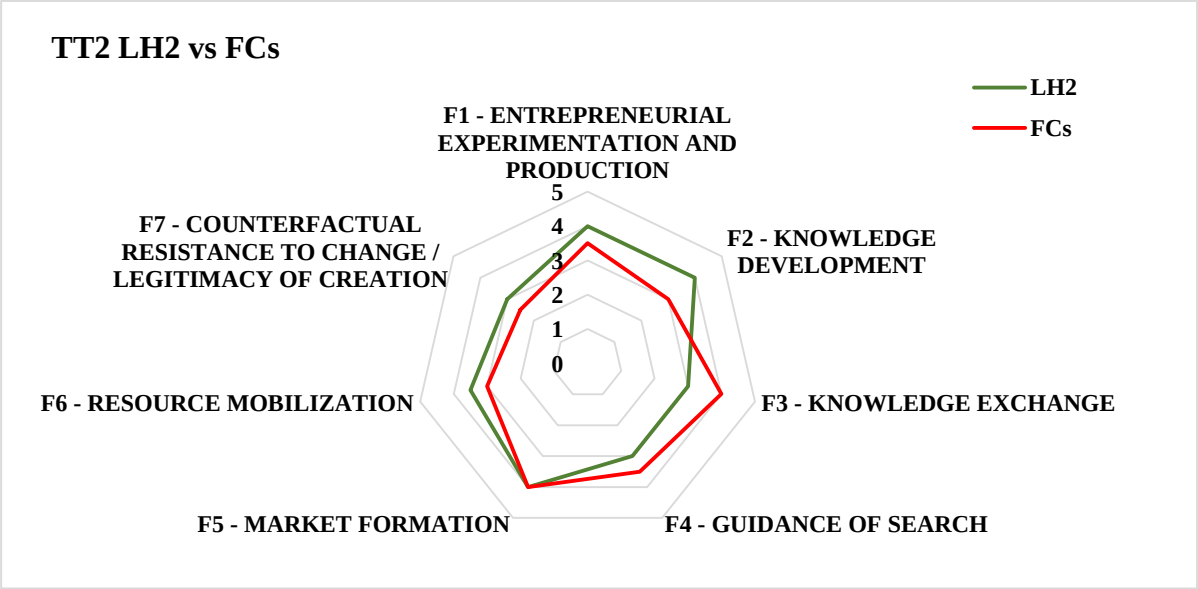


Fig. 11: Spider graph TT2 for LH2 and FCs as a control group.

Regarding TT2 (Flexible energy management and storage), both F1 and F5 represent strengths when we compare these two pillar functions' scores with the thresholds. Conversely, F7 represents a weakness. When comparing both scores of the same pillar functions for both LH2 and FCs, three of these pillar functions represent opportunities for replication of the SBM from LH2 to FCs, with a minor replication possibility for F7, as the related score for LH2 represents a weakness. That said, these possibilities are linked with high replication potential for F1 and F7, and even higher replication potential for F5. Tab. 13 summarizes the results of the pillar functions' scores related to TT2, for both LH2 and FCs.

Tab. 13: TT2 pillar functions scores: replication in green, barriers to replication in orange.

Pillar Functions / Ecosystems	F1	F5	F7
LH2	4	4	3
FCs	3,5	4	2,5
Guidelines for action	R	R	R

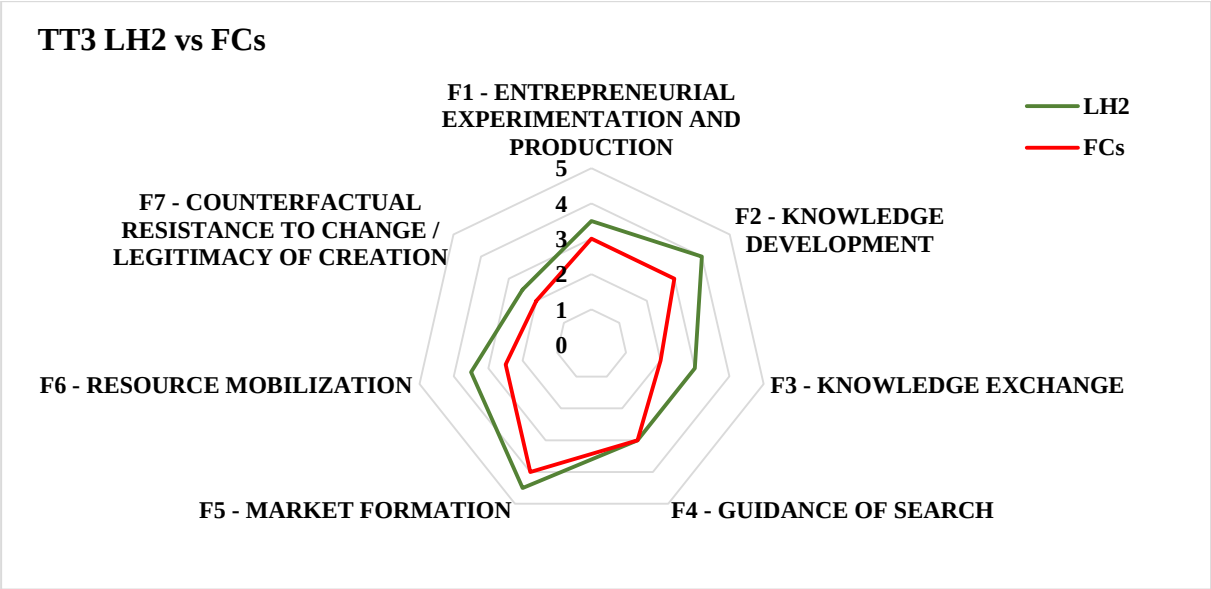


Fig. 12: Spider graph TT3 for LH2 and FCs as a control group.

When comparing pillar functions' scores for LH2 related to TT3 (Intelligent mobility solutions) with the thresholds, F1 and F5 are identified as strengths, while F7 as a weakness.

On the other hand, in comparing both scores for the same pillar functions, three of them represent opportunities for replication of the SBM from LH2 to FCs, with a minor replication possibility for F7, as the latter represents a weakness for LH2.

These possibilities are coupled with high replication potential in FCs in each of the three pillar functions.

Tab. 14 summarizes the results of the pillar functions' scores related to TT3, for both LH2 and FCs.

Tab. 14: TT3 pillar functions scores: replication in green, barriers to replication in orange.

Pillar Functions / Ecosystems	F1	F5	F7
LH2	3,5	4,5	2,5
FCs	3	4	2

Guidelines for action	R	R	R

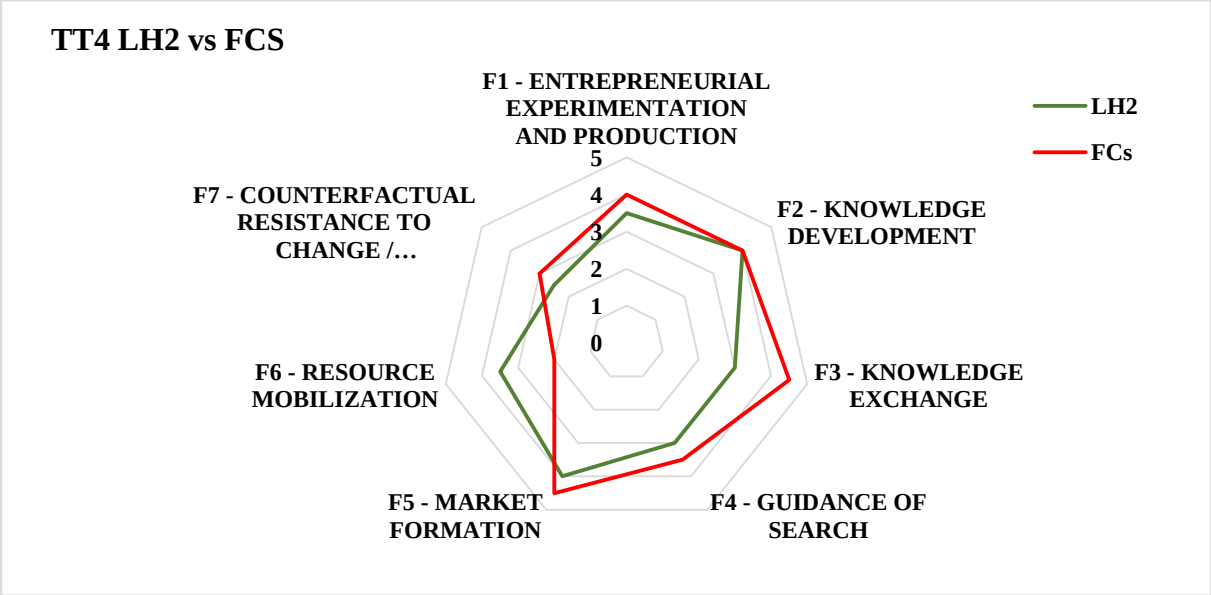


Fig. 13: TT4 spider graph for LH2 and FCs as a control group.

When comparing the functions' scores for LH2 related to TT4 (Digital transformation and services) with the thresholds, both F1 and F5 are identified as strengths, whereas F7 represents a weakness.

Comparing the pillar functions' scores reveals that regarding this TT, no function represents an opportunity for replication from LH2 to FCs, given the low level of replication potential in FCs for each of the three pillar functions.

Tab. 15 summarizes the results of the pillar functions' scores related to TT4, for both LH2 and FCs.

Tab. 15: TT4 pillar functions scores: replication in green, barriers to replication in orange.

Pillar Functions / Ecosystems	F1	F5	F7
LH2	3,5	4	2,5
FCs	4	4,5	3
Guidelines for action	S	S	S

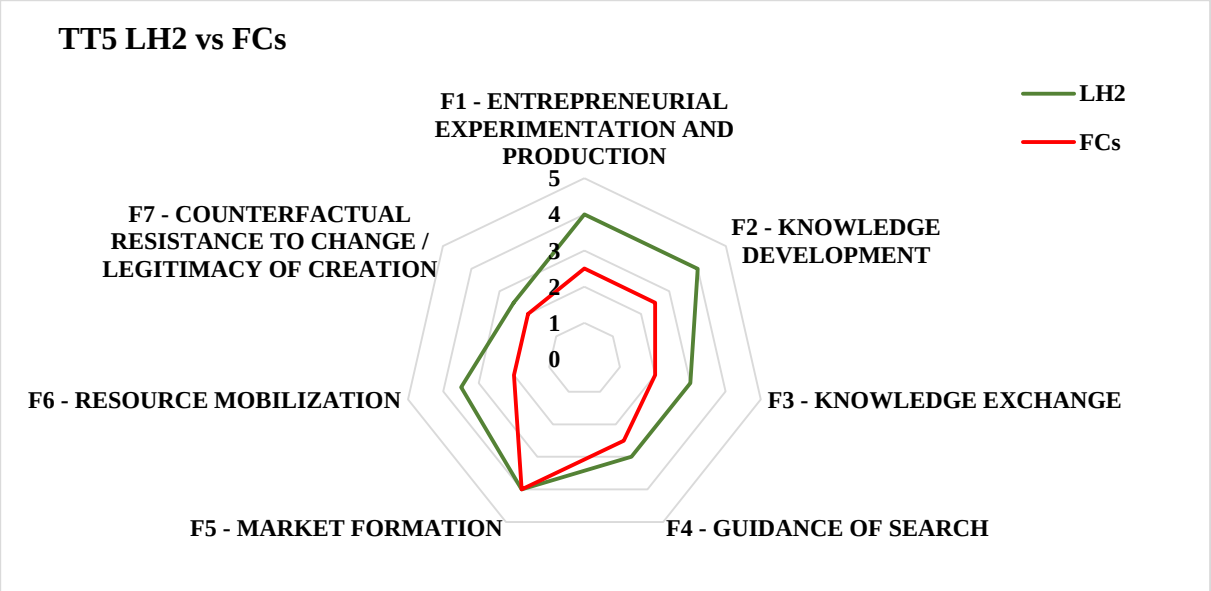


Fig. 14: TT5 spider graph for LH2 and FCs as a control group.

Finally, with reference to TT5 (Citizen Engagement and Co-creation), while comparing the pillar functions' scores of LH2 with the thresholds, three of the pillar functions, F1 and F5, are identified as strengths, while F7 represents a weakness. Subsequently, in comparing the functions' scores, all the three pillar functions provide a possibility for replication from LH2 to FCs. That said, the replication possibility remains weaker with reference to F7, the latter representing a weakness for LH2. For each pillar function, FCs denote high replication potential. Tab. 16 summarizes the pillar functions' results for both LH2 and FCs related to TT5.

Tab. 16: TT5 pillar functions scores: replication in green, barriers to replication in orange.

Pillar Functions / Ecosystems	F1	F5	F7
LH2	4	4	2,5
FCs	2,5	4	2
Guidelines for action	R	R	R

3.1.2.3- Gothenburg Transition Tracks and FCs

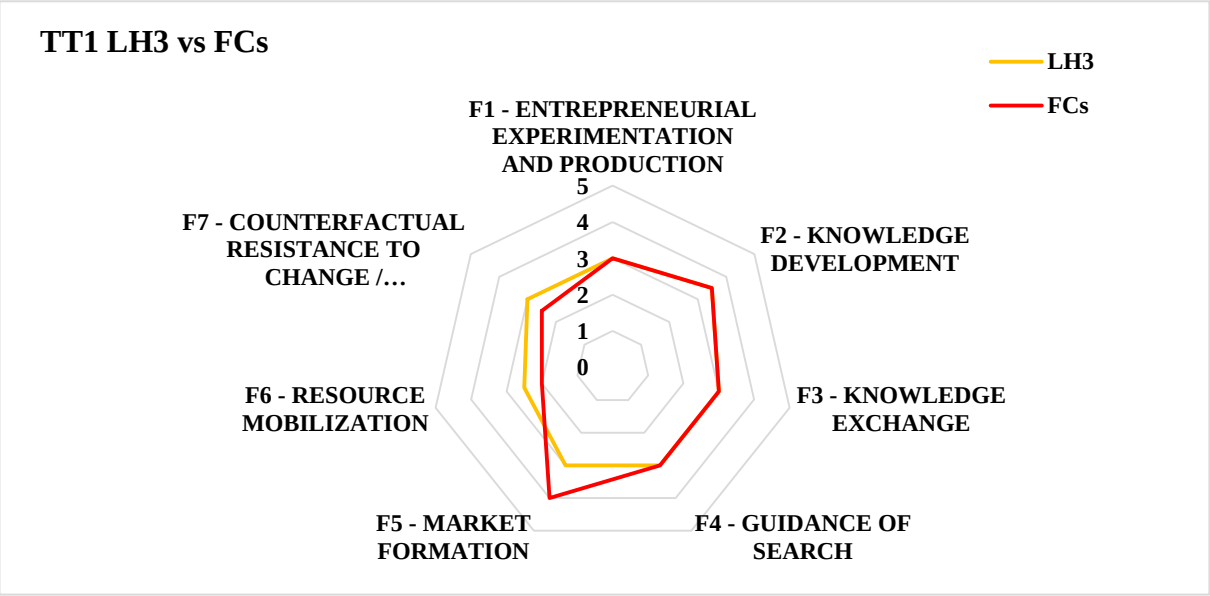


Fig. 15: Spider graphTT1 for LH3 and FCs as a control group.

With reference to LH3, when considering TT1 (Renewable and energy positive districts), in comparing the pillar functions' scores for LH3 with the thresholds, all the three pillar functions, F1, F5 and F7, denote weaknesses. On the other hand, while comparing the same pillar functions' scores for LH3 and FCs, F1 and F7 provide opportunities for replication from LH3 to FCs, but such a replication remains weak, given that the related scores of F1 and F7 both denote weaknesses for LH3. Conversely, F5 does not provide an opportunity for short term replication, since the score for LH3 is lower than the one for FCs, thus denoting low replication potential in FCs. Tab. 17 summarizes the pillar functions' results for both LH3 and FCs related to TT1.

Tab. 17: TT1 pillar functions scores: replication in green, barriers to replication in orange.

Pillar Functions / Ecosystems	F1	F5	F7
LH3	3	3	3
FCs	3	4	2,5
Guidelines for action	R	S	R

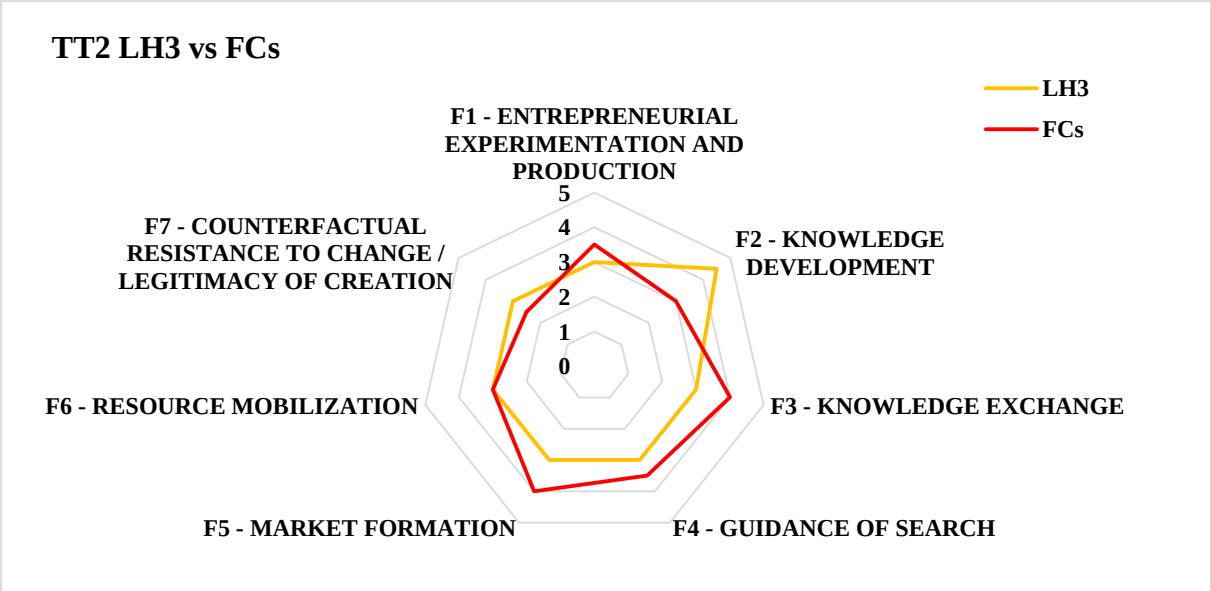


Fig. 16: Spider graphTT2 for LH3 and FCs as a control group.

Focusing on the TT2 (Flexible energy management and storage), when comparing the functions' scores for LH3 with thresholds, all the three pillar functions, F1, F5 and F7, denote weaknesses. When comparing the scores of the pillar functions of LH3 and FCs, neither F1 nor F5 provide opportunities for immediate replication from LH3 to FCs, the latter holding low replication potential in those two pillar functions. However, a possibility for replication emerges when considering F7, for which FCs present high replication potential; nonetheless, considering the weakness for LH3 in relation to F7, such a replication appears to be weak. Tab. 18 summarizes the pillar functions' results for both LH3 and FCs related to TT2.

Tab. 18: TT2 pillar functions scores: replication in green, barriers to replication in orange.

Pillar Functions / Ecosystems	F1	F5	F7
LH3	3	3	3
FCs	3,5	4	2,5
Guidelines for action	S	S	R

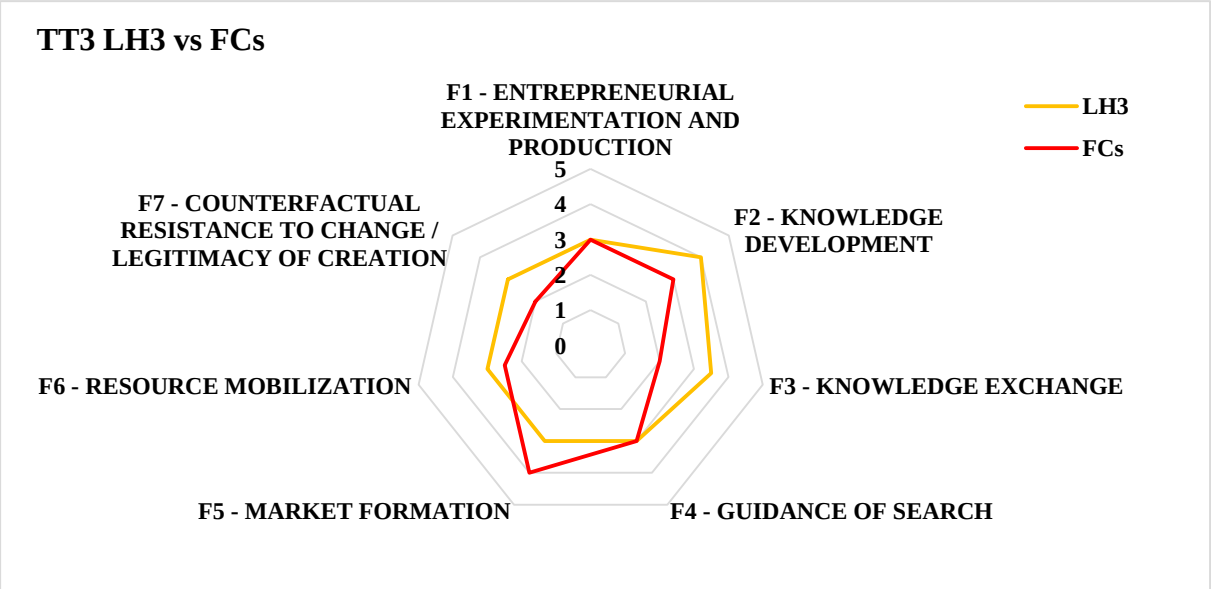


Fig. 17: Spider graphTT3 for LH3 and FCs as a control group.

Regarding TT3 (Intelligent mobility solutions), when comparing the pillar functions' scores for LH3 with the thresholds, all the three pillar functions, F1, F5 and F7, denote weaknesses for LH3. Then, when in comparing the scores for LH3 and FCs for each pillar function, both F1 and F7 provide opportunities for replication from LH3 to FCs, with a minor replication potential for the former. With reference to F5, no replication possibility is provided, since the score for this function is remarkably lower for LH3 than for FCs, thus denoting a low level of replication potential in FCs. Tab. 19 summarizes the pillar functions' results for both LH3 and FCs related to TT3.

Tab. 19: TT3 pillar functions scores: replication in green, barriers to replication in orange.

Pillar Functions / Ecosystems	F1	F5	F7
LH3	3	3	3
FCs	3	4	2
Guidelines for action	R	S	R

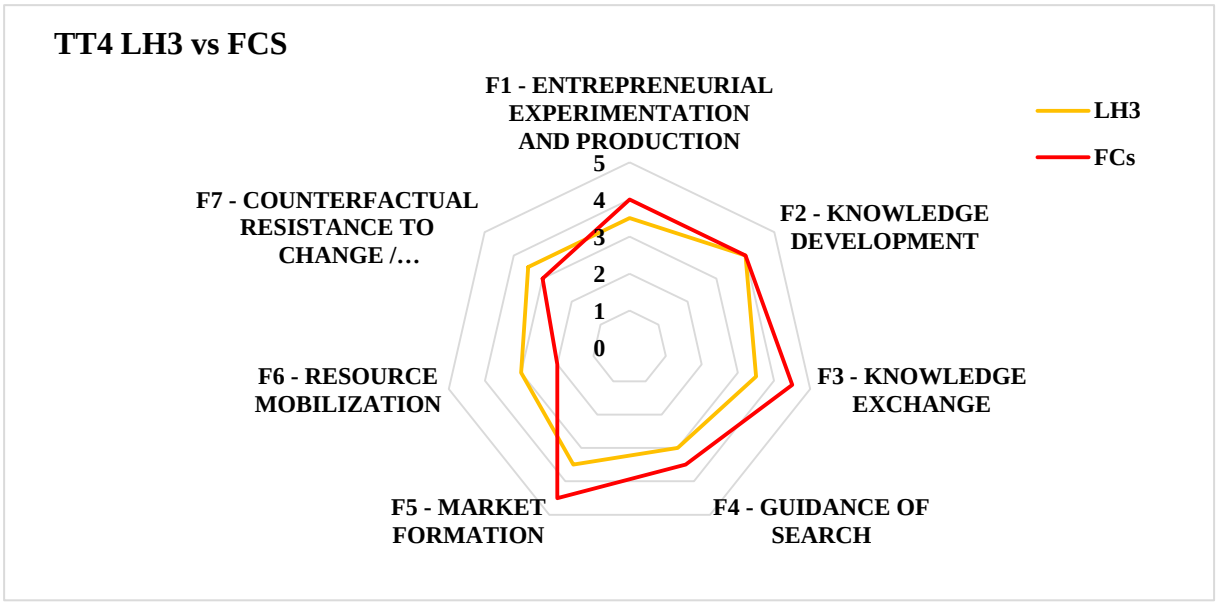


Fig. 18: Spider graphTT4 for LH3 and FCs as a control group.

Regarding TT4 (Digital transformation and services), comparing the pillar functions' scores for LH3 with the thresholds reveals that all the three functions denote a strength. Then, when comparing both scores for the same pillar function for LH3 and FCs, neither F1 nor F5 provide possibilities for replication from LH3 to FCs, given a low replication potential in FCs in these functions. Conversely, F7 seems to provide an opportunity for replication, being the score of FCs for F7 inferior to the corresponding score for LH3. Tab. 20 summarizes the pillar functions' results for both LH3 and FCs related to TT4.

Tab. 20: TT4 pillar functions scores: replication in green, barriers to replication in orange.

Pillar Functions / Ecosystems	F1	F5	F7
LH3	3,5	3,5	3,5
FCs	4	4,5	3
Guidelines for action	S	S	R

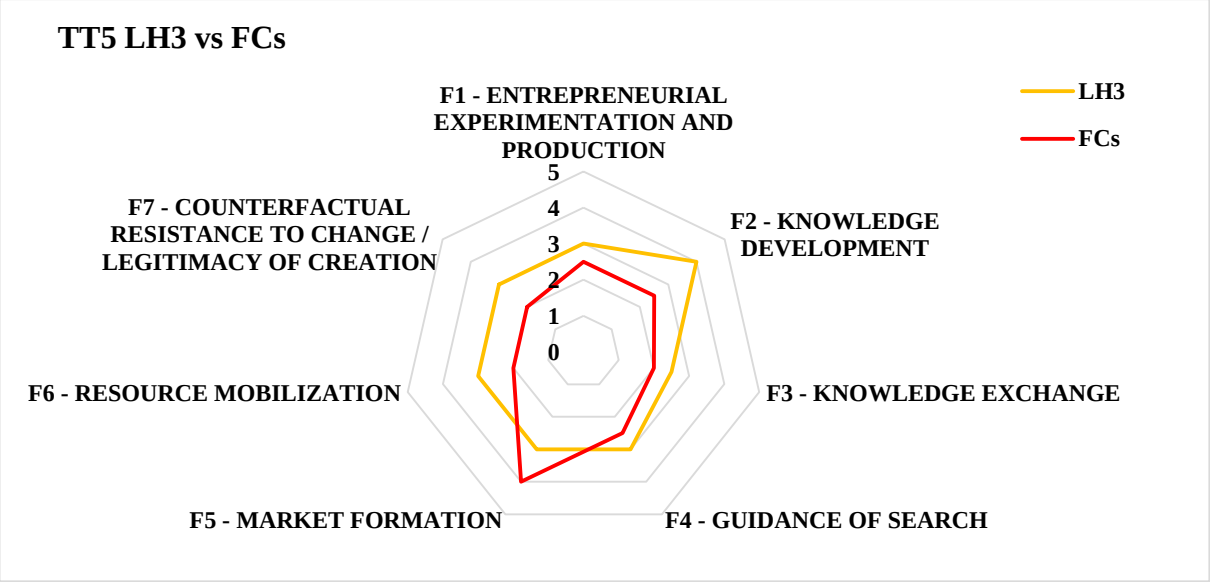


Fig. 19: Spider graphTT5 for LH3 and FCs as a control group.

Finally, regarding the TT5 (Citizen Engagement and Co-creation), when comparing the pillar functions' scores for LH3 with the thresholds, all the three pillar functions, F1, F5 and F7, denote a weakness. Then, when comparing the scores of the same pillar functions for LH3 and FCs, F1 and F7 provide the possibility of a weak replication, since these two pillar functions represent weaknesses for LH3, linked with high replication potential in FCs for the same pillar functions. Conversely, F5 does not provide an opportunity of replication from LH3 to FCs, given low replication potential for FCs; indeed, the score for this pillar function for FCs appears to be remarkably higher than the one for LH3. Tab. 21 summarizes the pillar functions' results for both LH3 and FCs related to TT5.

Tab. 21: TT5 pillar functions scores: replication in green, barriers to replication in orange.

Pillar Functions / Ecosystems	F1	F5	F7
LH3	3	3	3
FCs	2,5	4	2
Guidelines for action	R	S	R

Overall, when comparing LH1, LH2 and LH3 at the ecosystem level, LH1 and LH2 result to be the lighthouse cities with the better performance in terms of strengths; specifically, both the two cities account a strength in 4 of the total 7 functions. With reference to the pillar functions, both LH1 and LH3 hold a strength in F1 and F5, with LH1 denoting the highest strength, compared to the other LH cities, for what concerns entrepreneurial experimentation (captured by F1). LH3 also denotes strengths for 4 of the 7 functions, but with lower scores in comparison to LH1 and LH3. With regards to FCs, the latter seems to hold a remarkably low level of replication potential in relation to Market formation (captured by the pillar function F5).

At the transition track level, interesting results emerge. Particularly, LH3 results to be the better-performing lighthouse city in terms of strengths, followed by LH1 and LH2. On the other hand, FCs

seem to hold significant levels of low replication potential in the domains of ICT (captured by TT4) and energy management and storage (captured by TT2).

With reference to LH3, significant strengths appear with reference to all the TTs, in particular for TT1, TT2 and TT5. Hence, LH3 seems to hold notable points of strength in relation to the domains of energy and Citizen engagement. With regards to the replication process to FCs, the latter seems to be feasible for most functions in every TT, with the exception of F3, which seems to constitute the weak point for LH3. Indeed, LH3 seems to hold a weakness in Knowledge exchange in virtually all TTs. In addition, another weakness also emerges for LH3 in relation to F7, capturing Resistance to Change. Nonetheless, in this case, no issues for the replication process occur in most of the cases.

With reference to LH1, the latter denotes significant strengths in TT1 and TT2, with special reference to F1 (Entrepreneurial experimentation). A high score for F1 is also detected in relation to TT4, encompassing the ICT domain. Ultimately, the conditions for the emergence of a SBM in LH1 are particularly favourable with reference to the energy domain (captured by TT1 and TT2). On the other hand, LH1 also presents some strengths, but in a minor extent, in relation to the other TTs. Particularly, for TT3 and TT5, it seems that Knowledge Development constitutes a point of strength for LH1 in the domains related to mobility and citizen engagement. With regards to the replication process to FCs, a good potential for replication emerges for every TT, with the exception of TT4. It hence appears that with reference to the domain of ICT, FCs hold on average low replication potential with respect to LH1. Finally, LH1 generally denotes, across the various TTs, a weakness in relation to F7, thus denoting a significant degree of resistance to change among the actors of the LH1 ecosystem.

With reference to LH3, the latter denotes significant strengths in relation to TT4, thus in the domain of ICT. Nonetheless, always when considering the same Transition Track, the level of replication in FCs is lower in most functions. For LH3, minor points of strength emerge in relation to TT2 and TT3, especially concerning F2. This suggests that LH3 holds notable strength in Knowledge Development in relation to the domains of energy and mobility.

Finally, when considering FCs, it can be noticed how on average the latter concede a low margin for replication in the pillar function F5 (capturing Market formation), but a higher potential for replication in relation to F1 (Entrepreneurial experimentation), especially when considering Nice LH1.

3.2. The most interesting solutions to replicate for FCs

In the previous subsection we showed, through the findings of the TIS analysis, in which specific functions LH cities hold a potential for replication of integrated solutions in FCs. In this subsection, we move a step further, going to investigate at the level of each follower city the points of strengths and weaknesses withhold in relation to specific functions, to assess the potential for replicability of specific integrated solutions. To this aim, during the CPB in Vaasa (4-6 June, 2019) and with intensive discussions with Mauritz Knuts, we could collect the following inputs from the FCs on the most interesting solutions to be replicated in their ecosystem.

3.2.1. Alexandroupolis

Alexandroupolis ambitions the development of a Smart multi-sourced low temperature district heating. The construction of a geothermal district heating network will start in early 2019 for Traianoupolis area for heating 22 public/municipal buildings. Lower operational temperatures and other sources of energy will allow the system to expand to more customers. In the meantime, Alexandroupolis is keen to learn from other smart solutions and related business models.

Challenges and barriers for replication are described and can be interpreted as follows:

- At the technical level (F1), novel technologies may present a technical barrier and a challenge for local engineers, technicians and operators.
- At the financial level (F5), Capital intensive interventions highlight the challenge to finance solutions.
- At the environmental level (F5), there is no barrier or challenge recognised here.
- At the legal level (F7), there is a lack of legislation for novel technologies.
- At the social level (F7), Energy transition will happen from citizens. Acceptance and engagement to innovative solutions is always perceived as a challenge.

In that respect, Alexandroupolis expresses the need for guidelines in the following fields:

- Clear and simplified technical description of the solutions tested/implemented in LCs (for presentation to non-technical audience)
- Investment costs, operation & maintenance costs
- Detailed information regarding business models applied
- Citizen's engagement activities, stakeholders involvement
- Decision making process

3.2.2. Santa Cruz de Tenerife

Santa Cruz de Tenerife targets the following promising solutions:

- Prepilot sun houses and Krokslät office building.
- Prepilot near zero energy retrofit in social houses
- Prepilot ElectriCity (Electrical bus).
- Bus and tram priority

For Santa Cruz de Tenerife, the challenges and barriers are the following ones:

- F1, F5, but also F4: Criteria to take decisions, especially in the choice of the best energy efficiency systems and amortization periods, and in combing household energy management measures with global measures.
- F1 and F5: Learn for other technical solutions, business models, running of operations, decision making process

- F7: Communication with and education of households/residents, in the field of energy saving, and make them accustomed to using their own vehicle and not public transportation, which demands to do educational activities as well as improving public transport.

Santa Cruz de Tenerife is expecting collaboration from the IRIS partners in the following fields:

- Description of decision making process, stakeholders involved, citizen´s engagement,
- Follow up of solutions
- Technical solutions and calculations, capacity, power, investments, running costs, etc. related to selected solution and possible options.
- Cost-benefit information of the technical solutions in order to compare.
- Business solutions, incentives

3.2.3. Vaasa

For Vaasa, the most interesting solution to be replicated is the smart multi-sourced low temperature district heating. Low temperature district heating is planned for Ravilaakso area where construction will start in 2020. Planned network consists of waste heat utilization, heat storage (+1 GWh) and cooling (absorption pumps). Vaasa wants to learn from other solutions and related business models.

Major challenges and barriers identified by Vaasa are:

- F1: Decision criteria for selecting energy solution: Justification of additional costs comparing to normal district heating (energy storage, absorption pumps) and profitability of investment versus not business related criteria as CO2 neutrality, innovations etc.
- F1 and F5: Financing of investment: How to get investment back for investors without increasing cost for households.
- F1 and F5: Business model: Who will be the operator? In Vaasa local energy company hesitates to take responsibility of developing/using the technological solutions, but in the meantime does not want others to enter the market.

For Vaasa, the most important reasons for collaborating within IRIS are to be better equipped on:

- Technical solutions, especially in getting more efficient in calculations, capacity, power, investments, running costs
- Business models, especially Background of business solutions, subsidies and incentives, operator, profitability calculations, funding, etc.
- Running of operations, costs, maintenance
- Decision making process, especially in the identification of the stakeholders involved, citizens engagements, reporting
- Follow up solutions

3.2.4. Foscani

Foscani ambitions the replication of the following solutions:

- Near-zero energy buildings applied for administrative buildings: energy efficiency measures + renewable energy sources
- Increasing energy efficiency of the district heating system: energy generating facility + district heating network
- Development of innovative mobility services: e-buses, bicycles
- Implementation of City Innovation Platform data acquisition and management for: city traffic, district heating system, public lighting system

In that process of replication, Foscani identifies challenges and barriers in the following areas:

- Legal framework (F7)
- Population awareness (F7)
- Financial issues (F5)
- Energy poverty (F1)

The collaboration within IRIS should relieve the challenges and barriers of Foscani, especially in:

- Implementation of legal framework –buildings, district heating, public transportation
- Project financing possibilities
- Examples of population awareness campaigns

4. Output to other work packages

We believe there are many WPs and Deliverables that might benefit from D3.2. We will now explain how D3.2 provides output to other work packages, tasks and deliverables within the IRIS project.

WP3 – Development of bankable business models and exploitation activities

D3.2 is analysing the conditions for letting new business models to emerge, based on the TIS analysis that is described as central in T3.1 of WP3 "Development of bankable business models and exploitation activities", which offers the opportunity to proxy the basic pillars of the IRIS Sustainable Business Model (SBM) while providing a dashboard for local ecosystems (LHs and FCs). By contributing to identify efficient pathways for replication from LHs to FCs, D3.2 is complement with D3.3 "European cities and district market analysis". D3.2 is related to MS4 "Detailed report for the Innovative Business Model adaptation tool City available" on the issue of the sustainable business models adaptation, and the current Deliverable contains an exposition of MS4 which provides complementary tools to D3.2. D3.2 is also impacting D3.1 "Learnings from innovative business model adaptation tool" as the current Deliverable uses the TIS analysis which will be further developed and extended in D3.1. Through the exposition of the dashboard tool and the Pepite scheme, D3.2 deals with successful models of entrepreneurial experimentation which will be extensively investigated in D3.4 "SCUIBI-programme 3.0 handbook for implementation in IRIS cities and beyond". D3.2 is also in close relation to D3.8 'IRIS exploitation plan and operations' which sustains a temporal process in the deployment of IRIS solutions, first by scaling up in the LH districts and second by replication from the LH to the FC, it is noteworthy that a similar conclusion is drawn from (and can be grounded on) the TIS analysis used in the current Deliverable. Finally, D3.2 is an input to the other Deliverables in WP3, like D3.6 'IRIS City innovation management performance and roadmaps', D3.7 'Financing solutions for cities and city suppliers' and D3.9 'IRIS Beyond business plan'.

WP5/WP6/WP7 – Utrecht/Nice/Gothenburg demonstration activities

D3.2 is part of WP 3 "Development of bankable business models and exploitation activities" which is a transversal body of work on new business models. D3.2 is producing dashboard tools for visualizing the possibilities of replication from LH to FC, by characterizing the strengths and barriers on the way to replication, as well as action guidelines to make the way to replication smoother and more efficient, often requiring an extensive scaling up in districts before engaging replication. D3.2 has been using preliminary framework developed in D6.1 "Baseline, ambition & barriers for Nice lighthouse interventions", adapted here focusing on replication from LHs to FCs, and D6.2 "Planning of Nice integration and demonstration activities", D5.1 "Baseline, ambition & barriers for Utrecht lighthouse interventions" and D5.2 "Planning of Utrecht integration and demonstration activities", as well as D7.1 "Baseline, ambition & barriers for Gothenburg lighthouse interventions" and D7.2 "Planning of Gothenburg integration and demonstration activities".

WP8 – Replication by lighthouse regions, follower cities, European market uptake

D3.2 is primarily targeted to replication processes from LH to FC. As an outcome, LHs and FCs can be included as a target audience, since they can typically visualize using the dashboard tool what others are experiencing or have already experienced, with major obstacles together with strong

opportunities on the path to a Smart City. D8.1 “A Roadmap for replication of activities” could get both insights and a benchmark from D3.2 on the issue of replicability of IS solutions from LHs to FCs. One of the conclusions of D3.2 is that FC need to develop inhouse ‘absorptive capacities’ - like the entrepreneurial experimentation and production capacities that are described in the Pepite Scheme of D3.2 - in view of absorbing external solutions provided by LHs and developing replication smoothly and efficiently, based on opportunities of successful incubation.

WP10 – Communication and dissemination

Results in D3.2 will be presented at academic and non-academic events. We expect to produce academic papers to be presented in National and International conferences, and later on, published in top scientific journals in the field. All publications will be uploaded at Emdesk and will be reported in D10.9 “Communication and dissemination tools and materials”.

5. Conclusions

The dashboard tool has been elaborated to position the strengths and weaknesses of the LHs regarding the ambitions of the FCs on the way to a smart city, in view of capturing in greater depth the opportunities of replication from the LHs to the FCs.

5.1. Dashboard conclusions – Ecosystem level

From this dashboard tool, we can see at the level of each LH that:

- Nice has strong replication opportunities in F1/type of technological innovation, as the entrepreneurial experimentations that are developed in the ecosystem of Nice meet the ambitions of the FCs. This means that for FCs, the technological innovations that are developed in Nice (all transition tracks included) appear as of great interest for replication in their own location. Alternatively, although there is replication potential in FCs of the technology provided by Nice, market maturity (F5) that is observed in the location of Nice, as well as change inherent in behaviors and legislation (F7) implemented in Nice, seem to be largely behind the current development of market and regulatory context that is observed in FCs. As a consequence, if Nice technologies are seen among the best by FCs, the related market and regulation contexts do not seem sufficiently mature at the FC level to allow a replication in a short time span from Nice to the FCs, as these market and regulation components have still to be adapted to the local market and legal context of the FCs, and ultimately require further efforts of scaling up before (successful) replication.
- Utrecht has also replication opportunities in F1, meaning that the solutions developed at the level of the LH of Utrecht entail replication potential in FCs in terms of entrepreneurial experimentation/type of technological innovation. Another good point is that the experience in terms of market formation (F5) developed in Utrecht seems replicable in the FCs, and to fit with the local context in FCs. Market characteristics in FCs seem to be not far from what is required to the deployment of solutions developed in Utrecht, probably because these solutions have already been scaled up in different Utrecht districts, and in this way both the technological side and market side Utrecht characteristics do not seem so difficult to deploy in the local context of the FCs. Alternatively, resistance to change (F7) is perceived as different in the LH of Utrecht and FCs, leading to a lesser impact in terms of replication, due to local regulation and consumers' habits that represent a constraint at the level of FCs. Although Utrecht does a lot of efforts in scaling up from district to district, involving better replication opportunities both in the field of technology and market requirements, regulation still represents a limit for successful short-term replication. Replicating from country to country is obviously constrained by different (national) regulatory contexts that limit the opportunities of replication.
- Gothenburg has strong opportunities of replication in F1 entrepreneurial experimentation and some opportunities of replication in F7 resistance to change. This means that the FCs value these efforts of Gothenburg as strong, both from the technology side and regulatory side. Technology developed in Gothenburg entails replication potential in FCs, and the

associated regulatory context observed in Gothenburg – presumably more 'soft regulation', i.e. ways to involve citizens, than 'hard regulation' which again is highly country specific – are likely to be replicable. In the meantime, the definition of F5 market formation in the LH is not seen as immediately replicable in the context of the FC, and need probably some further refinements. This mean that market requirements in view of replication in FCs need to be better refined through scaling up.

These results are summarized in the Tab. 22 below, with assorted guidelines of action, i.e. Replication or Scaling up.

Tab. 22: Higher opportunities vs lower opportunities of replication at the level of each ecosystem.

Higher opportunities of replication from the LHs to the FCs	Lower opportunities of replication from the LHs to the FCs
Nice: F1	Nice: F5, F7
Utrecht: F1, F5	Utrecht: F7
Gothenburg: F1, F7	Gothenburg: F5
Guidelines of action: Replication	Guidelines of action: Scaling up

These results suggest that much is expected from the FCs with regard to the entrepreneurial experimentation developed in the demonstrators of Nice, Gothenburg and Utrecht, while successful replication in the local context of the FCs depends on market conditions, as well as legal framework and consumers' involvement in the respective FCs, that need to be further improved through scaling up.

5.2. Dashboard conclusions – Transition tracks level

In the case of Nice, the dashboard conclusions show that:

- All transition tracks demonstrators have significant chances of replication in the FCs, as in all cases we obtain more high scores than low scores of replication (see Tab. 22 above).
- For some transition tracks – namely TT3 on mobility and TT5 on citizen engagement – the IS might be adopted in a short time span by the FCs as in these two transition tracks, F1 entrepreneurial experimentation, F5 market formation, and F7 resistance to change are all together considered with higher opportunities of replication. In sum, FCs can expect replication to occur in a shorter time span in these TTs, as the LHs already did intensive efforts of scaling up before replication.
- For other transition tracks – namely TT1 and TT2 on renewable energy and energy storage – F1 entrepreneurial experimentation and F5 market formation are associated with higher opportunities of replication, while lower opportunities of replication for F7 resistance to change suggest that legal framework and/or citizens involvement is still to be adapted, and that scaling up is a necessary step before (successful) replication.

- For one transition track – TT4 on city innovation platform – entrepreneurial experimentation F1 has a high level of replication, meaning that the FCs see the LHs demonstrators in this field as highly promising, but in the meantime, F5 market formation and F7 resistance to change need more efforts to be fully imported by FCs. In that context, LHs need to do more efforts scaling up these solutions before launching the process of replication.

These results are summarized in Tab. 23 below.

Tab. 23: Higher opportunities vs lower opportunities of replication at the level of each transition tracks in the LH of Nice.

Higher opportunities of replication from the LHs to the FCs	Lower opportunities of replication from the LHs to the FCs
TT1 Nice: F1, F5	TT1 Nice: F7
TT2 Nice: F1, F5	TT2 Nice: F7
TT3 Nice: F1, F5, F7	
TT4 Nice: F1	TT4 Nice: F5, F7
TT5 Nice: F1, F5, F7	
Guidelines of action: Replication	Guidelines of action: Scaling up

In the case of Utrecht, the dashboard conclusions show that:

- Most of the transition tracks – TT1 on renewable energy, TT2 on energy storage, TT3 on mobility, and TT5 on citizen engagement are all associated with high opportunities of replication. In all these transition tracks, the FCs are suitable locations of replication, and FCs consider that F1 entrepreneurial experimentation, F5 market formation, and F7 resistance to change in the demonstrators in Utrecht provide a robust template of what could be experimented in their local context.
- The only exception is TT4 on city innovation platform, where there seems to be lower opportunities of short term replication, as F1 entrepreneurial experimentation, F5 market formation, and F7 resistance to change need further development of scaling up to be successfully imported.

These results are summarized in Tab. 24 below.

Tab. 24: Higher opportunities vs lower opportunities of replication at the level of each transition tracks in the LH of Utrecht.

Higher opportunities of replication from the LHs to the FCs	Lower opportunities of replication from the LHs to the FCs
TT1 Utrecht: F1, F5, F7	
TT2 Utrecht: F1, F5, F7	
TT3 Utrecht: F1, F5, F7	

	TT4 Utrecht: F1, F5, F7
TT5 Utrecht: F1, F5, F7	
Guidelines of action: Replication	Guidelines of action: Scaling up

Finally, when considering the case of Gothenburg, the results of the dashboard tool show that:

- For some transition tracks – namely TT1 on renewable energy, TT3 on mobility, and TT5 on citizens' engagement – F1 entrepreneurial experimentation and F7 resistance to change developed in the local context of Utrecht are highly replicable in the context of the FCs.
- For other transition tracks – namely TT2 on energy storage and TT4 on city innovation platform – F7 resistance to change is seen as a source of inspiration to be quite rapidly imported in the FCs.
- In all transition tracks, however, F5 market formation appears as specific to the local context of Gothenburg and not easily imported in the FCs without prior scaling up being achieved.

These results are summarized in Tab. 25 below.

Tab. 25: Higher opportunities vs lower opportunities of replication at the level of each transition tracks in the LH of Gothenburg.

Higher opportunities of replication from the LHs to the FCs	**Lower opportunities of replication from the LHs to the FCs**
TT1 Gothenburg: F1, F7	TT1 Gothenburg: F5
TT2 Gothenburg: F7	TT2 Gothenburg: F1, F5
TT3 Gothenburg: F1, F7	TT3 Gothenburg: F5
TT4 Gothenburg: F7	TT4 Gothenburg: F1, F5
TT5 Gothenburg: F1, F7	TT5 Gothenburg: F5
Guidelines of action: Replication	Guidelines of action: Scaling up

As a general conclusion, we can see that:

- All LH cities are well positioned to replicate in a short or longer time span their solutions in FCs and, conversely, FCs are keen to import the solutions developed in the LHs demonstrators.
- Utrecht is ready to deploy the solutions in the FCs in a short time span, in all transition tracks except TT4 on city innovation platform where F1 entrepreneurial experimentation, F5 market formation and F7 resistance to change need to be further improved by scaling up, prior to successful replication.

- Nice is well positioned to replicate the solutions in all transition tracks, with especially distinctive forces in F1 entrepreneurial experimentation and F5 market formation, while F7 legal adjustments and characteristics of citizens engagement will be necessary in view of successful replication, presumably after some additional scaling up efforts.
- Gothenburg offers good opportunities of fast replication in all transition tracks, with strong experience on F1 entrepreneurial experimentation and F7 resistance to change, while F5 market formation needs to be further calibrated through further scaling up efforts, in view of replication in the FCs.

References

Azevedo, A., Apfelthaler, G., and Hurst D. (2012). "Competency development in business graduates: An industry-driven approach for examining the alignment of undergraduate business education with industry requirements". *The International Journal of Management Education*, vol. 10, pp. 12-28.

Azoulay, P., Jones, B., Daniel K. J., Miranda, J. (2018). "Age and high-growth entrepreneurship". NBER Working Paper N. 24489.

Baron, R. A. and Markman G. D. (2003). "Beyond social capital: the role of entrepreneurs' social competence in their financial success". *Journal of Business Venturing*, vol. 18, pp. 41-60.

Bergek, A., Jacobsson, S., Carlsson, B., Lindmark, S., and Rickne, A. (2008). "Analyzing the Functional Dynamics of Technological Innovation Systems: A scheme of Analysis". *Research policy*, vol. 37(3), pp. 407-429.

Cohen, S., Fehder, D., Hochberg, V., and Murray F. (2019). "The design of startup accelerators", *Research Policy*, vol. 48(7), pp. 1781-1797.

Foschi, M. and Valenzuela, J. (2007). "Selecting job applicants: Effects from gender, self-presentation, and decision type". *Social Science Research*, vol. 37, pp. 1022-1038.

Hekkert, M., Negro, S., Heimeriks, G., and Harmsen, R. (2011). "Technological Innovation System Analysis: A manual for Analysts". Technical report, University of Utrecht.

Krafft, J., (2004). "Entry, Exit and Knowledge: Evidence from a Cluster in the Info-Communications". *Research Policy*, vol. 33(10), pp. 1687-1706.

Purpura, P. (2019). "Applicant Screening and Employee Socialization". Butterworth-Heinemann publisher, pp. 149-181.

Annex 1: Business canvas and related models

	Customer segments	Explains the kind of links a company establishes between itself and its customer segments	Who are the final users of your product/service? How do you interact with them Do your customer and/or the final users of your product/service directly or indirectly involved in the production process? (level of involvement high or low)
Infrastructure management	**Key partners**	Portrays the network of cooperative agreement	Please specify what stakeholders are involved in your company's business and their role in the business. Could you please specify the type of cooperative agreement you established with them
	Key resources	Outlines the competencies necessary to execute the company's business model	Please specify what tangibles and intangibles resources are essential to the success of your business Among these resources, which ones (Gassman and Bader, 2006) - exist before the collaboration with your partner and have been developed within the collaboration - exist before the collaboration with your partner and have been developed thanks to collaboration - Emerged from the collaboration and with your partner - Emerged during the collaboration without your partner
	Value	Describes the	Please describe how assets are

	configuration	arrangement of activities and resources	(technically) combined (concentrated/distributed)
Financial aspects	**Cost structure**	Sums up the monetary consequences of the means employed in the business model	Please describe in your company business model who pay to whom?
	Revenue streams (model)	Describes the way a company makes money through a variety of revenue flows	
3C Framework		**Description**	**Interview question guidelines**
Dimensions (Zhang et al. 2007; Lin et al.2009)	**Key elements**		
Context of the innovation - **Lifecycle stages (Moore, 1993, 1996)**	**Birth phase**	The birth phase is structured in 4 sequences that are: new ideas for developing value-creating relationships, action and experimentation, value for customers and investors and reflection upon what has been created. These sequences set up a learning cycle focusing on the creation of economic value.	Please describe what was your company's role at different stages of its ecosystem birth Please describe the relationships between you and your partners at different stages of your company's business birth
	Expansion phase	Members put in relation their components in order to form a whole coherent	Please describe the development of your company's - Business - Business ecosystem Please specify if the role of your company evolve in the different stages of its ecosystem development
	Authority phase	Leadership phase	
	Renewal phase	Improvement of the innovation or death	
Configuration	**Patterns**	The way the constructive elements and process of a system are integrated delivers various configuration patterns	Please describe how coordination with external partner occur within your company's business ecosystem

	External relationships	Type of the ecosystem : platform strategy (based on modularity)	Do platform strategy important for your company ? Please explain the importance of this platform strategy - in your business - in your ecosystem -
Capability	**Inter-firm network capabilities**	Business ecosystem members must string together capabilities to make new end-to-end systems of value creation (Moore, 1996) In global network, capability include (Srai and Gregory, 2008): - Capabilities of communication and sharing - Integration and synergizing - Innovation and learning - Adaptation and restructuring In business ecosystem literature, capabilities take the form (Loilier and Malherbe, 2013): - Technical competences - Commercial competences - Relational competences	Please describe what intra-capabilities are essential to the success of - Your company's own business - Your company's ecosystem
	Intra-firm network capabilities		Please describe what intra-capabilities are essential to the success of - Your company's own business - Your company's ecosystem

Background information

Since Chesbrough and Rosenbloom (2002)'s work, the concept of business model has become a major preoccupation and a growing area of interest for researchers. It is understood as a structural template that describes the firm's organizational and financial architecture. Providing a valuable new tool for analysis a management in research a practice (Zott and Amit, 2008; Schaltegger et al. 2012), the business model concept is applied by a growing number of works as an analytic tool. Even if several definitions of the business model concept exist in the literature, key authors aligned with the approach describing a business model through four, or more, building blocks (pillars). Generally, business model's pillars are: value proposition made to the user, the customer interface, the

infrastructure and the financial model (Osterwalder and Pigneur, 2005, 2009). By describing these pillars, the concept of business model offers a definition on how the enterprise delivers value to customers, entices customers to pay for value and converts those payments to profit (Teece, 2010, p.172). From the exiting definitions of the business model concept and the typology of its pillars, several matrices have been proposed by practitioners and academics. Because they have been extensively tested in practice, and successfully applied in several fields, the matrix of Osterwalder and Pigneur (2004), commonly known as *"business model canvas"*, is the most applied one. Its main function is to help entrepreneurs to generate profit, as the business model concept is understood by the authors as *"the rational of how an organization creates, delivers, and captures value"* (Osterwalder and Pigneur, 2009, p.14). In terms of analysis, the business model canvas is a good tool for examining and comparing companies and markets in a structured way. It helps managers to design, implement, operate, change, and control their business (Johnson, 2010) and can function as blueprints that are ready for being copied (Baden-Fuller and Morgan, 2010).

However, in the specific context of smart cities this framework is not totally suitable as the guiding question is not only related to value creation. Smart cities are here understood as the practice territory of a business ecosystem surrounding an innovative service (Attour and Rallet, 2014). Such business ecosystems are complex networks where *"firms combine their individual offerings into a coherent, customer-facing solution"* (Adner, 2006, p.2). Their particularity lies in the fact that they crosscut a variety of industries (Moore, 1993; 1996), so there are important problems of coordination between members of the ecosystem. The question of business model concept is then no longer limited to value creation, but considers also the importance to identify its model of governance (who is the leader of the network, who controls the value network and the overall system design). Such question is of importance as in the specific case of SC services, government or other (semi)-public organisations become active participants in the ecosystem (the value network) of the innovative service by contributing value themselves (e.g. opening up data, developing applications, deploying infrastructure, etc.). In order to identify the role of the public actors, the framework of Osterwalder and Pigneur's canvas is used is used in a first theoretical step. The main aim here is to identify which business models of services for smart cities are bankable. To identify how these business models may be replicable in other ecosystems than the one they were born, this analysis is completed by a focus on the emergence of their business ecosystems. Indeed, Osterwalder and Pigneur's canvas cannot capture the increased complexity of a business ecosystem including public actors in its current form, due to the pecular nature of these organisations and the ways in which they are funded.

An extension of the business model canvas is then proposed by introducing new parameters related to the business ecosystem, its birth and governance. The focus is on what Chesbrough (2010) named *business model innovation* which is understood as a strategic renewal mechanism for organizations facing changes in their external environment (Sosna et al. 2010). More precisely, it is *"the development of new organizational forms for the creation, delivery and capture of value"* (Ritcher, 2013, p. 1228). The new organizational form studied here is business ecosystem of services for smart cities. The concept of business ecosystem is well adapted for our analysis as it known as helpful to explain the requirements concerning partners' interoperability, i.e., the process of coevolution of industrial systems. Business ecosystems have two main characteristics: the lifecycle and the stakeholders. The business ecosystem lifecycle includes birth, expansion, authorities and renewal (Moore, 1993; 1996). The stakeholders are members from heterogenous industries that have to collaborate while some of them are initially competitors. Moore (1996) explains that in the birth phase of business ecosystem, members must string together capabilities to make new end-to-end systems of value creation. To this end, members need "*to invest in coevolutionary [four] sequences of*

building capability that establish the elusive trait known as value" (Moore, 1996, p.70). These sequences are the following: new ideas for developing value-creating relationships, action and experimentation, value for customers and investors and reflection upon what has been created. They set up a learning cycle focusing on the creation of economic value.

From there, in order to understand the birth and governance of business model in smart cities in terms of lifecycle and stakeholders' role (members of the ecosystem), three parameters are added to the business model canvas: context of the innovation, configuration and capability. These three parameters are the three dimensions of the 3C framework commonly used to analyse a network system in general (Zhang et al. 2007; Lin et al. 2009). The context dimension identifies the environmental features of the network. From the view of lifecycle, it can be studied from the challenges of each stages (Moore, 1996). The configuration dimension is useful to identify the external relationships among members of a business ecosystem and its configuration patterns. It helps to answer questions about how to establish a network to achieve certain capability in a certain context (Zhang et al. 2007; Lin et al. 2009). The capability dimension investigates the key success features of the ecosystem from the functional view of design, production, inbound logistics and information management. It helps to understand and identify which member of the ecosystem successfully succeed on introducing modularity within the network (Zhang et al. 2007; Lin et al. 2009). As explained it Iansiti and Levien (2004), such modularity is essential to a business ecosystem as it gives to its actor the power to govern his network.

References

Adner, R. (2006), "Match your innovation strategy to your innovation ecosystem", *Harvard Business Review*, vol. 4, pp. 1-11.

Attour A., Rallet, A. (2014), "Le role des territoires dans le développement des systems trans-sectoriels d'innovation locaux: le cas des smart cities", *Innovations*, vol. 1(43), pp. 253-279.

Chesbrough, H., Rosenbloom, R.S. (2002), «The role of the business model in capturing value from innovation: evidence from Xerox corporation's technology spin-off companies », June 2002, *Industrial and Corporate Change*, vol. 11(3), pp. 529-555.

Chesbrough, H. (2010), "Business model innovation: opportunities and barriers", Long Range Planning, vol. 43, pp. 354-363.

Iansiti, M., Levien, R. (2004), The keystone advantage: what the new dynamics of business ecosystems mean for strategy, innovation, and sustainability, HBS Press, Boston.

Lin, Y., Zhou, L., Shi, Y.J., Ma, S.H. (2009), "3C framework for modular supply networks in the Chinese automotive industry", *International journal of logistics management*, vol. 3, pp. 322-341.

Loilier, T., Malherbe, M. (2013), "Experimentation and the development of eco-systemic competencies in the field of contactless mobile services", *Understanding business ecosystems*, S. Ben Letaifa (ed.), De Boeck, Paris, pp. 193-207.

Moore J. (1993), "Predators and Prey: a new ecology of competition", Harvard Business Review, Vol.71(3), pp. 75-86.

Moore J. (1996), "The Death of Competition – Leadership and Strategy in the Age of Business Ecosystems", Harper Business.

Osterwalder, A., Pigneur, Y. (2005), “Clarifying business models: Origins, present, and future of the concept”, Communications of the Association for Information Systems (AIS), 15, article.

Osterwalder, A., Pigneur, Y. (2009), Business model generation: a handbook for visionaries, game changers, and challengers, Whiley.

Ritcher, M. (2012), “Business model innovation for sustainable energy: German utilities and renewable energy”, *Energy Policy*, Vol. 62, pp. 1226-1237.

Schaltegger, S., Lüdeke-Freund, F., Hansen, E. (2012), “Business cases for sustainability – the role of business model innovation for corporate sustainability”, *International Journal of Innovation and Sustainable Development*, vol. 6(2), pp. 95-119.

Sosna, M., Trevinyo-Rodríguez, R. N., Velamuri, S. R. (2010), “Business models innovation through trial-and-error learning: The Naturhouse case”, *Long Range Planning*, vol. 43, pp. 383–407.

Srai, J.S., *Gregory*, M. (*2008*) “A supply network configuration perspective on international supply chain development”, *International Journal of Operations & Production Management*, vol. 28(5), pp. 386-411.

Teece, D. J. (2010), “Business Models, Business Strategy and Innovation”, Long Range Planning, vol. 43(2,3), pp. 172-194.

Zhang, Y. Gregory, M., Shi, Y. (2007), « Global engineering networks (GEN): The integrating framework and key patterns », *IMechE Proceedings, Part B: Journal of Engineering Manufacture*, vol. 221(8), pp. 1269-1283.

Zott, C., Amit, R. (2008), “The fit between product market strategy and business model: implications for firm performance”, *Strategic Management Journal*, vol. 29, pp. 1-26.

Annex 2: TIS questionnaire

Name of the company/organisation:

Company/organisation age:

Company/organisation size:

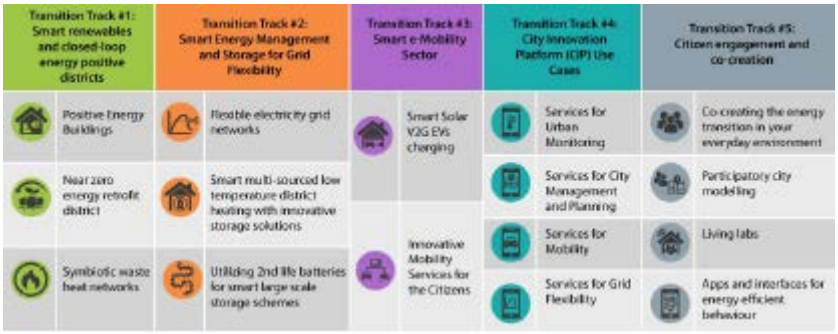
Name of the Contact:

Function of the Contact:

Contact details:

Main field of activity (in reference with Table 10 of the Grant Agreement):

Secondary field of activity (in reference with Table 10 of the Grant Agreement):



Stage of development (pilot, development in the local ecosystem, development outside the local ecosystem):

Date of involvement in Smart City activities:

Size of the team dedicated to Smart City activities:

F1 - Entrepreneurial Experimentation and Production

1. In your opinion, the number of key players in the Smart City ecosystem is:

• Very low • Low • Average • strong • Very strong

2. According to you, the diversity of these key players is:

• Very low • Low • Medium • Strong • Very strong

3. Choices and positioning of these actors in the Smart City have an effect on your own activity which is:

• Very low • Low • Medium • Strong • Very strong

4. The effect of your own activity on the choices and positioning of other actors is:

• Very low • Low • Medium • Strong • Very strong

5. According to you, the degree of innovation of the actors in the Smart City is:

• Very low • Low • Medium • Strong • Very strong

6. Within the Smart City ecosystem, the share of your activities involving technological breakthroughs could be qualified as:

• Very low • Low • Medium • Strong • Very strong

7. The share of your activity involving market creation/disruption in the Smart City could be qualified as:

• Very low • Low • Medium • Strong • Very strong

8. According to you, the opportunities offered by the development of the Smart City for your own company/organisation are:

• Very low • Low • Medium • Fort • Very strong

9. According to you, the interest and efforts of the actors in the Smart City dedicated to impulse development and large-scale production of technologies/products/services are:

• Very low • Low • Medium • Strong • Very strong

10. According to you, the efforts and contribution of the actors already installed in the Smart City are:

• Very low • Low • Medium • Strong • Very strong

11. According to you, the efforts and contribution of new actors are:

• Very low • Low • Medium • Strong • Very strong

12. In view of moving to a next phase of development of the Smart City, the presence of new players plays a role that you would value as:

• Very low • Low • Medium • Strong • Very strong

13. The presence of new players could generate barriers to the development of the Smart City, in an extent that you would value as:

• Very low • Low • Medium • Strong • Very strong

14. According to you, within the Smart City ecosystem, the following uncertainties seem very low, low, medium, strong or very strong:

Type of uncertainties	**Intensity**
Technology	• Very low • Low • Medium • Strong • Very strong
Human resources available	• Very low • Low • Medium • Strong • Very strong
Financial resources available	• Very low • Low • Medium • Strong • Very strong
Physical infrastructure	• Very low • Low • Medium • Strong • Very strong
Industrial partners	• Very low • Low • Medium • Strong • Very strong
Consumer behaviours	• Very low • Low • Medium • Strong • Very strong
Local policy institutions and guidance	• Very low • Low • Medium • Strong • Very strong

15. Your own experience with these risks could be qualified as:

• Very low • Low • Medium • Strong • Very strong

16. Did you gain this experience through participation in other Smart City projects, and if so would you value is as:

• Very low • Low • Medium • Strong • Very strong

17. Your ability to cope with these risks can be qualified as:

• Very low • Low • Medium • Strong • Very strong

F2 - Knowledge Development

18. According to you, scientific and technical knowledge required for the development of the Smart City are:

• Very low • Low • Medium • Strong • Very strong

19. Would you say that local access to scientific and technical knowledge related to the development of innovation in technologies/products/services in the Smart City is:

• Very low • Low • Medium • Strong • Very strong

20. In your opinion, the availability at the local level of market knowledge in the Smart City ecosystem is:

• Very low • Low • Medium • Strong • Very strong

21. The quality of the technical knowledge available within the Smart City seems to you as:

• Very low • Low • Medium • Strong • Very strong

22. Do you think the quality of market knowledge within the Smart City is:

• Very low • Low • Medium • Strong • Very strong

23. Existing knowledge (related to technical, market issues) is a plus for new knowledge to be developed within the Smart City, would you range this as:

• Very low • Low • Medium • Strong • Very strong

F3 - Knowledge Exchange

24. According to you, Knowledge Exchange between academic actors and industrial actors in the Smart City is:

• Very low • Low • Medium • Strong • Very strong

25. According to you, Knowledge Exchange between end users and industrial players is:

• Very low • Low • Medium • Strong • Very strong

26. According to you, Knowledge Exchange with actors external to the ecosystem is:

• Very low • Low • Medium • Strong • Very strong

27. Do you think the lack of Knowledge Exchange within the ecosystem of Smart City could be considered as:

• Very low • Low • Medium • Strong • Very strong

28. In your opinion, this lack of Knowledge Exchange could create barriers you value as:

• Very low • Low • Medium • Strong • Very strong

F4 - Guidance of Search

29. The development of the Smart City ecosystem in the near future can be anticipated and planed with a degree of precision you value as:

• Very low • Low • Medium • Strong • Very strong

30. In your opinion, technological development is a dimension that can be anticipated and planed with a degree of precision that is:

• Very low • Low • Medium • Strong • Very strong

31. According to you, the economic dimension is rather predictable in a range that is:

• Very low • Low • Medium • Strong • Very strong

32. Do you think the vision of local public actors and institutions on technological development challenges in the Smart City is in sum:

• Very low • Low • Medium • Strong • Very strong

33. Do you think the vision of local public actors and institutions on economic issues involved by the Smart City more likely is:

• Very low • Low • Medium • Strong • Very strong

34. In your opinion, the alignment/coordination of actors in the Smart City ecosystem regarding potential uncertainties (technological, political, consumer adoption, etc.) is

• Very low • Low • Medium • Strong • Very strong

35. According to you, the lack of alignment/coordination of the actors could hinder the development of the Smart City in a range that is:

• Very low • Low • Medium • Strong • Very strong

F5 - Market Formation

36. In your opinion, the size of the current market is:

• Very low • Low • Medium • Strong • Very strong

37. In your opinion, the expected market size is:

• Very low • Low • Medium • Strong • Very strong

38. Concerning your own activities in the Smart City, would you consider market opportunities as exploratory and long-term oriented, in a range you value as:

• Very low • Low • Medium • Strong • Very strong

39. Your activities related to the Smart City involve market opportunities that are exploitation and short-term oriented, in a range that is:

• Very low • Low • Medium • Strong • Very strong

40. In your opinion, the size of the market is a barrier to future development, in an extent which is:

• Very low • Low • Medium • Strong • Very strong

41. According to you, the Smart City could generate economic benefits in the short-term that are:

• Very low • Low • Medium • Strong • Very strong

42. According to you, the Smart City could generate economic benefits in the long-term that are:

• Very low • Low • Medium • Strong • Very strong

43. Your activities are oriented towards a particular group of users, in an extent which is:

• Very low • Low • Medium • Strong • Very strong

44. In your opinion, market opportunities are socially inclusive in an extent which is:

• Very low • Low • Medium • Strong • Very strong

F6 - Resource Mobilisation

45. According to you, the presence of mobilisable/accessible human resources within the Smart City ecosystem is:

• Very low • Low • Medium • Strong • Very strong

46. According to you, the availability of financial resources existing within the ecosystem of the Smart City is:

• Very low • Low • Medium • Strong • Very strong

47. According to you, the level of development of the physical infrastructures of the Smart City is:

• Very low • Low • Medium • Strong • Very strong

48. You would value the constraints of the ecosystem of the Smart City as

For human resources:

• Very low • Low • Medium • Strong • Very strong

For financial resources:

• Very low • Low • Medium • Strong • Very strong

For physical infrastructures:

• Very low • Low • Medium • Strong • Very strong

F7 – Counterfactual Resistance to Change/legitimacy of creation

49. In your opinion, the time needed to develop and mature the ecosystem of the Smart City is:

• Very low • Low • Medium • Strong • Very strong

50. You would value technological Resistance to Change as:

• Very low • Low • Medium • Strong • Very strong

51. According to you, support/subsidies at the local level the Smart City activities are:

• Very low • Low • Medium • Strong • Very strong

52. Do you think barriers related to regulation and legislation are:

• Very low • Low • Medium • Strong • Very strong

53. According to you, within the Smart City, these barriers are related to:

Legislation, standards, and industrial/intellectual property, in an extent which is:

• Very low • Low • Medium • Strong • Very strong

Related to ethics, standards, behaviours:

• Very low • Low • Medium • Strong • Very strong

54. In your opinion, barriers are related to:

Contract structures (public-private), in an extent which is:

• Very low • Low • Medium • Strong • Very strong

Data and privacy, in an extent which is:

• Very low • Low • Medium • Strong • Very strong

Liability and security, in an extent which is:

• Very low • Low • Medium • Strong • Very strong

Electronic communication networks, in an extent which is:

• Very low • Low • Medium • Strong • Very strong

55. The involvement and citizen participation is a factor of development of your activities, in an extent which is:

• Very low • Low • Medium • Strong • Very strong

56. Compared to other projects of Smart City at the national/international level, would you say that the Smart City regroups favourable conditions of development, in a range that is:

• Very low • Low • Medium • Strong • Very strong

57. Would you consider the development of the Smart City as beneficial for other municipalities in the neighbourhood, in an extent which you value as:

• Very low • Low • Medium • Strong • Very strong

58. The project of Smart City generates/will generate a positive impact on the image of the city, in a range that is:

• Very low • Low • Medium • Strong • Very strong

Annex 3: The PEPITE scheme

The results of the TIS analysis have demonstrated how for Nice LH1, Entrepreneurial experimentation (captured by the function F1) represents the main point of strength for the city in terms of potentiality for the emergence of a SBM; this applies in particular to integrated solutions belonging to the domains of energy and ICT. In this Annex, we describe in detail the PEPITE scheme, a solution which has been developing within the Nice ecosystem and which has been proven to represent a successful example of Entrepreneurial experimentation (F1), thus offering interesting margins of replication to follower cities.

The PEPITE scheme is an ambitious program enacted by the French government aimed at stimulating university students' entrepreneurship. It was launched in 2013 with the aim of reducing the gap in the French educational system on students' entrepreneurial activities; namely, to reduce the gap between the promotion of entrepreneurship proposed by "French Business Schools" and "French Public Schools". Indeed, before then, university courses in business education were not widespread in the French public educational system. The only projects dedicated to French student entrepreneurship were proposed by private business schools and engineering schools.

To cope with this issue, the French government became involved to extend entrepreneurial projects in public universities, which lead to the creation, at the national level, of the "student entrepreneur status"; the latter is a status which can be granted to any holder of a French baccalaureate[2] by a committee made of public officers related to the Ministry of Higher Education and Research, and representatives of a special institution called "PEPITE" ("Pôle étudiant pour l'innovation, le transfert et l'entrepreneuriat", which can be translated as a "Student Pole for Innovation, Transfer and Entrepreneurship")[3]. A PEPITE is namely an incubator within a French institution of higher education, which after having contributed to grant the student entrepreneur status, selects a certain number of applicant students to help them developing their entrepreneurial project. The main novelty of the student entrepreneur status hence consists in carrying out entrepreneurial projects in the pole, in parallel with the standard university studies. Since combining the two things together may result a somewhat cumbersome task, the French government further introduced in 2014 the "Diplôme d'établissement d'étudiant-entrepreneur". The latter is a university program specifically designed for entrepreneurial students, which better allows the latter to conciliate standard university courses with the PEPITE activities.

With reference to the PEPITE, as of 2019, the French government has established 19 student poles for innovation spread all over the national territory[4]. Each PEPITE is individually responsible for the administrative *iter* of the region where it is located, and through an online platform it receives information and applications from students holding the student entrepreneur status willing to participate to the PEPITE scheme. Once the application has been submitted via the platform, it is assessed by a committee. The committee is composed of: academics in entrepreneurship, professionals, representative of the Ministry of Research and Higher Education, and a person responsible for hosting the project. The national coordination of PEPITE establishes the general guidelines for the evaluation grid. Nonetheless, each PEPITE has the freedom to decide the evaluation criteria, and it enjoys some margin of manoeuvre in the setting of the application

procedure. Ultimately, a PEPITE can be considered as an incubator helping students to develop their entrepreneurial project. This process is carried out through different ways; namely: to assist students to look for funding, to provide them ad hoc business courses, personalized support and networking, and to grant them access to the PEPITE coworking space and facilities.

In addition, with regard to the steps of the PEPITE process (starting from the initial application of a student to obtain the status of student entrepreneur until the realization of an entrepreneurial project), the latter can slightly differ depending on the pole for innovation considered; nonetheless, it is possible to outline a synthetic summary virtually common to each pole. Namely, each pole accepts student entrepreneurial projects deriving from a single student or from a team composed of two or more students (in this case, it is just sufficient for the applicant to hold the status of student entrepreneur). The evaluation grid utilized by the committee in assessing the students' projects generally relies upon four different criteria: Market dimension, Financial dimension, Maturity of the project and Team's cohesion (if a project involves more than one applicant). Each member of the committee issues one vote based upon a Likert scale, ranging from 1 (totally unsatisfactory) to 5 (very satisfactory), for each of the four assessment criteria. Subsequently, if a project manages to obtain at least half of the total votes higher or equal than 3, the project is accepted by the committee, and the student(s) can access the PEPITE program. Eventually, at the end of the PEPITE program, the final aim is to help transforming the entrepreneurial student project into the creation of a start-up enterprise. Fig. 20 visually summarizes all these steps.

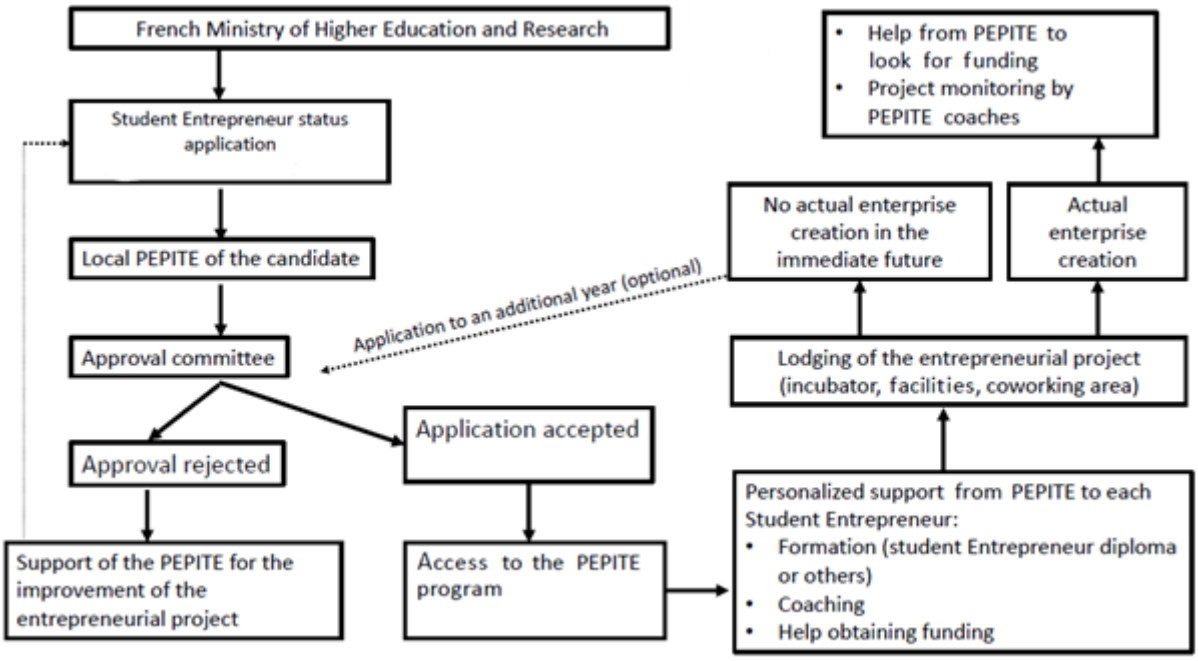


Fig. 20: Steps of the PEPITE process.

A3.1. The PEPITE Paca Est

The PEPITE Paca est is the pole covering the departments of Alpes-Maritimes and Var (Fig. 21), and it is further constituted by different independent incubator hubs, to which students can apply depending on the nature of their project (Tab. 26). Among these incubators, the "Nice Métropole (CEEI)" is the one established and managed by the city of Nice, and it welcomes students' applications whose area of activity falls within the domain of Smart Cities[5]. Among all the French poles, the Nice Métropole (CEEI) has witnessed one of the highest rates in terms of successful project development (i.e., students who, after having completed the incubation phase, have successfully materialized their entrepreneurial project creating a startup which is currently operational). In this regard, the Nice Métropole (CEEI) has been representing a successful example of Entrepreneurial experimentation for the city of Nice; therefore, investigating the drivers leading to its success, represents an important aspect to understand the strengths of Nice LH in relation to the F1 function encompassing Entrepreneurial experimentation; in addition, this exercise can provide some interesting insights for a potential replication processes to follower cities.

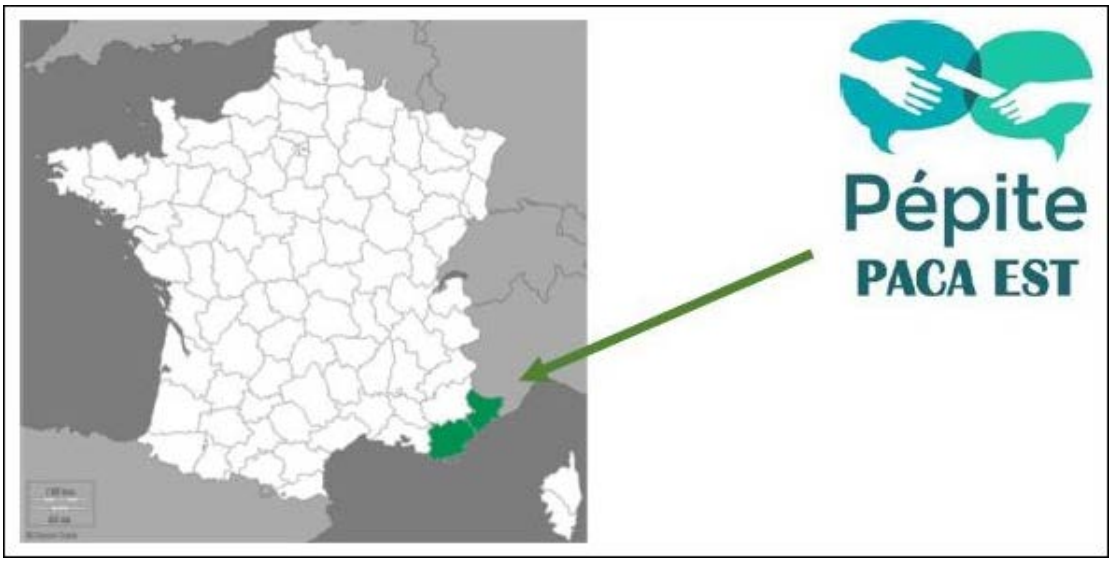


Fig. 21: Localisation of the PEPITE Paca Est.

Tab. 26: Incubator hubs of the PEPITE Paca Est.

Nature of project	Incubator hub	Location	Department
Smart cities	Nice Métropole (CEEI)	Nice	Alpes Maritimes
Chemistry	Pôle Azur Provence	Grasse	Alpes Maritimes
Film industry, tourism	CréaCannes	Cannes	Alpes Maritimes
Arts & Humanities	L'E.CO.LE.	Carros	Alpes Maritimes
Craft production	Créative06	LeCannet	Alpes Maritimes
Business &	Edhec Business	Nice	Alpes Maritimes

finance	Center		
Business & finance	Skema Business Center	Sophia Antipolis	Alpes Maritimes
Business & finance	Kedge Business School	Toulon	Alpes Maritimes and Var
High-tech	Toulon Var Technologies	Toulon	Alpes Maritimes and Var
High-tech	Telecom ParisTech	Sophia Antipolis	Alpes Maritimes

A3.2. Data and methods

The drivers bringing a student entrepreneurial project to success are undoubtedly related, first of all, to the competence, effort and resource availability of the students developing the same project (Baron and Markman, 2003). On the other hand, the effectiveness of the incubation program enacted by the incubator represents an additional element responsible for the success of the project. The latter can in fact be affected by a different variety of elements, such as the quality of the courses provided to students, the level of preparation of teachers, the availability of proper facilities, etc. (Cohen et al., 2019). However, due to the fact that the different poles for innovation generally proved to possess such characteristics in a rather similar fashion, the principal drivers for success have to be reasonably found somewhere else (Purpura, 2019). An insight to this, could derive from the empirical literature stressing the importance of selection policies as a main driver of success (See, e.g., Purpura, 2019; Foschi, M. and Valenzuela, 2007). In other words, choosing the right candidate will result to be of primary importance, since the quality of human capital represents one of the principal ingredients for achieving entrepreneurial success. Particularly, having to select among a notable number of applications, but owning a limited amount of resources to be delivered to each student, the incubator shall select only those students who will be reputed to have the highest probability of success in materializing their entrepreneurial project. Studies on firms stressing the importance of selection procedures to choose the most promising candidates can easily be extended to the selection policies enacted by incubators; such selection policies can indeed result as a crucial element to discriminate the rates of success (in terms of survival rates of start-ups created by student entrepreneurs exiting the incubator) among different incubators. Within this context, the ability to select the best candidates may have hence likely represented one of the points of strengths for the Nice Métropole (CEEI) incubator.

In the following sections, we will exploit a unique dataset of student entrepreneurial projects which were assessed by the Nice Métropole (CEEI) incubator, with the aim of understanding, through an empirical analysis, which factors increased or decreased the probability of project acceptance by the incubator.

A3.2.1. Data

The dataset we utilize for the empirical analysis is constituted by a series of cross-sectional units related to the 220 applications made by entrepreneurial students in 2017 to the Nice Métropole (CEEI) incubator. The variables of the dataset are either continuous or categorical, and they capture information on individual characteristics of applicants (age, gender, background, education, etc.) and information about their project (number of persons involved, to which IRIS smart track the project is associated to, etc.), as well as indicating whether a project was accepted or rejected by the incubator committee. Tab. 27 reports descriptive statistics for the set of variables of interest. First, the age variable suggests how, on average, an applicant falls in the age category of a graduate student, or a student which has already completed a master's degree. With reference to gender, it is possible to observe a predominance of male applicants over female applicants (respectively 74% versus 26%). Then, the variable "N. members" summarizes the number of persons involved in the project. Indeed, the project submitted by the student entrepreneur can involve just the single student, but also other additional members which will be involved in the project (and in the latter case, the student-entrepreneur who submitted the project will be regarded as the "team leader", being in charge for the development of the project in the incubator). On average, projects with more than one single person result to be more common than single-individual projects. Then, the variable "Master" indicates whether the applicant holds a master's degree. In fact, even though applicants are on average almost 25-year old, only one fourth of them holds a master's diploma. On the other hand, however, it also emerges how the 35% of applicants had at least one team member with advanced technical skills, and 29% with advanced business skills[6]. Subsequently, the educational background of applicants is captured by a set of four categorical dummy variables; from the table, it appears how there exists a rather homogeneous distribution in the share of applicants in reference to their educational background, with applicants having a scientific background representing a slight majority compared to the others. Finally, an additional set of categorical variables associates each project with the corresponding transition tracks; specifically, the variable "Energy and Mobility" is a dummy variable indicating whether a project relates to the TT1, TT2 or TT3 on smart solutions falling in the domains of energy and mobility; the variable "ICT" is a dummy variable indicating whether a project relates to the TT4 on smart solutions falling in the domains of ICT / digital innovations. The base category is represented by projects encompassing solutions framing within the TT5 related to citizen engagement and co-creation, which can be considered as a transition track dealing with projects targeting (in more general terms) city life improvement. From the table, it appears how more than two thirds of all the applications received are associated to the TT5 on city life improvement, whereas one quarter of projects are related to ICT / digital solutions, and a relative minority to solutions in the domains of energy and mobility.

Tab. 27: Descriptive statistics for the variables of interest, Nice Métropole (CEEI) incubator dataset (2017).

Variable	Type	Description	Shares
Age	Continuous	Age in years	Mean = 24.6 Years
Gender	Categorical	Male or female	Female = 1 (26%), Male = 0 (74%)
N. members	Continuous	Number of persons involved in the project	Mean = 2.4
Master	Categorical	The applicant holds a master's degree	Yes = 1 (25%), No = 0 (75%)

Economics and Business	Categorical	Educational background 1	Yes = 1 (23%), No = 0 (77%), (Benchmark = Other)
Humanities	Categorical	Educational background 2	Yes = 1 (21%), No = 0 (79%), (Benchmark = Other)
Science	Categorical	Educational background 3	Yes = 1 (30%), No = 0 (70%), (Benchmark = Other)
Energy and Mobility	Categorical	Project related to TT1, TT2 and TT3	Yes = 1 (6%), No = 0 (94%), (Benchmark = City life improvement)
ICT	Categorical	Project related to TT4	Yes = 1 (20%), No = 0 (80%), (Benchmark = City life improvement)
Technical	Categorical	At least one member has an advanced technical background	Yes = 1 (35%), No = 0 (65%), (Benchmark = Different background)
Business	Categorical	At least one member has an advanced business background	Yes = 1 (29%), No = 0 (71%), (Benchmark = Different background)

Overall, of the 220 applications made by students, only 63 of them were accepted, corresponding to a percentage of approximately 30.5%; this percentage can provide some preliminary insights on the strictness of the selection process, which eventually narrowed down the final number of applications received. The most straightforward intuition beneath this could be attributed to the fact that it is not such an easy task to develop a project within the context of a smart transition track (and this could explain the rejection of some projects which could not be considered as dealing properly with topics related to Smart Cities). On the other hand, there can be as well other factors conversely related to applicants' and team members' individual characteristics which could exert an impact on the probability of project acceptance. The variables of the dataset encompass information about both these two aspects, which we will hence control for in our empirical investigation.

A3.2.2. Methods

For this analysis, we utilize econometric techniques relying upon non-linear estimators. Specifically, we aim to quantify the impact exerted by both applicants' and team members' characteristics, and project characteristics, on the likelihood of project acceptance. To briefly explain the econometric methodology we utilized: the probability of a single project acceptance is described by a categorical dummy variable, Y, which is equal to 1 if the project is accepted, and 0 otherwise. Denote then as X the vector encompassing all the variables affecting the probability of project acceptance (i.e., the variables of interested listed in Tab. 24 related to team members' characteristics, and project characteristics). Mathematically, we can synthetize this relationship in the following expression:

$$p = pr[Y = 1|X] = f(X'\beta) \quad (1)$$

Where the probability p of the project being accepted conditional on the variables related to individuals' and project characteristics, can be modelled by a predetermined functional form f, with β denoting the vector of coefficients for X. In the econometric literature, there exist various possibilities to select the desired functional form; given the fact that the probability lies in the interval [0,1], the Probit and Logit models have been represented a recurrent choice to model binary outcome data, given their power to delimit the predicted probabilities within the range [0,1]. Specifically, in the Probit model, $f(X'\beta)$ is the cumulative density function (cdf) of a standard normal distribution, so that:

$$f(X'\beta) = \phi(X'\beta) = \int_{-\infty}^{X'\beta} \phi(z)dz$$

Conversely, in the Logit model, $f(X'\beta)$ is the cumulative density function (cdf) of a logistic distribution, so that:

$$f(X'\beta) = \wedge(X'\beta) = \frac{e^{X'\beta}}{1 + e^{X'\beta}} = \frac{\exp^{X'\beta}}{1 + \exp^{X'\beta}}$$

Eventually, the probit and logit functions have a similar functional form, and as stressed, they both have the desired property of delimiting the predicted probabilities in the range [0,1]. Both the Probit and Logit models are estimated using the maximum likelihood method. In order to provide a better interpretation of results, it is a common procedure to compute the marginal effects for the coefficient estimates through partial derivative measures. Specifically, the marginal effects report the change in the probability of Y = 1 given a 1 unit change of a certain explanatory variable j contained in the vector X. Accordingly, the marginal effect for the Probit model is computed as:

$$\frac{\partial p}{\partial X_j} = \phi(X'\beta)\,\beta_j$$

Similarly, the marginal effect for the Logit model can be derived as:

$$\frac{\partial p}{\partial X_j} = \wedge(X'\beta)[1 - \wedge(X'\beta)]\,\beta_j = \frac{e^{X'\beta}}{\left(1 + e^{X'\beta}\right)^2}\,\beta_j$$

For our analysis, we will estimate the marginal effects of Eq. (1) utilizing both the Probit and Logit models. As an additional robustness check, we will also estimate Eq. (1) utilizing the variables related to individuals' characteristics alone, to assess the stability of our estimation results. The results of the econometric estimates are reported in Section 4.2.3.

A3.3. Results

The coefficient estimates for the marginal effects of the Probit and Logit models are reported in Tab. 28.

Tab. 28: Marginal effects for the Probit and Logit models.

Variables	(1)	(2)	(3)	(4)
Age	-0.0506***	-0.0511***	-0.0516***	-0.0523***
	(0.0144)	(0.0143)	(0.0146)	(0.0145)
Gender	-0.0508	-0.0446	-0.0479	-0.0386
	(0.0727)	(0.0714)	(0.0728)	(0.0714)
Master	-0.1500**	-0.1320*	-0.1490**	-0.1280*
	(0.0691)	(0.0700)	(0.0672)	(0.0684)
Economics and Business	0.1880*	0.1610*	0.1860*	0.1650*
	(0.104)	(0.100)	(0.107)	(0.103)
Humanities	0.0260	0.00881	0.0144	0.00741
	(0.103)	(0.0992)	(0.103)	(0.0995)
Science	0.0338	0.0135	0.0286	0.0127
	(0.0925)	(0.0900)	(0.0919)	(0.0894)
Technical	0.1580*	0.1300*	0.1610*	0.1330*
	(0.0825)	(0.0800)	(0.0848)	(0.0814)
Business	0.114	0.0777	0.118	0.0795
	(0.0866)	(0.0839)	(0.0901)	(0.0860)
N. members	0.0119	-0.00511	0.0149	-0.00398
	(0.0234)	(0.0217)	(0.0235)	(0.0218)
Energy and Mobility	0.0277		0.0572	
	(0.157)		(0.165)	
ICT	0.2730**		0.2830**	
	(0.0938)		(0.0974)	
Log-likelihood	-135.2267	-124.2019	-119.3311	-124.0662
AIC	263.05	268.40	262.66	268.13
BIC	303.78	304.34	303.39	304.07
Observations	220	220	220	220

Note: Probit estimates refer to (1) and (2); Logit estimates refer to (3) and (4). Standard errors in parentheses.
**** p<0.01, ** p<0.05, * p<0.1.*

From the table, interesting results emerge. Firstly, the overall satisfactory stability of the coefficient estimates across the different model specifications suggest that our model has been correctly specified. Then, when looking at the estimation results, with reference to the age variable, it seems that older applicants have less chances of having their project accepted compared to younger applicants. This result could be related to the fact that it is often easier for teachers to make students assimilate certain business schemes more easily in undergraduate than in graduate students, as the latter, due to their advanced education, may already possess some conceptual schemes which may render less flexible the assimilation of certain concepts (Azevedo et al., 2012). This could hence possibly explain why the committee may favour bachelors over master students. On the other hand,

the variable associated to gender is not significant in any model specification, therefore the fact of being a female or a male does not seem to affect the probability of acceptance.

Surprisingly, applicants holding a master's degree seem to be less likely to have their project accepted. This result may be interpreted considering the finding for the age variable; specifically, this may suggest that the committee seem to provide a higher weight to younger students at the bachelor's level rather than older graduate students. On the other hand, however, having in the team at least one member with advanced technical skills seem conversely to increase the likelihood of acceptance. This could be seen under the perspective that the team leader may likely be carrying out the business practices (for which generally, as stated above, undergraduate students are preferred over graduate students), whereas the team member with advanced technical skills may help in facing the technical issues related to the business development.

At the same time, it seems that having a background in economics and business for the applicant, increases he rate of success with respect to the other types of background. Then, it also emerges how the numerosity of the team seem not to exert a significant impact on the likelihood of acceptance.

Finally, with regard to project characteristics, it seems that projects falling in the domain of ICT (/digital solutions) have a higher chance of acceptance; this may suggest that, compared to the other smart domains (Energy and Mobility and City life improvement), projects related to ICT (/digital solutions) are perceived with a greater potential and/or higher feasibility.

To summarize all the results emerging from the econometric estimates, it hence appears that younger bachelor's student applicants with a background in economics and business who rely upon the collaboration of at least one external team member having high technical skills, have higher chances to have their project accepted. In addition, being a project centered on the smart transition track dealing with the ICT and digital solutions field, seems also to increase the probability of acceptance.

A3.4. Conclusions

For the PEPITE scheme, the conclusions show that:

- The PEPITE scheme, representing an example of success for the city of Nice with reference to the key function F1 on entrepreneurial experimentation, holds some key factors which could be replicated by FCs.
- Incubation appears as playing a key role in the development of new entrepreneurial experimentation, and is also a way for FCs to absorb more efficiently the external solutions developed by LHs.
- Investigating the drivers affecting the selection procedures of the Nice Métropole (CEEI) incubator for the selection of the most promising candidates, noteworthy results emerge. Specifically, both applicants' and team members' characteristics, and project characteristics seem to exert a significant impact on the likelihood of project acceptance by the incubator,

and further on the quality of entrepreneurial projects to be achieved in FCs as “absorptive capacities” of IS in the replication process.

- From the econometric estimates, it emerges how younger students, students with a background in economics and business, and applicants who have in their team at least one member with a highly technical background, are more likely to have their project accepted. For the FCs this means that the younger (smart) generations need to be involved in an active way in the development of the Smart City, and that interdisciplinarity in entrepreneurial teams need to be favoured in the deployment of replication.
- In addition, it also appears that projects related to ICT and digital solutions (in relation to the TT4) are also more likely to be accepted. This finding mirrors in fact the results obtained in the TIS, which revealed a major point of strength for Nice LH1 in entrepreneurial experimentation, with particular reference to integrated solutions belonging to the domain of ICT. By extension, this means that the more Nice (and potentially other LHs cities) will deploy IS within TT4 by scaling up from district to district, and the more the FCs will be equipped in terms of incubation in that field, the better will be replication results. As such, since the results of the TIS dashboard tool revealed a high level of replication from Nice LH city to follower cities on F1 for the TT4, the findings of the empirical analysis from the PEPITE scheme might provide an interesting practical insight to such aim. The promotion of incubation programmes favouring ICT projects addressed to local student entrepreneurs could be a tool to increase the level of entrepreneurial success by follower cities.

Endnotes

[1]Although there might also be differences that will be more apparent throughout the development of the IRIS project and will be accommodated by SBM adaptation, see MS4 lead beneficiary IMCG.

[2]To qualify for the status of "student entrepreneur" a student must fill a specific application form, as well as being in possession of a French baccalaureate (or an equivalent foreign diploma).

[3]Specifically, after a first positive evaluation by the committee, the same evaluation is then submitted for an additional approval and control to the representatives of the Regional Delegation for Research and Technology (DRRT). When the DRRT also approves, the PEPITE committee sends the evaluation to the Ministry of Higher Education and Research, which will issue the national status of student entrepreneur to the admitted students. The status is granted by the Ministry of Higher Education and Research, and its duration is valid for one year with possibility of renewal.

[4]The establishment of the various PEPITE across France was designed to provide a good coverage across the different French regions. Nonetheless, nothing prevents a student living in a certain region to apply to a PEPITE located in a different region.

[5]Namely, projects related to smart solutions encompassing the domains of ICT, Energy and Mobility, and city-life improvement.

[6]The term "technical skills" here includes a person with (at least) a master's degree in hard sciences (engineering, physics, chemistry, etc.). On the other hand, the term "business skills" includes a person with (at least) a master's degree in business administration / management.