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**CAN SMART CITIES BE FRUGAL?
An Exploratory Study of Inclusive Innovation Mechanisms
and Influencing factors on the potential adoption of frugal
projects in an urban living lab in Amsterdam**

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List of Acronyms

BoP	Base of the Pyramid
BR	Business Representative
DT	Diffusion Theory
FI	Frugal Innovation
ICTs	Information, Communication and Technologies
IIMs	Inclusive Innovation Mechanisms
MR	Municipality Representative
RMs	Relational Mechanism
RR	Resident Representative
TPB	Theory of Planned Behavior
TR	Transition broker
EC	European Commission
UN	United Nation
ULLs	Urban Living Labs
ENOLL	The European Network of Living Labs

Abstract

This research is an exploratory study, which discusses Inclusive Innovation Mechanisms and the potential adoption of Frugal Innovation projects in a Transition-driven Urban Living Lab. It is believed that by exploring the links between these two concepts an inclusive smart city model can be created as well as increasing equality of BoP in cities like Amsterdam. In this respect, the four inclusive dimensions framework developed by Schillo and Robinson (2017) resulted to be useful to give a shape to these mechanisms. Secondly, the study defined key influencing factors on the potential adoption of FI projects in an Urban Living Lab. In order to reach this goal, the theory of diffusion and the Theory of planned behavior were used to see the level of attractiveness of FI characteristics in a ULL. Finally, there is an attempt to illustrate possible patterns between mechanisms and adoption of FI projects to produce innovation strategies for inclusion. Two research strategies were selected to answer theoretical and empirical research questions. These strategies are desk research of academic literature and Case Study, which are particularly appropriate to study how **inclusive innovation mechanisms** facilitate the potential adoption of **frugal projects** in an Urban Living Lab operating under Amsterdam's smart city program. The analysis uncovers strategies and practices involve in the innovation processes. Resulting in a relevant framework where IIMs stimulate the adoption of FI projects and at the same time FI might strengthen the performance of IIMs in the ULL. In addition, the research complements the four-dimensional framework for inclusive innovation created by Schillo and Robinson (2017) by adding a list of possible mechanisms useful to boost inclusion in an organization. Lastly, policy, theoretical and practical contribution are given. As a result, the study found that by applying inclusion innovation mechanisms and allowing them to work as a mediator's Smart cities can be frugal. However, future research should be orientated towards the application of these IIMs in other smart initiatives to prove their inclusive nature and their relationship with the potential adoption of FI projects in a western context.

Relevance to Development Studies

Globally, countries have different development priorities. Yet, there is a general rising concern regarding *growth* practices due to the fact that they are not inclusive enough. In addition, inequalities in living conditions, income and education are prevalent not only across regions and social groups but also within each of these groups. Often, these inequalities are greater in developing countries than in developed countries. However, with the influence of technology, developed regions are continuously realizing larger gaps between citizens who make up the BoP and other societal groups. As a result, those at the BoP face difficult living conditions, societal and economic exclusion, even in developed regions. For example, when looking into poverty research in The Netherlands, non-western *ethnic minorities*¹ represent the BoP of the income distribution in the country. Therefore, Poverty is becoming increasingly 'ethnicized', because the share of minorities in the population is growing (Vrooman and Hoff, 2004). Therefore, this research is relevant for development studies because on the one hand, it addresses exclusion and inequality challenges in a developed region. Moreover, it suggests that ULLs, which support 'Smart' interventions, should promote a more bottom-up

¹ According to the definition used by Statistics Netherlands (CBS), a member of a minority is a person living in Netherlands at least one of whose parents was born abroad. Ethnic minorities are distinguished by country of origin and the main division is western and non-western ethnic minorities. Ethnic minorities from Turkey, Africa, Asia, or Latin America are classified as non-western ethnic minorities.

approach to foster local community-driven initiatives. Additionally, ULLs should introduce inclusive mechanisms in order to enhance smart tools. On the other hand, it suggests that in order to solve these problems affordability, exclusivity and frugality should be cultivated.

Keywords

Smart city development, Inclusive mechanisms, Frugal Innovation, local and urban development, and transition Urban Living Labs

Chapter 1

Introduction

1.1 Background

In recent years, the world is experiencing a rapid process of urbanization. According to UN (2008) by 2050 nearly the 70 percent of the populations is going to be living in urban areas. As a result, there is an evident effort of local governments to achieve a sustainable development and to manage the complex urban issues that accompany the growing urban population. These issues can be especially complex if the existing institutions and organizations are not well-resourced to manage uncertainty and complexity (Guan, 2012). Therefore, when cities address urban development based on the optimization of existing structures it impedes the adoption of necessary changes to reach long-term sustainability. Moreover, policy-makers, city planners and political elites are becoming more aware of the need to create *innovative and inclusive strategies* to solve current challenges such as: accelerate process of urbanization, governance issues, social exclusion of low-income communities, sustainable use of resources, and the improvement of the quality of life of vulnerable communities within the cities. As a consequence, cities are adopting a smart management approach based on the role of Technologies– ICTs– and usage of data to create urban solutions. But, according to Husar and Ondrejicka (2019) the application of “the concept of ‘smart city’ in different cities has been uncritically accepted and has been perceived by majority as very a good modern and effective solution for tackling urban problems” (p.3). Currently, there is an academic effort to look at the discourse of smart cities promoted by municipalities and private agents. For example, in the analysis of Vanolo (2013) research, he suggests that “smart city discourse is a powerful tool for the production of docile subjects and mechanisms of political legislation” (p. 01). Therefore, some scholars point out that there is a need to change some attributes of this management approach (Kummitha and Crutzen, 2017). The reason is because it keeps replicating the old top-down and linear approach towards the solution of urban and social problems, making structural problems like exclusion and inequality a more remarkable reality. For example, for example, one phenomenon used to highlight the human and social orientation in smart cities is the creation of Urban Living Labs (Garcia Robles et al. 2016). These ULLs are an innovation methodology to face challenges such as *poverty, inequality, the scarcity of natural resources and climate crises* (Evans et al; 2016). In order to address these challenges cities had been introducing changes in the way service systems have been planned and delivered through different versions of ULLs interventions. For instance, the municipality of Amsterdam has created the CO2 Fore ULL to include marginalized communities in the design and implantation of its smart cities programs to create a sustainable urban society with better life standards for all the citizens in Zuidoost, one of the underdeveloped areas of the city of Amsterdam. George et al (2012, p.1) proposes that if cities want to involve low-income citizens in their planning, they should adopt inclusive innovation to promote improvements in the social and economic well-being of communities that have structurally been excluded in innovation setting. This type of innovation might be materialized in mechanisms–by which such inclusive innovations initiatives occur.

1.1 The context of the study: Amsterdam’s Smart city development

Amsterdam smart city is well-known as a leader in the application of successful smart city strategies and has been awarded multiple times because of it. According to the study done by Mora et al. (2019) part of the success of this smart city program is due to its holistic vision.

The program promotes both technology and socio-technical systems. For example, In EU programs such Europe Vision 2040 and Smart Cities for Europe, the importance of Smart cities is highlighted and the ULL is considered a *bests practice* in this context (Paskaleva, 2011). By introducing the ULL principles to urban innovation *smart* cities are trying to stimulate both user-innovation and the development of innovations that fit better the needs of their citizens. To reach this goal ULLs stimulate collaborative model of innovation with multiple stakeholders. According to Juujärvi and Pessa (2013) the collaborative model shows business with the highest level of participation with around 46 % and 56%, being the most active organization in this network. Consequently, government and civil society organizations have the lowest participation with 22% and 10% respectively.

1.2 Nature of the problem

The interest of this study in *inclusive innovation mechanisms* is driven by the observation that many top-down interventions performed by smart cities have fail to provide the “expected” economic and social development, especially, for those who represent the BoP, in urban areas. For example, Datta (2018, p. 01) argue that smart cities, the ones already being developed, have left a “*significant amount of people behind and it is expected for the next generation of smart cities will produce the same effect on society*”. Additionally, *smart city agenda rarely addressed issues of social differences in already-existing cities*”. Moreover, Berry and Glaeser (2015) pointed out that cities implementing smart city planning, lack interest to diminish existing urban inequalities, resulting in the worsening of urban inequalities. However, In EU programs such Europe Vision 2020 and Smart Cities for Europe, ULLs are considered to be a best human centric *practice* (Paskaleva, 2011). According to Lievens et al. 2012; Voytenko et al (2016) there is a lack of studies in *procedures or inclusive mechanisms* through which ULLs might be producing inclusive interventions. Therefore, it is relevant to know how smart city initiatives can use inclusive innovation to generate inclusion, especially for those at BoP. However, Berry and Glaeser (2015) suggest that often the type of citizens getting involved in smart city methodologies are well-educated, technology-led groups, ignoring the needs of the people at the bottom. According to Kummitha & Crutzen (2017) and Berry and Glaser (2015) the design and implementation of smart cities should create a sustainable urban society to be able to reduce social disparities.

A secondary objective of this study is to determine the influencing factors that can stimulate the adoption of “frugal innovation projects”. The reason is because to there is an increasing claim in research for frugal innovations within (Western) smart city settings and it is expected to increase even more in the future as a result of socioeconomic, environmental crises and demographic changes alongside with increasing constraint on resource (Datta, 2018). Therefore, the study pretends to generate insights or strategies on **how organizations supporting a smart city approach can ‘potentially’ adopt frugal projects** (Tiwari et al; 2007). According to Tiwari and Kalogerakis (2016) Frugal process and frugal products have been object of large investigation, but the potential of adoption of FI projects has not been deeply studied, especially in Western context yet. Additionally, it was found that development of a *frugal mindset* is essential precondition for Westerns organizations to successfully develop frugal projects. Therefore, it will be briefly address in the resent research.

1.3 Research Objectives and Research Questions

Firstly, the research aimed to define various types **inclusive innovation mechanisms that have the potential to be incorporated in innovation settings promoted by Smart city. In this respect, the four** dimension's framework developed by Schillo and Robinson (2017) resulted to be useful to give a shape to these mechanisms. Secondly, the study defined key influencing factors on the adoption of FI projects in a ULL. In order to reach this goal, the theory of diffusion and the Theory of planned behavior were used to see the level of attractiveness of FI characteristics in a ULL. Finally, there was an attempt to illustrate possible patterns between mechanism sand adoption of FI projects to produce innovation strategies for inclusion.

1.4 Research Question

Main Research Question:

How do **inclusive innovation mechanisms** facilitate the potential adoption of **frugal projects** in an Urban Living Lab operating under Amsterdam's smart city program?

Research Sub-question

Academic Discussion

1. What are the key **inclusive innovation mechanisms** that can be identified in the academic discussion?
2. Which are the influencing factors in the 'potential' adoption of frugal innovation projects that can be identified in the academic discussion?

Empirical Work:

3. What key inclusive innovation mechanisms can be observed in the ULL?
4. Which influencing factors in the 'potential' adoption of frugal innovation projects that can be observed in the ULL?
5. What patterns can be observed between inclusive innovation mechanisms and the influencing factors in the 'potential' adoption FI projects in the ULL?

1.5 Justification and relevance of this research

1.5.1 Academic Relevance: Complementing a framework

The aim of an exploratory study is to contribute with information where a reduced amount of knowledge exists. Therefore, in this study the focus is put on breaking down and understanding the inclusive *mechanisms* used by ULLs to include citizens, such as the BoP, to make it easier to assess why this inclusion is effective or ineffective. Ideally, successful mechanisms can be replicated or enhanced in other spaces related to innovation development (Ylikoski, 2012). As a result, the study attempted to complement the "the *four-dimensional framework for inclusive innovation*" established by Schillo and Robinson (2017). This framework was adopted in this study to give the background to the theoretical definition of *the inclusive innovation mechanism* that were tested in the ULL used to include low-income citizens in the innovation process. This framework is important to, assess if ULLs are actually including this population (BoP) and which tools-processes are been used to reach them. This, in fact, is a theoretical

gap in western contexts due to the vagueness of whom exactly and which tools the ULLs are trying to support or include within the innovation system.

1.5.2 Practical relevance: Strategies

In addition, it is also important to explore key influencing factors in the ‘potential’ adoption of FI products in a setting where mechanisms of inclusion are implemented. This research suggests that the pre-existence of these inclusive mechanisms might facilitate the ‘potential’ adoption of frugal projects in Urban Living Labs (ULLs). Specifically, if these mechanisms are used to include low-income citizens in the innovation process (Zeschky et al. 2011). As a result, the empirical dimension of the research founded key patterns that linked inclusive mechanism and FI adoption. Overall, the exploration on the ‘potential adoption of FI adoption resulted in the classification of successful strategies that can be replicated or enhanced in other spaces related to innovation development to adopt a more inclusive and frugal innovation approach. In this perspective, this research pretends to contribute to the practical gap in developing an understanding on how a strategic alignment with FI can be achieved as well as frugal mind-set can be cultivated. (Zeschky et al. 2011; Krohn and Herstatt, 2018).

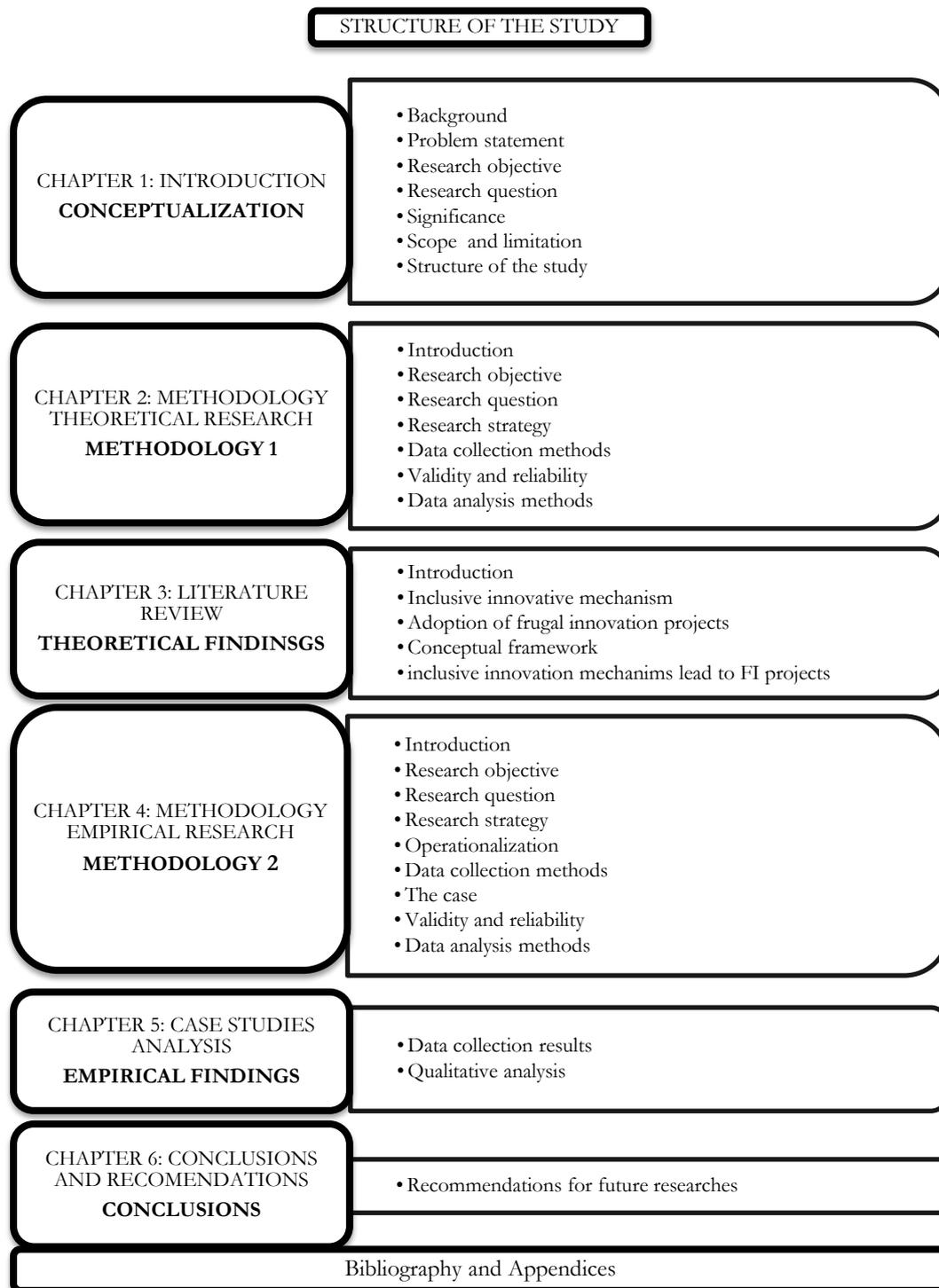
1.6 Scope and Limitations

The research focused on a *transition* Urban Living lab that make part of Amsterdam smart city project. The reason is because only one showed the expected “inclusive mechanisms” that were theoretically develop for the present study. The number of participants interviewed, during the data collection, present another scope limitation, only six were interviewed due to the novelty of the project and present workload of the participants. In addition, two of the interviewees were part of the BoP. The level limitation of the study also depended on the interest of the ULLs to join in the study, accessibility of the organization’s data and the language barrier with the ULL due to the different ethnicities of the participants. Since the research aims to explore and define inclusive mechanism and key influencing factors that lead to the adoption of FI projects it required a broad study of a real that possess those mechanisms. Moreover, due to the limitations of time and resources available, a reduction of a selection of a single case led to diminish external validity. Therefore, the level of generalization of the study in other situations may be reduced. But, the safest approach to enhance reliability and validity, in this case, is to analyze the case by identifying patterns related to the main research variables and triangulate data collected. Another important limitation is the scarcity of theoretical knowledge about inclusive mechanism and adoption of frugal projects in the ULLs. Moreover, this topic is really challenging to be empirically studied, since ULLs, as a study field is very young, which make it harder to extract inferences. Lastly, during the desk research about potential ULLs to be studies most of the data was in Dutch.

1.7 Structure of the Study

This research has a sectional structure since two different strategies were chosen to answer the main question (Figure 2).

Figure 1: Structure of the study



Chapter 2 : Research Design and Methods 1

2.1 Introduction

In this chapter the methodology to answer the three first theoretical research sub-questions is illustrated (chapter 1). The purpose of doing it is to answer the main research question. Here the three theoretical sub-questions and its objective will be stated, already presented in chapter 1. In addition, the research strategy, data collection and analysis methods to conduct the first part of the study are introduced. As mention before, two research strategies were selected but only the *desk research of academic literature* will be addressed in this chapter. This strategy was selected because it is essential to get an outline of the current literature on this novel conceptualization to generate knowledge on the variables of the research question.

2.2 Research Objectives and Research Question

Research Objective

The research aims to define various types of strategies based on **inclusive innovation mechanisms used by the ULL** and how these strategies and the key elements of the potential adoption of FI projects in ULLs relate. In this section the study attempts to introduce “the *four-dimensional framework for inclusive innovation*” established by Schillo and Robinson (2017). This framework has been adopted in this study to give the background to the theoretical definition of *the inclusive innovation mechanism* that were tested in the ULL used to include low-income citizens in the innovation process. Additionally, this study conceptualized key influencing mechanisms of the eventual adoption of FI projects in an ULL.

2.3 Research Strategy

In order to achieve the objective of the study both theoretical and empirical research is needed. Therefore, *Desk Research* was the theoretical research strategy chosen, especially, a *systematic literature review* (SLR). In the research, the literature review is seen as a mechanism to “to identify, select and appraise all the studies previously done that possess certain level of quality that are relevant to a particular question. The results of the studies are then analyzed and summarized. In addition, synthetizing evidence help to find out what we know and does not know about what works and what does not work” (Booth et al. 2012, p.3). Therefore, the *literature review* was used (1) to identify and select the relevant studies to **inclusive innovation mechanism** used in the innovation process used in ULLs and to the key influencing factors on the **‘potential’ adoption of frugal innovation projects**. (2) To build a conceptualization on these two variables. The SLR is based on existing secondary data. The theory generated showed how inclusive mechanisms have been studied so far. To describe these mechanisms and influencing factors on the eventual adoption of FI projects it was fundamental to answer the two theoretical sub-questions. Consequently, the answer to these sub-questions are necessary to both create a coherent conceptual framework and to progress to the empirical stage of the study.

2.4 Data Collection

This study used a qualitative data collection. This approach is chosen because the study deals with a new phenomenon. Consequently, in this study primary and secondary collection and analysis methods were combined in two steps. In step one is related to secondary data, explained in below in table 1. In step two, primary qualitative data is collected and analyzed, portrayed in chapter 4.

Table 1: Theoretical exploration–Research methodology

Strategy	Data	Method	Approach	Variants	Analysis	Output
Desk research	Secondary data	SLR	Analysis of the relevant academic literature about the two main variables (see operationalization)	Thematic ordering and summary	Supported textual software analysis (Mendeley)	Literature review and Conceptual framework (chapter, 3) Operationalization (chapter, 4)

Source: Adjusted from Van Thiel (2014)

Desk-research–Literature Review

I. Secondary Qualitative data collection

Academic Literature Review: It involves the use of existing data, collected, created and published by other scholars. Within the selection process of the articles that contain the variables of interest were, Literature that describe the main characteristics of ULLs, their inclusive mechanisms, engagement mechanisms, innovation mechanisms, mechanism used by ULLs.

Table 2: Search parameters in academic database and academic engines

Website link	Academic databases/research engine	Urban Living Labs	Inclusive innovated mechanisms	Adoption of frugal projects	Research parameters
Eur.nl/ub/	Erasmus University database	162 results	81 results	97 results	Peer-review Articles (English Spanish)
researchgate.net	ResearchGate	76 results	56 results	81 results	Journal Articles
scielo.org	Scielo	3 results	8 results	35 results	Articles
Scholar.google.com	Google Scholar	1021 results	173 results	1019 results	Articles

Source: Author's own elaboration

(II) For the literature review a snowball method was used to select new publications by reviewing the academic references of the articles primarily found. The selection focuses on articles from 2000 to 2019. The second selection of academic articles targeted possible relationships between inclusive innovation and frugal innovation. (III) This first research about the inclusive mechanisms in ULL topic lead to different types of engagement mechanisms and its main characteristics. The study lead to Schillo and Robinson (2017) and Akhmouch and Clavreul (2017), Leminen (2013), Zaheer et al. (1998) Vargo and Lush, (2006) as important research to identifying and setting up these mechanisms. In the second case, to

defying the influencing factors in the adoption of frugal projects the studies of Krohn, and Herstatt (2018) the Scale developed by Rossetto et al. (2018), the theory of planned behavior of Ajzen (1991), the diffusion theory of Rogers (2010), the action phases of Gollwitzer' (1990) and Tornatzky and Klein (1982); Weigel et al (2014) work on combining diffusion theory and Theory of planned behavior Were also relevant. (IV) The final selection of 21 publications because counting the ones listed before. The publications selected were used to create an overall knowledge about inclusive innovative mechanisms in ULLs in the academic literature. Therefore, publication was narrowed down to specific themes. The new studies were Lavie and Khanna (2012) Kale et al. (2000) and McEvily and Marcus (2005), Cullen et al. (1995); Sarkar et al. (2001). Puerari and de Koning, (2018); Lusch (2007), Lastly, about 47 publications such as papers, books, chapters and thesis were systematically revised and included in the present literature review presented in chapter 3.

2.5 Data analysis

The data obtained through a literature review was used to understand the subject and what is known about inclusive mechanisms and the influencing factors in the adoption of frugal projects in ULLs. Therefore, the selection done of existing significant material, was done manually and supported by the software Mendeley where the data was uploaded and tagged. The literature collected focused on:

1. Definitions of Urban Living Labs and types
2. Definitions of inclusion
3. Definition of inclusive innovation
4. Definitions of inclusive mechanisms
5. Definitions of frugal Innovation, diffusion and mindset
6. Definition of key element of adoption of frugal innovation

Several codes were created to categorize the data with the attributed listed before. With this procedure the data was divided in small units to describe the meaning of that part of the data. For example, the most recurrent definitions of inclusive innovations and its characteristics were included in the definition for inclusive innovative mechanisms potentially present in ULLs. As a result, the literature review shows the relevant information to define the variables (inclusive mechanism and potential adoption of frugal projects, which materialize in a conceptual framework. These variables were operationalized enabling their measurement through indicators (tables 14 and 15).

Chapter 3 : Exploratory Literature Review

Introduction

This chapter aims to answer the main question and the two theoretical sub-questions. To reach these goals, this section will present an overview of the existing academic data and debates about key inclusive mechanism used in current ‘smart’ innovation settings and relevant influencing factors on the adoption of frugal innovation projects in these settings. The first part of this literature review will briefly discuss the core characteristics of Urban Living Labs, followed by a description of **inclusive innovation dimensions** and different **inclusive innovation mechanisms found in the literature review**. In the second part of this chapter, a definition of frugal innovation characteristics as well as theories of innovation ‘potential’ adoption will be presented. Moreover, influencing factor in the ‘potential’ adoption and a definition of a ‘deliberative’ frugal mindset will be provide.

3.1 Urban Living Labs (ULLs)

Currently, cities are adopting ‘Smart’ planning to face growing economic, social and environmental challenges. These challenges are related to overflowing urbanization trends, which their main consequences are *poverty, inequality, the scarcity of natural resources and climate crises* (Evans et al; 2016). In order to address these challenges cities have made changes in the way service systems have been planned and delivered. For example, one phenomenon used to highlight the human and social orientation in smart cities is the creation of Urban Living Labs. The European Network of Living Labs (ENOLL) argue that ULLs are considered a methodology, an organization, an environment and a system where delivering innovation is the main goal (Garcia Robles et al. 2016). In the literature review three types of ULL were found: technology-driven, transition-driven and citizens driven. However, this research focusses on a transition driven ULL. The reason is because “[...] it preents a hybrid, flexible and transdisciplinary innovation platform” (Nevens et al. 2013, p. 115). Consequently, this type of ULL implement a new model of local governance reaching both gorups the ones that have been normally detached from urban planning and the other stakeholders of the Quadruple Helix Mode (Wallin et al. 2017). Therefore, this type of ULL is relevent to explore the systemic governance of stakeholders interactions between the top-down tools and the bottom-up inititives. Hence, this type of ULL offers the context for the present study to test *the inclusive innovation mechanisms* that are defined as mediator tools to include structurally detached groups—low-income citizens— from the innovation process. Additionally, transition ULLs focuses on the governance of problem-solving and improvements of societal systems (Schliwa, 2013). Therefore, it includes a “portafolio of *tools* that have as a common objective to enable change in practices and structure ‘institutions’ directed to sustainable targets” (Nevens et al. 2013, p. 114). Which is the perfect scenario to explore the potential adoption of FI projects.

3.1.2 Mechanisms, Innovation and Dimensions of Inclusive Innovation

This research adopts Elster (1998, p. 65) definition of mechanisms as “mediators, recurrent and easily recognizable causal patterns that are activated under generally unknown conditions or under undetermined consequences”. In general terms, mechanisms are ways of doing and thinking to reach specific targets (Ison and Wallis (2007). Therefore, if the goal of an organization is to produce inclusion within the innovation process, the mechanisms might become means or intermediators to reach such a goal. Ylikoski (2012) argued that the focus on mechanism is “to break up original explanations-seeking why questions into a series of smaller questions about causal process: what are the participating entities, and what are their relevant properties? How are the interactions of those entities?” (p. 160).

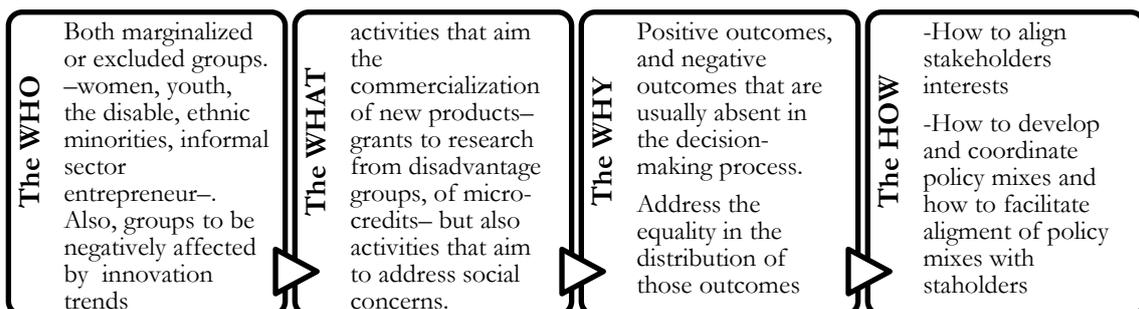
Inclusive Innovation

For this study, Innovation is “a set of micro-processes conducted by individuals, possibly but not necessarily within the organizations. These microprocesses stimulate the propagation and adoption of new ideas under precise conditions”. Therefore, innovation can be defined as “an organization’s inner capability to generate new value propositions for and with stakeholders” (Dervitsiotis, 2010). Moreover, according to George et al (2012, p.08) basic conditions of innovation in practice depend on both the local and stakeholders’ needs and resources’ available. Hence, inclusive innovation is the development and implementation of new ideas through a set of *micro-processes* conducted by individuals and organizations, possibly but not necessarily within the organizations, which create opportunities that enhance social and economic well-being for citizens whom are excluded by society. Therefore, this microprocesses can be understood as inclusive mechanisms used to make interventions more inclusive.

Dimensions of Inclusive Innovation

According to de Beer and Jain (2018) for inclusive innovation to take place “opportunities for participation need to be largely available to all as well as the benefits of innovation need to be shared by all” (p.27). In this regarding Schillo and Robinson (2017) developed a four dimension’s framework that assess if an innovation is really inclusive (figure 6). These inclusive dimensions are: (1) **the people** involved in the innovation (who), (2) the type of innovation **activities** (what), (3) the range of **outcomes** to reach, (4) **the governance** mechanisms of innovation (how). often, organizations performing participative innovation approach address all of this element. The coming section each dimension of inclusive innovation will be explained. Moreover, each dimension will be connected to an inclusive mechanism that is activated within the innovation process to reach specific goals.

Figure 2: Dimensions of Inclusive Innovation

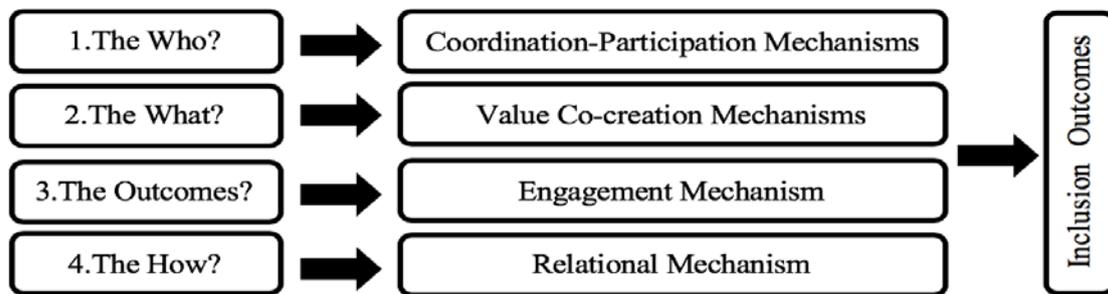


Source: Schillo and Robinson (2017)

3.1.4 The four Dimensions of Inclusive Innovation and the Mechanisms of Inclusive Innovation

In order to explore how excluded groups such as low-income communities are been included in current innovation settings—ULLs—, this study exanimates the four dimensions of the inclusive innovation to give shape to specific inclusive innovation mechanisms. As mention before, these mechanisms are “means”, “mediators” “ways of doing” and “thinking” to reach inclusionary goals. Consequently, these inclusive mechanisms mediate between each dimension and inclusion outcomes (figure 7). For example, an ULL can be considered as inclusive if it generates inclusion outcomes such as positive social *and economic outcomes* for low-income population, which can be assessed through the engagement mechanisms used by the ULL.

Figure 3: Dimensions of inclusive innovation and related mechanisms



Source: Author’s own elaboration adapted from Schillo and Robinson (2017) and Elster (1998)

In the next section the dimensions of inclusive innovation and its relationship with the innovation mechanisms will be explored.

The Whom?

The present study focuses on an Urban Living Lab that seeks to include low-income citizens and communities (BoP) in its innovation processes. Hence, in order to address the question, namely; *‘which groups should be involved in the innovation settings promoted by smart city development?’*, this research suggests that the BoP is a segment of the city that should be included. The BoP is quite regularly defined by incomes of \$1.25 USD per day or similar cutoffs (Chataway et al. 2014). According to Sen (2000) from an inclusive innovation perspective the BoP in developed countries can be translated into social exclusion, which is a feature of excluded minorities. Often, inclusive innovation interventions target minorities such as the disabled and ethnic minorities (Heeks et al. 2014). For the present study, ULLs are relevant *environments* for inclusive innovation and development. The reason is because ULLs enable a participatory design in a real-life setting (open source) where users are seen as co-creators able to handle their own activities (Almirall et al. 2012). Therefore, ULLs are a relevant setting to observe inclusive innovation mechanisms.

3.1.5 Coordination and Participation Mechanisms

Coordination Mechanisms: The Top-down VS the Bottom-up

On the one hand, the coordination mechanisms can be categorized in two dimensions Top-down approach and bottom-up approach (Leminen, 2013) (table 3). According to Sabetier (1986) these approaches have different characteristics and are relevant in different circumstances. He defines the former as coordinated activities to achieve centralized and official targets. In contrast,

the latter is defined as coordination activities that operate at the grassroots level and focuses on local needs. Additionally, Sabetier (1986) argues that both approaches often ignore the benefits of their contrary approach. For instance, a formal activity is not designated in bottom-up approach and a top-down strategy often overlooks the local needs of the different stakeholders. This study adopts the perspective Leminen (2013), where hierarchy is seen as an *innovation-facilitation mechanism* towards a given target. Therefore, in this study top-down coordination approach in ULLs as a hierarchical innovation strategy that is led by the top to the bottom when *co-creating*. This perspective corresponds to the idea of Westerlund and Leminen (2011) that ULLs are facilitated rather than managed. Currently, this has been the perspective of innovation towards the involvement of low-income groups in the innovation settings promoted by smart city development (Almirall et al. 2012). Overall, Halme et al (2012) that top-down and bottom-up approach perspectives are needed to develop inclusive innovation mechanisms.

Participation Mechanisms: Exhalation VS Inhalation

Leminen (2013) has detected a new way of assessing participation mechanisms in ULLs addressing different societal challenges. He proposes two extremes *Inhalation-dominated and Exhalation dominated* (table3). On the one hand, he suggests that *Inhalation-dominated* or “out-in” approach, it is originated at fulfilling the needs of a driving party by engaging other stakeholders in innovation activities.

Table 3: Coordination and participation mechanisms in different types of ULLs

COORDINATION AND PARTICIPATION MECHANISMS				
		Mechanisms	Definition	Participation approach
Coordination approach	TOP-DOWN	Provider-driven mechanism Methods for collective creativity	The innovation activities of the Living lab aim to develop a solution for participants or other stakeholders or have an educational purpose.	<i>Exhalation-dominated</i>
		Utilizer-driven mechanism Open innovation	The participants’ activities are designed to develop or improve the product or service of a third-party (the utilizer)	Inhalation-dominated.
	BOTTOM-UP	Enabler-driven mechanism Social innovation	Taking a bottom-up approach, the activities focus on fulfilling the needs of a local community or association like improving the local social development where the living lab is located.	<i>Exhalation-dominated</i>
		User-driven mechanism User innovation	The participants collaborate to develop their own personal ideas or projects. Living labs activities focus on fulfilling the needs of individual users or user communities	Inhalation-dominated

Source: Leminen, 2013 and Westerlund and Leminen (2011)

This approach incites parties to bring their knowledge, skills, and resources into the open innovation network. On the other hand, Leminen (2013) argues that *Exhalation dominated* participation mechanisms or ‘in-out’ approach, seek to fulfil the requirements and wishes of other stakeholders that are nor the initiators. This approach engages stakeholders for collective action in the open innovation network. Currently, innovation settings see citizens as users and co-creator able to solve their pressing daily life issues (Almirall et al. 2012). This perspective is often use in ULLs where they consider a relevant actor. In this respect, Leminen et al. (2012) have identified four types of actors in different types of ULLs (table 4).

Table 4: Typology of LL based on Main Actors Participation

Typology of ULLs based on Main Actors' Participation				
Typ	Utilizer-driven	Enabler-driven	Provider-driven	User-driven
Purpose	Strategic R&D activity with present objectives	Strategy development through action	Operations development through increased knowledge	Problem solving by collaborative accomplishments
Organiza-	Network forms around utilizer, who organizes actions	Network forms around a region or a founded project	Network forms around provider organization(s)	Network initiated by users lacks formal coordination mechanisms
Action	Utilizers guides information collection from the user and promotes knowledge creation to reach of target goals	Information is collected and used together, and knowledge is co-created in the network	Information is collected for immediate or postponed use: new knowledge is based on then information that provider gets from others.	Information is collected informally and builds upon user's interests: knowledge is utilized to help the user community
Outcomes	New knowledge for product and business development	guided strategy changes into a preferred direction	Network knowledge supporting operations development	Solutions to user' everyday-life problems

Source: Adopted from Leminen (2013) and Westerlund and Leminen (2011)

The What?

The literature review showed that mechanisms of inclusive innovation in ULLs have a strong focus on science and technology-based initiatives, their development and their distributions. Therefore, these activities are focus on providing grants to researchers from excluded groups, the **establishment of programs to popularize science and technology in low-income urban areas** (Planes-Satorra and Paunov, 2017). Moreover, the activities are reinforcing by research, education, co-creation, experimentation, learning and evaluation (Westerlund and Leminen, 2011). However, most of these activities seem to focus on economic considerations in current ULLs. This situation represents a concern for current initiatives that are trying to focus more on producing social outcomes (Wallin et al. 2017).

Table 5: Activities perform by different types of ULLs

ACTIVITIES	TECHNOLOGY-DRIVEN	TRANSITION-DRIVEN	CITIZENS-DRIVEN
Cocreation	Provider-driven	Enabler driven	User-driven
Exploration	Products and services	Different scales of intervention, uses and process	Challenges for the citizens, management of innovation
Experimentation	Systematic and monitored cycle planning	Collaborative and individual process	Informal meeting
Evaluation-learning	feedback collected to develop products/services	intended monitoring system of feedback	Informal feedback

Source: Adapted from Costa (2017)

3.1.6 Mechanisms of Value Co-Creation

Co-creation

Co-creation is one of the crucial aspects of ULLs, a human-centric involvement and a collaborative method of operation. In general terms, in the co-creation process the participating actors together give shape to the innovation process. The literature review five mechanism of value-co-creation were identified. They are (1) the purpose of the co-creation, (2) informal and formal processes of co-creation, (3) the ownership of the co-creation process and (4) the motivations and incentives (table 12).

Table 6: Mechanisms of value Co-creation

KEY MECHANIMS OF VALUE CO-CREATION	
1. The purpose of the co-creation	Making together: Specific innovation goal or output is produced
	Learning together: focus on knowledge creation
2. formal and informal -Intensity of engagement: Heavily engaged versus short term engaged.	Formal: Process deliberately set up by the initiators (one stakeholder or a group). Co-creation process are defined steps, participants and selected forms of participation.
	Informal: Process of collaboration based on shared goals or need to work together. Less official planning, non-selected participation (everyone is valuable), short term engagement-processes of self-organization.
3. The ownership process -defining roles, steps in and steps out of the roles	Clear initiator group: This group dominate the practices and the rules of the co-creation process
	Initiators share ownership: deliberative process to find consensus on how co-creation might be exercise
4. The motivation and incentives	Intrinsic motivation: Motivation to engage in an activity for one's own sake, without apparent external stimuli. It is associated with internal incentives- satisfaction or joy-.
	Extrinsic Motivation: intention to obtain a desired income. It is associated with external incentives-monitory compensation, recognition-.

Source: Adopted from Puerari and de Koning, (2018)

The Why?

The exploration through the literature showed that inclusive innovation addressed both narrow outcomes based on economic growth and more broad outcomes that focused on context and field specific impacts like social, environmental and innovation outcomes. Currently, these broader outcomes make part of policy efforts to contribute to solving complex societal challenges through urban and innovation environments (Kuhlmann and Rip, 2014). For example, cities have introduced ULLs as a mean to reach different types of outcomes. In table 7, more detail about the outcomes in different types of ULLs are shown. However, as suggested by Martin (2016) capturing these outcomes of innovation is challenging. The reason is that often organization only capture positive impacts, leaving negative effects aside of the analysis and decision making. Moreover, the aim of inclusiveness in ULLs complicates the analysis of the outcomes because the overall goal embraces a sequence of goals.

Table 7: Outcomes of different types of ULLs

OUTCOMES	TECHNOLOGY-DRIVEN ULL	TRANSITION-DRIVEN ULL	CITIZENS-DRIVEN ULL
Urban	Technological innovation	Experimental urban development	Citizens empowerment
Economic	New products and local services	Creation of new business increasing of employment	Efficient use of resources
Social	Enhance public services	Sustainability	Solve user's problems
Knowledge	Open exchange of technological innovation	Open exchange with strong local network	knowledge creation
Negative	Limited users' involvement	Prior skills and knowledge	Initiative depend on user's resources.

Source: Adapted from Costa, 2017

As seen in table 7, negative outcomes (Costa, 2017) are been acknowledged by each perspective coming from exclusion of other users' perspectives to need of technical skill and to resources–time and financial– limitations.

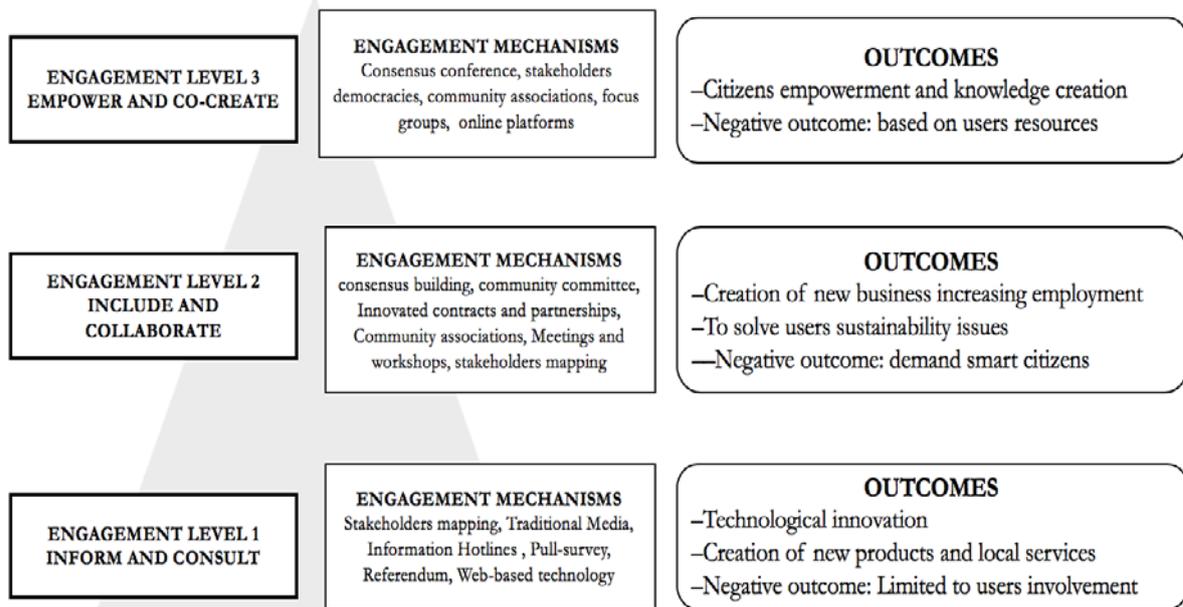
3.1.7 Engagement Mechanisms

During the literature review a variety of mechanisms for engaging stakeholders in different organizations were found. In Ison and Wallis (2017) study about 24 engagement mechanism were found and they can be classified in two dimension *formal and informal mechanism* (Appendix 1). However, when used together are useful to reach innovation goals. On the one hand, formal mechanism can be perceived as single minded and authoritarian (OECD, 2015). On the other hand, Informal mechanisms powers reside in the open atmosphere and dynamic deliberation spaces that they stimulate as well as their capacity to build a sense of community between the different stakeholders. But, from these types of mechanism is very difficult to include outcomes in the final decision-making because there is not systematization of progress. Therefore, suggested by Akhmouch and Clavreul (2017) “the effectiveness of a mechanism also relies on the capabilities and resources needed for stakeholders to use them effectively, including knowledge, know-how and funding” (42).

Citizens Engagement, Mechanisms and Outcomes

According to Smart city program promote by the European Commission, there is three level pyramid that can describe the level of engagement that citizen and communities have in an innovation setting. These are empowerment and co-create, include and collaborate and inform and consult. Each level has its own resources, mechanism and key actors (Walker-Love, 2016). In the first level, *Inform and Consult, Include and Collaborate* and *Empower and co-create*. This framework is useful to align the level of citizens engagement, with the mechanism of engagement used and the expected outcomes in the process of innovation.

Figure 4: Pyramid of Citizens engagement, Mechanisms and Outcomes

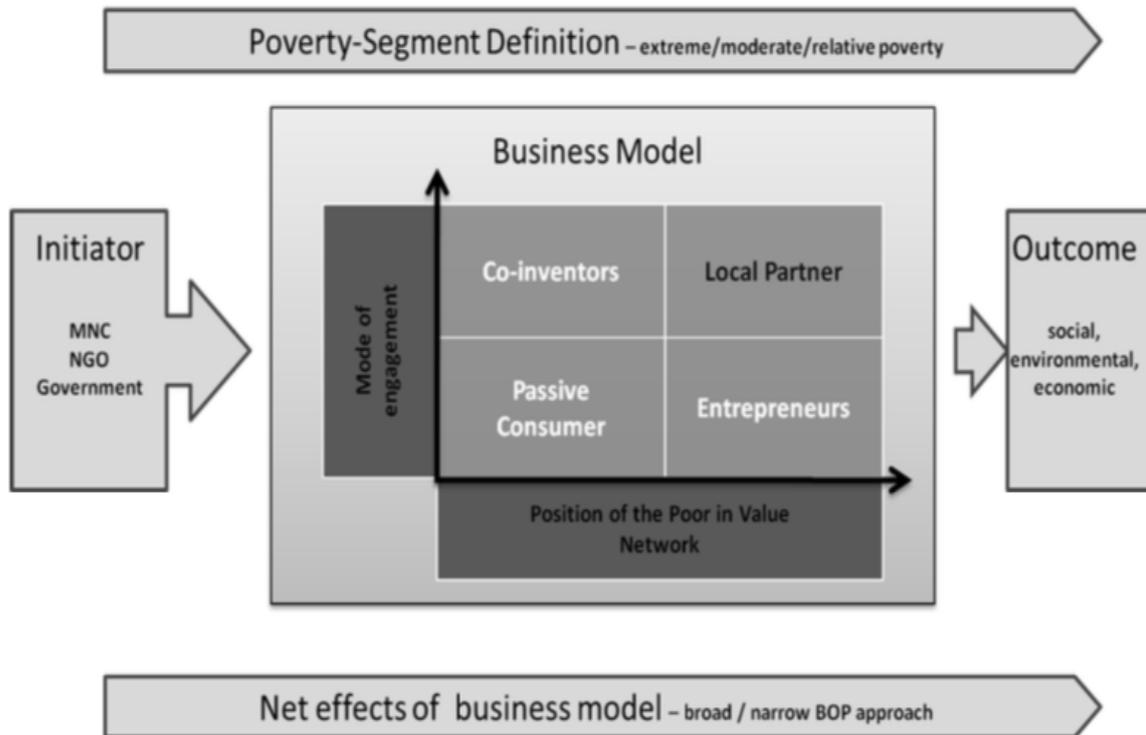


Source: Source: Adapted from Walker-Love, 2016; and OECD (2005) and Rowe and Frewer (2005) and Costa (2017)

The How?

According to Schillo and Robinson (2017) organizations need to re-define the level of involvement of stakeholders in innovation, which demand changes in innovations processes and institutional flexibility within the innovation systems. In order to define how low-income groups should be included in innovation settings, Heeks et al (2013) suggests that there must be an *intention*, citizens might be seen as *users*, positive *impacts* towards low-income population. According to Heeks this impact can be seen in economic terms, well-being, capability increases, among others. Additionally, within the *process* of innovation it is important to distinguish between being informed, consulted, collaborating, empowered or being in control. Hence, the inclusiveness of an innovation can be observed in the *structure* of the intervention and the discourse, where *power distribution* and its outcomes can be observed at a societal level. This scenario can be translated into current models of local governance adopted by cities. For example, According to Baccarne et al (2014) ULLs enable systemic governance of stakeholder's interactions and connect top-down policy and bottom-up initiatives. In this regard, ULLs are being rapidly introduced into and overlaid onto existing urban governance structures, practices and networks, specially across Europe (Voytenko et al. 2016). However, it is believed that ULLs are not yet able to ensure transparency and flexibility in the process of innovation as well as putting societal interests and sustainability over technological advancements. Additionally, the literature review about the BoP showed that innovation models adopted to address the BoP initiatives needs to clarify who is the initiator of the projects and if the expected outcome is social, economic or environmental (Kolk et al. 2010) (figure 5). In the literature review it was evident that not only MNCs are the initiators but also local firms, organizations, ULLs or even local NGOs. Therefore, all of these initiators have represented different ways of addressing the BoP. Therefore, this model is relevant to make visible the inclusive innovation model of the ULLs

Figure 5: BoP Business model–Inclusion of the poor



Source: Adapted from Kolk et al. 2010

Overall, the governance model has to do with how main stakeholders interact, which means that relational innovation mechanism are useful tools to access inclusion innovation.

3.1.8 Relational Mechanisms (RMs)

Relational mechanisms are *purposeful* methods implemented to support and formed relations between the different stakeholders included in the innovation process in ULLs (DeHaes and Van Grembergen, 2006). RMs focus on ensuring *motive* alignment between the stakeholders and the Urban Living Lab through a participatory approach. In general terms, RMs center their attention in “stakeholders’ participation, partnerships, strategic dialogue and shared learning” (Van Grembergen et al, 2004 p.21). During the literature review several relational mechanisms were identified such as *mutual trust*, *relational embeddedness*, and *relational commitment* (Sarkar et al. 2001; McEvily and Marcus, 2005). It has been proven empirically that these mechanisms improve the use of collaboration, which lead to the improvement of the current partnerships (Kale et al. 2000). According to Alam and Campbell (2013) these mechanisms are voluntary actions that are often informal intangible and tacit in the organization (DeHaes and Van Grembergen, 2006). Alam et al. (2013) found that RMs were largely informally organized. But when they are adopted a pattern of inclusivity appear (table 8).

Table 8 Relational Mechanism, definitions and their Usefulness

RELATIONAL MECHANISM		
DEFINITION		USEFULLNESS in ULLs
Mutual Trust	Refers to the confidence that each party will fulfil its obligations and behave as expected (Ring and Van De Ven, 1992)	Mutual trust is needed to avoid non-equal partnerships that often lack formality (Gulati and Sing, 1998). It is an informal mechanism that reduces transition costs associated with bargaining and negotiation of interests, provides resource exchange and enable reciprocity. Consequently, mitigates conflict, goodwill and it improves the effectiveness of collaboration (Madholk, 1995), (Zaheer et al. 1998)
Relational embeddedness	The degree to which partnerships are driven by social attachment and interpersonal ties (Granovetter, 1985)	It supports the face-to-face exchange of information. It is useful for the stakeholders to realize about the value creation through the partnerships and to develop specialized knowledge (Dhanaraj et al. 2004). Moreover, it boosts interactions with the coordination tasks performers (McEvy and Marcus, 2005).
Relational commitment	Refers to the partners' intent to establish enduring, reciprocal obligations in their partnership (Sarkar et al. 2001)	As the partners get more involved with the alliance, they try to avoid loss of enthusiastic investments. Therefore, they support each other, their activities by creating spontaneous (Gulati and Sing, 1998) alternatives to reach their goals. Consequently, there is an improvement of the performance of the partnership

Source: Adopted from Dhanaraj et al. 2004; Granovetter, 1985; Gulati and Sing, 1998; Madholk, 1995; McEvy and Marcus, 2005; Ring and Van De Ven, 1992; Sarkar et al. 200; Lavie et al. 2012

3.2 Mechanisms of Inclusive Innovation and their dynamic

The term ‘mechanisms’ have been the objective of intense critique in science studies and certainly cannot be used non-reflexibly. According to Ison and Wallis (2007) a strategy to not select and combine in simple mechanistic way to solve problem is to “recognize that every concept, theory, tool, technique or method always has a user and that this use always happens within a context and for a human set purpose”(p. 160). Overall, the mechanisms have a more or less contextual nature, that is because they are often considered as operating with other contextual mechanisms that serve as detonators. Therefore, the four dimensions of inclusive innovation framework developed by Schillo and Robinson (2017) is the conceptual and theoretical background under which these mechanisms are built. Consequently, this theory is used to avoid a mechanistic analysis of the IIMs in the present study. In addition, Gonzales (2016) suggests that ‘mechanisms’ can be found hierarchically nested with each other, providing a plausible strategy to connect levels of micro and macro analysis, which is the case of the present study when analyzing the *whom*, the *what*, the *why* and the *how* dimensions and linking to them specific IIMs (figure 3). In this regard, this research breaks the mechanisms down to explore their role as mediators and causal patterns” (Elster 1998, p.45). Therefore, IIMs seek to make explicit the processes by which certain explanatory factors are linked with the existence of certain phenomena such as the potential adoption of FI. Hence, through the IIMs it is possible to make visible the type of ‘inclusiveness’ been promoted on the institutions, when used to steer the implementation of innovation. In practice, the task to create proper mechanisms to include and engage different stakeholders in the process of innovation, may be very complex due to the number of actors involved (Ison and Wallis

(2007). Therefore, depending of the organization some mechanisms might be used more than others and they can practically overlap. The relevance of these mechanisms comes from the demands of new models of governance, the effort of local government to provoke structural changes and the usage of new tools such as technology to solve social, economic and sustainable issues.

3.3 Frugal Innovation

In the process of the literature review it was perceived that frugal innovation is a concept of increasing interest for academics and practitioners in Western countries (Tiwari et al. 2018). The reason of this interest is because it is useful to address the needs of consumers with low-income purchase capacity in Western cities. This study adopts the definition of frugal innovation proposed by Tiwari and Kalogerakis (2016, p.17) and Rossetto et al (2018, p.33):

Frugal Innovation consist on creating value proposition that is attractive to the selected audience, focusing on the essential functionalities and performance of the products and services. Therefore, minimizing the use of material, financial and organizational resources throughout the value chain. It provides substantial cost reduction usage and property costs while meeting or even exceeding the prescribed quality standards, without losing sight of the quest for creating a frugal ecosystem.

According to Brem and Wolfram (2014) frugal innovation also refers to problem-oriented and creative problem-solving approach, which often integrates local needs as a starting point and works from the bottom-up to develop solutions depending on the context. Therefore, frugal innovation is seen as a *process*, where it becomes ends and means at the same time. For example, FI often relies on the combination of existing knowledge and previous technological efforts (Bhattacharyay, 2012). For frugal innovation it is central to improve *accessibility* and resource efficiency as a result it may improve social and ecological sustainability. According to the definition above, FI can be understood as “the *redesign* of products, system and services to make them affordable for low-income consumers” (Bhatti, 2012, p.18). Hence, when redesigning FIs a more inclusive markets perspective appears by developing products for citizens and communities with affordability constraints. According to Knorrinda et al. (2016) “frugal innovation implies that existing capital-intensive top-down innovations processes should become *interactive* and *polycentric*, giving a more prominent role to local producers and consumers” (p. 146). For example, Radjou and Prabhu (2014) suggest that marketing departments should focus on working with *small-scale projects* and alternatives that are connected with *local knowledge* and *local needs*, which might positively contribute to innovation system.

3.3.1 Theories of Adoption and Diffusion of Innovation

This section reviews the literature on frugal innovation and the influencing factors that might affect individual’s decision to ‘potential adoption’ of FI projects. By potential adoption the study refers to the capacity of an organization to develop FI in the future. The reason to explore ‘potential adoption’ is because as suggested by Krohn and Herstatt (2018) FI projects do not make part of the innovation system and mindset in western organizations yet. Additionally, this review is useful to build the research framework for the empirical part of the study.

Roger's theory of diffusion

The second stage of Rogers' theory says that a general attitude towards the 'potential' adoption is central to the adoption of an innovation. In this phase individuals get mentally involved with the innovation and actively seek to develop knowledge and expertise about it. As suggested by Rogers (2010), the most relevant factors at this phase are possible adopters' *perceptions* of the features of the innovation. Rogers theory is based on the belief that the perceived attributes of an innovation are a relevant explanation of the level of adoption. He defines five attributes: relative advantage, compatibility, complexity, trialability and observability and he assigned great relevance to the first two attributes over the rest. For instance, Lunsford and Burnett (1992) research in the barriers of adoption identified that perceived value (relative advantage), product usage (complexity), cultural values (compatibility) and perceived risk influence the user's potential adoption decisions offer a more robust analysis than demographic factors of the potential adopters.

Theory of Planned Behavior (TPB)

According to Krueger (2017) the TPB is a robust framework to explore the intention building process of individuals in the adoption a specific behavior. Ajzen (1991) suggests that 'intentions' are useful to predict behavior. Moreover, he also argues that a person's intention is the most powerful predictor of a person's future behavior. Moreover, this framework has been widely applied in fields like open innovation and virtual customer integration on product development projects (Kautonen et al. 2013; Nedon et al. 2015). Overall, the TPB suggest that the eventual performance of a behavior depends on both motivation (intention) as well as the ability (perceived behavioral control) of a person to perform it (Ajzen, 1991).

In the framework of the TPB (Ajzen, 1991), the connection between individual's beliefs, subjective norms, attitudes towards a behavior, and the perceived behavioral control is explained (table 10).

3.3.2. Factors Affecting 'potential adoption' of an organization to develop FI projects

Even though the frameworks mention above offer different emphasis, there are intersecting factors that influence individual's 'potential' adoption behavior. For example, Tormatzy and Kleins (1982) use both theories to build a complementary framework towards explaining 'potential' adoption of innovation. This was possible because diffusion of innovations is concerned with the perceived characteristics of the 'potential' innovation and TPB is concerned with variables that affect the behavior of the future adoption of decision-makers. Overall, both models offer a better understanding of the eventual decision to adopt an innovation. Often, the analysis of these framework is done through a qualitative analysis. However, for the present study the variables of each theory will be covered by a qualitative analysis.

Table 9: Variables of diffusion theory and Theory of Planned Behavior and its relationship with

adoption of innovation

CONCEPT	DEFINITION	RELATIONSHIP
Attitude Towards Behavior	Degree to which a decision-makers holds a positive attitude towards the adoption of the innovation	Positive
Subjective Norm	The degree to which a decision maker feels it necessary to behave in a manner consistent with the social environment	Positive
Perceived Behavioral Control	The degree to which the decision-maker is confident about performing the behavior	Positive-
Relative Advantage	The degree to which an innovation is perceived as better than the idea it supersedes	positive
Compatibility	The degree to which an innovation is perceived as being consistent with existing values, past experiences and needs of potential adopters	positive
Complexity	The degree to which an innovation is perceived as difficult to understand and use	Negative

Source: Adapted from Weigel et al. 2014

According to the literature review, the innovation characteristics from diffusion of innovation will significantly relate to innovation adoption propensity (Tornatzky and Klein, 1982; Weigel et al. 2014). However, the features that cover the TPB have stronger significant influence on innovation adoption predisposition (table 15). Overall, a of group individuals in an organization are likely to adopt frugal innovation projects when:

- I) They see the benefits and advantages from adopting FI projects
- II) They think that frugal projects are compatible with their current practices and values as well as feeling social pressure from their environment to adopt FI projects (*perceived compatibility and normative beliefs*)
- III) They have the perception that the can handle the difficulties associated with the adoption FI projects (*Control beliefs and perceived complexity*). Moreover, they perceived barriers and risks for the adoption of FI projects and

3.3.3 Key influencing factors on the ‘Potential’ Adoption of Frugal Projects

The literature review on FI provides necessary insights on key influencing factors in decision-making of the individual within the organizations (ULL) towards the eventual adoption of frugal projects. The results from this literature review will be display below (table 11).

Table 10: TPB, DT and Influencing factor in the potential adoption of FI projects

TPB and DT	Application	
Behavior	The TPB is used to predict individual’s behavior towards a particular course of action Ajzen (1991). In this case, “Adopting/supporting FI projects”	Relationship
Intention	Intention is described as the strength of conscious plans to perform a particular (goal) behavior (Ajzen, 1991). –strength to potentially adopt FI projects	
The attitude toward the potential adoption of FI and relative advantage is affected by economic and social factors link to frugal innovation. As a result, both positive and negative characteristics of frugal projects have impact on the decision-making.	Opportunity to create economic value for organizations (Ray and Ray, 2010; Hossain, 2018). –Access to a larger group of potential users (positive) (Janda et al. 2018; Prahalad, 2009)	Positive
	Opportunity to create social value –Empowering resource-constrained consumers (Pisoni et al. 2018) –Creating sustainable products (Radjou and Euchner, 2016)	Positive Positive
	Organizational benefits –Unfamiliarity of frugal innovation (Janda et al. 2018) –Product that better fit users’ needs (Linna, 2013)	Negative Positive
Subjective norm and perceived compatibility: the professional setting and existing values have a strong effect on the building of intentions	–Resistance against Frugal products (Park and Ohm 2015)	Negative
	–Top management do not support FI (Tiwari et al. 2017)	Negative
	–Increase user’s motivation (Andel, 2013; Angot and Plé, 2015)	Positive
Perceived Behavioral control and perceived complexity of FI projects in the organization depend on perceived barriers for the adoption of frugal innovation projects	–Lack of target market knowledge (<i>constraint</i>) (Clark et al.2017)	Negative
	–Lack of local partnerships (<i>constraint</i>) (Reinhardt et al. 2018)	Negative
	–Sustainability is not a key value (<i>constraint</i>) (Hyypiä and Khan, 2018) (Agnihotri, 2015)	Negative
	–High regulatory standards (<i>constraint</i>) (Krohn, and Herstatt, 2018)	Negative

Source: Own elaboration, 2019

The literature review showed that there are central stakeholders in the eventual adoption of FI projects. These stakeholders are top management (Shan and Khan 2016; Hyypiä and Khan, 2018), middle management (Hossain 2018) and R&D members and engineers (Tiwari et al. 2017; Rao, 2018). All these stakeholders have strong influence in the development to the intention to support FI projects in an organization. Another influencing factor in the adoption of FI projects according to Soni and Krishnan (2014) and Tiwari and Kalogerakis (2016) is the existence of **frugal mindset** in Westerns organizations.

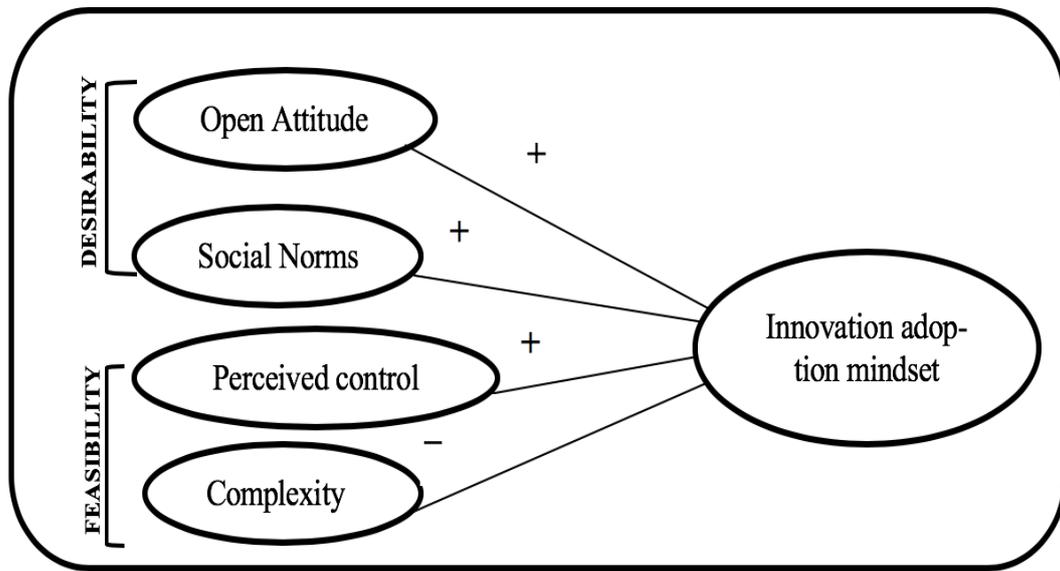
Frugal Mind-set

This study uses Gollwitzer’ (1990) and Ajzen (1991) theories to analyze organizational success through individual behavior (Krueger, 2007) on the ‘potential’ adoption of FI projects. Therefore, by capturing individual’s mindset, the mindset of the organization can be analyzed and improved. Gollwitzer’s framework suggests that there are two main phases the deliberative phase-pre-decisional phase– and the implemental phases of goal completion. On the one hand, The deliberative phase is composed by **desirability** is the degree to which an individual finds a behavior attractive for its adoption and **Feasibility** is the degree in which an individual’s belief that she or he it is personally able of adopting a specific behavior (figure 8). On the other hand, the implementation phase comprises different processes and are not relevant for this study. Overall, the features described by the TPB such as positive attitude and subjective norms define *desirability* while perceived behavioral control and perception of complexity explain *feasibility*. Consequently, this research uses the TPB to explore the

deliberative frugal mindset (Ajzen, 1991) of the decision makers in an organization. According to Krohn and Herstatt (2018) the deliberative frugal mindset is;

A cognitive orientation, which is characterized by the belief that offering innovations with **substantial cost reduction**, a concretization on **core functionalities** and an **optimal performance** levels that provides viable organizational opportunities and that the individual and organizations is capable of taking the necessary actions to develop these frugal solutions (p. 06).

Figure 6: Model of deliberative frugal mindset and the expected relationship with key influencing factors on the adoption of frugal projects



Source: Adjusted from the TPB developed by Ajzen (1991) and Weigel et al (2014)

As shown in table 15, the features that cover the TPB also have a significant influence on innovation adoption predisposition (Tornatzky and Klein, 19982; Weigel et al. 2014). The illustration in figure 11, shows the expected innovation adoption mindset in the present study.

3.4 Inclusive Innovation Mechanism and Frugal Innovation

Top-down and Bottom-up joint Action

Institutionally, innovation need support itself in local norms and institutional arrangements to enable the adoption of new products and solutions (Bhatti, 2012). Therefore, both top-down and bottom-up coordination strategies are essential processes to boost an institutional change towards current social and ecological problems. Consequently, IIMs as intermediaries' tools that enable both dimensions to act as drivers of innovation activities and as a space where ideas emergence. In this regard, IIMs might facilitate the potential adoption of FI projects in an organization. For example, Galema et al (2012) research showed that the actions coming from top-down have the strength to drive and push FI initiatives within the organization. In contrast, Halme et al (2012) discover that at the bottom periphery managers

entrepreneurial attitude boost the introduction FI projects within an organization. Additionally, he found that bottom-up activities are key to overcome resistance to FI projects coming from the top-down. In this regard, Knorringer et al. (2016, p. 148) suggests that “frugal innovation has a polycentric nature that combines top-down and bottom-up innovation processes”. Therefore, IIMs, which works as mediators might ensure equilibrium in the interaction between top-down and the bottom-up. Therefore, Heeks et al. (2014) suggests that FI alone might enable more inclusive forms of innovation due to its polycentric features. So, IIMs might strength the inclusive power of FI by ensuring asymmetric relationships between the stakeholder involved and FI might increase the inclusive nature of these mechanisms. As a result, IIMs might mobilize networks with shared purpose to achieve a more inclusive and heterogeneous innovation dynamisms (Rao, 2009). Consequently, organizations adopting FI and IIMs might develop the ability better understanding on how organization combine economic profits and the needs of the ‘poor’ (Arora and Romijn, 2011). This helps to avoid the idea of reconstituting the poor as ‘modern’ and value-conscious consumer, with unmet needs that can only be satisfied by market involvement (Dolan, 2012). In this respect, by the usage of IIMs and FI projects might not be passively driven only by low-income ‘consumers’ instead. it will be led by low-income co-creators and other citizens that are conscious about sustainability issues and willing to lower consumption. For example, Radjou and Prabhu (2015) argue that western consumers are becoming not only value-conscious but values-conscious, referring to consumers’ willingness to switch to socially responsible environmentally sustainable products.

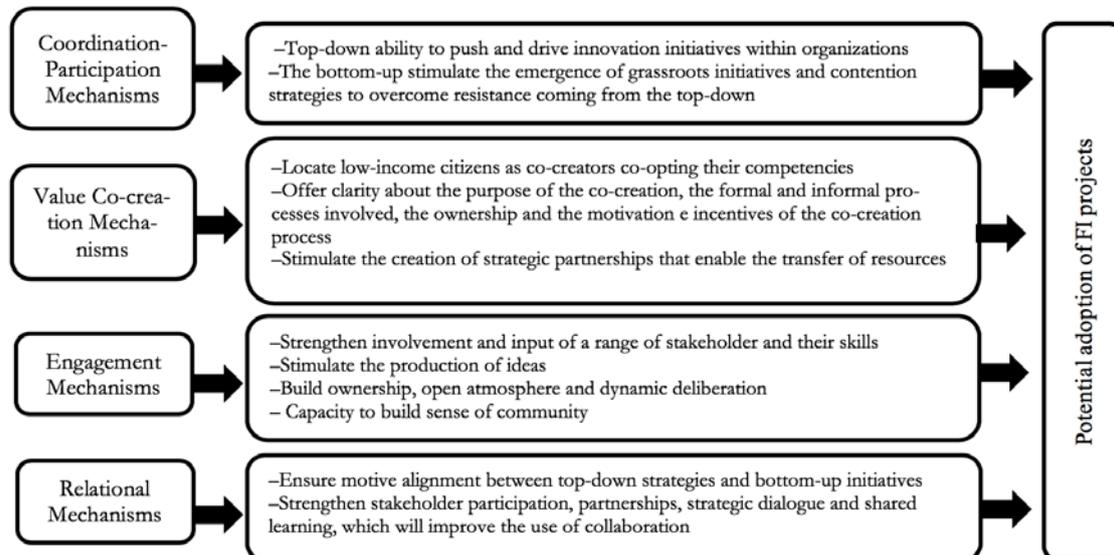
Ensuring motive alignment: Co-designing

According to Brown and Wyatt (2010) by embossing a co-designing thinking organization can boost creativity and solving-problems mindset. This approach is relevant to study problems in a structural manner, by acquiring information on needs, gaining empathy analyzing knowledge and iterating solutions for quick experimentations. However, according to Bhatti et al (2018) patterns of *trusts* and collaboration within the designing process are necessary to reach development success, even before the particular product is considered. In this regard, it has been proven empirically that IIMs improve the use of collaboration and local partnerships (Kale et al. 2000) which has been essential for the adoption of a co-creative and co-design perspective in an organization. Hence, these mechanisms are useful to develop strategic alliances to access to local capabilities offered by local professionals, citizens and informal network (Ray and Ray, 2011). Consequently, the efforts to stablish early-stage collaborative networks in the organization help to match individuals needs of citizens with the capabilities of the organization. Hence, when IIMs are adopted a pattern of ‘everyone interests inclusivity’ appear, which is essential to the potential adoption of FI projects (Alam and Campbell, 2013). In this regard, FI projects might influence the innovation process by boosting problem-orientated, creative approach, which integrates local needs and works from a bottom-up to contextually understand and develop solutions (Brem and Wolfram, 2014). while IIMs focus on strengthen alliance and collaboration. As a result, both IIMs and FI might **Strategic align of the innovation process for low-income communities** (Krohn, and Herstatt, 2018; Sivaprakasam and Srinivasan, 2015) where local and informal partnerships are essential to get access to context knowledge of the communities before co-designing products that fit better their needs. In general terms, IIMs and FI projects might keep the process of innovation in balance between actors and interests.

Resource Mobilization: bricolage

The movement that an organization make form learning together to making together as the purposes of the co-creation, from formal to informal processes of collaboration, from extrinsic to intrinsic motivation and from a clear ownership to shared ownership of the process of innovation might potentially influence the potential adoption of FI projects Puerari and de Koning, (2018). The reason is because these movements represent the activation of large amount resources that are made available through the active involvement of different stakeholders. In the resource mobilization process *bricolage* is a mechanism that allows individuals to work with the resources at hand and using combination of these resources to tackle problems and generate new opportunities (Baker and Nelson, 2005). Therefore, the organization seeking to co-create through these mechanisms might stimulate a ‘bricolage’ system. Additionally, low-income communities tend to have a different perception of resources and they are able to conceive resources scarcity as a driver rather than a limitation of creativity, inspiring them to deploy given resources and combine them. (Krohn and Herstatt, 2018). Therefore, IIMs locate low-income citizens as co-creators co-opting their competencies and stimulate the creation of strategic partnerships that enable the transfer of resources between different stakeholders might lead to the potential adoption of FI projects. In this respect, FI might influence the process by boosting ‘bricolage’ mechanisms, which allow citizens initiates to flourish in the absence of resources or low levels of institutional support (Desa et al. 2011). Therefore, by using FI projects the IIMs can use improvisation, which facilitates individuals to be more comfortable with ‘planning faster’ and ‘at any point’ of the innovation process. Overall, IIMs and FI projects can generate products that provide a better value propositions for low-income citizens. (Radjou and Prabhu, 2015; Gupta 2011). Below, an illustration of the relationship between IIMs and FI.

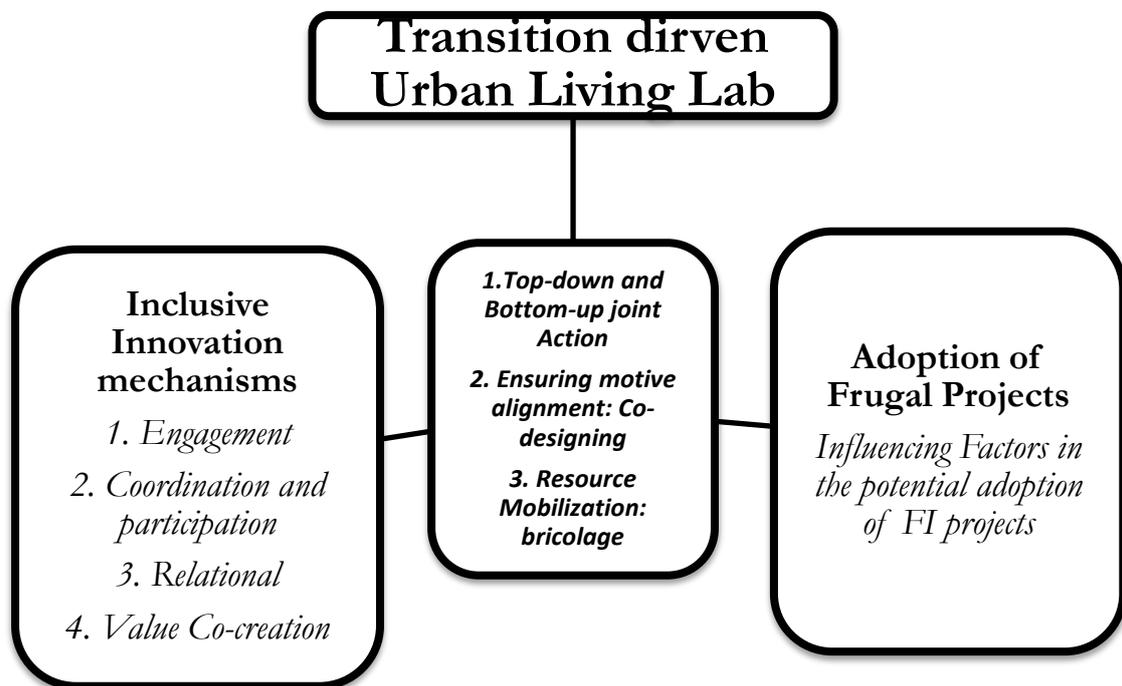
Figure 7: Summary of the indicators of IIMs and their link with the potential adoption of FI projects



Source: Authors Own Elaboration

3.5 The Conceptual Framework

Figure 8: Conceptual Framework Inclusive innovation mechanism and Frugal adoption



Chapter 4 : Research Design and Method 2

Introduction

This chapter describes the research methodology used to answer the three empirical research sub-questions and, consequently, the main research question (chapter 1). Since the research objective, the main question and the three first sub-questions were already recapitulated in Chapter 2, this Chapter focuses on the research strategy, data collection and analysis methods adopted to conduct a *Case Study*, using the theoretical findings discussed in the previous Chapter to develop them into empirical research by comparing multiple units of analysis—projects and individuals—, in order to assess the theory developed.

4.3 Research strategy

In this research, the Case Study strategy is particularly appropriate to study a novel phenomenon in an explorative manner and to find answers to ‘how’ and ‘why’ questions (Creswell et al. 2017 and Yin, (2017)). The study aimed at exploring ‘how’ **inclusive innovation mechanisms used to engage low-income citizens** might facilitate the potential adoption of **frugal projects** in an ULL. This objective is reached by tracing patterns between both variables in the innovation process of the ULL. The analysis uncovers the strategies and practices involved in such processes. Resulting from testing *the inclusive innovation mechanism*, useful to complement the “the *four-dimensional framework for inclusive innovation*” established by Schillo and Robinson (2017). In addition, it produced a classification of successful strategies that can be replicated or enhanced in other spaces related to innovation development to potentially adopt a more inclusive and frugal innovation approach. As a result, the study formulates a more general argument to answer the question Can Smart cities be frugal?

4.1. Type of case study

Single Case study

After a thorough review of the literature in the realm of inclusive innovation, urban governance related to ULLs, and eventual FI adoption, one case was selected in the city of Amsterdam with one in-depth case study of ULL for further analysis. A single case study approach is appropriate strategy for this study. According to Yin (2017) the use of a single case study strategy is recommended when “the theory specifies a clear set of circumstances within which its propositions are believed to be true. In this case, the single case represents the critical test of the theory (Critical Rationale)” (p.56) which is the case of present study. Additionally, within the typology of single case study, *the holistic case study* is a better choice for the current study due to its exploratory nature. Yin (2017) defines this type of case as “a strategy that focuses in examining only “the global nature of and organization or a program” and its attention is not directed towards the subunits of the organization or the program” (p. 58). Therefore, by adopting this type of case study, this research seeks, firstly, to provide easier deconstruction of a complicated issue and extends knowledge on the topic. Secondly, reveal situations or processes that are not understood well or are void of a theoretical background. Lastly, it allows for multi-level analysis and to gain more thorough qualitative understandings of the topic at hand.

4.3 Data Collection Methods

In chapter 2, a description of the qualitative approach chosen for the study was done. That decision is due to the novelty of the phenomenon addressed and the usage of relevant qualitative techniques to collect evidence for the case study (Yin, 2017). The first step explained was secondary qualitative data collection. Below, the second step is defined and summarized in table 12.

Table 11: Primary and Secondary Data Collection

Strategy	Data	Method	Approach	Variants	Analysis	Outputs
Single holistic and unique Case Study	Primary	Interview	choose purposive participants composed by members of the municipality, business, residents	open-ended interviews	Recording followed by textual selection and analysis (selected bias) of the transcriptions of the interview.	Empirical findings (chapter 5) Final results (chapter 6)
		Content Analysis	Interpreting the content of secondary data	Thematic ordering and coding	Thematic ordering and coding	
	Secondary	desk research	analysis of the academic literature relevant for the selected case	Thematic ordering and coding	Thematic ordering and coding	

Source: own elaboration, 2019

Primary Qualitative Data Collection

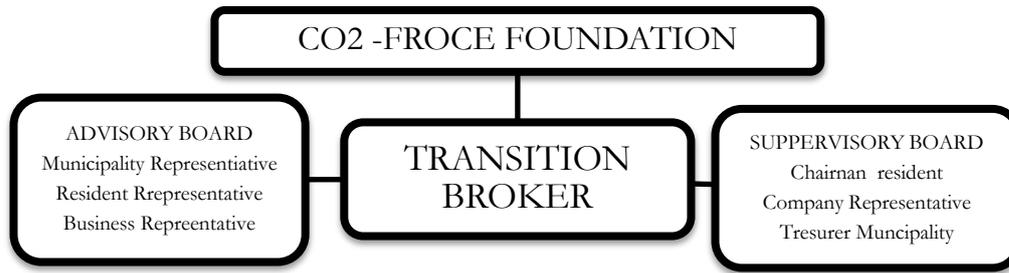
Content analysis: Documentation and archival research

This method involves the analysis of documental resources, such as reports, websites, project documents, newsletters, report of meetings of stakeholder of the ULL. This method fits well with exploratory approach of the present study. In addition, the information needed to support the answer of the guiding questions was coded. The documents were organized in categories, following the rule of focus.

The interviews

Semi-structure interviews were used, for the primary data collection. Due to time constraints and the busy schedule of the member of the organization the option chosen was to conduct interviews with a *purposive sample*. In addition, the literature review showed that decision-maker are central stakeholders in both the application of inclusive mechanisms in ULL's settings and in the adoption of FI projects (Shan and Khan 2016; Hyypiä and Khan, 2018; Tiwari et al. 2017; Rao, 2018). Therefore, the interviews were conducted only with the stakeholders of *the supervisory board, the advisory board* and the transition broker of the ULL. In addition, each board has one local resident as representatives of the interests of the local communities of Zuidoost.

Figure 9: Relevant sample for the study, decision makers in the ULL



Source: Adapted from the Organizational structure of the co2 force ULL

4.5 Case Study Type: a typical case of “transition urban living lab CO2 force”

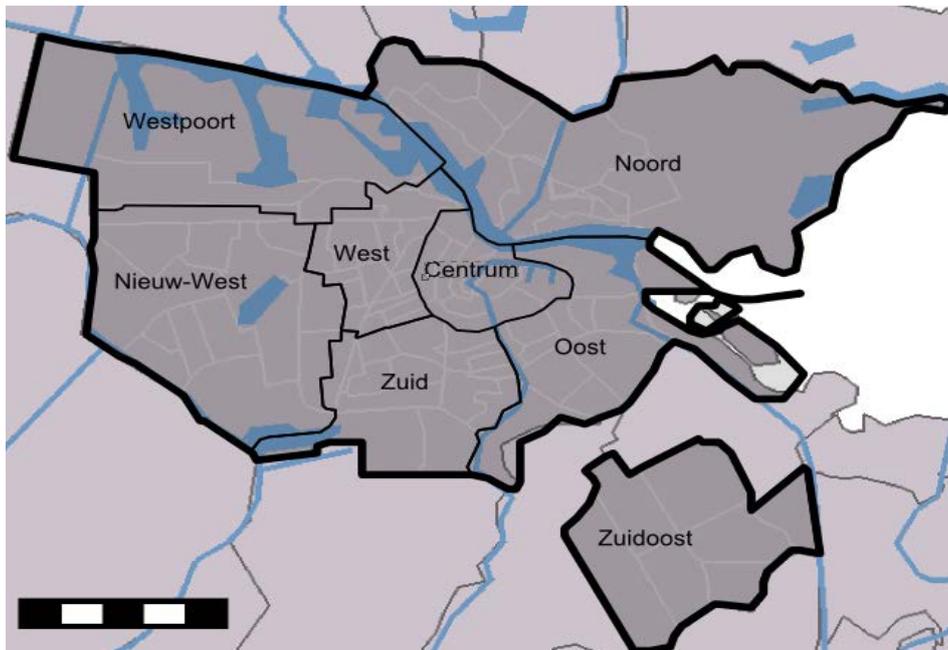
Gerring (2006) proposed nine types of Case Studies, from which this study selected the **Unique or unusual Case**. As suggested by Yin (2017, p.51) this type of case study should be used when the research “...*aims to reveal insights about normal processes, therefore, the value of case study can be connected to a larger number of organizations, well beyond the one represent the case*”. Therefore, CO2 Force ULL is considered to be the only transition ULL under the smart city program who is adopting IIMs. In order to justify the selection of this typology, this study makes use of the conceptualization developed by Nevens et al. (2013) about **Urban Transition Lab** which is described as “ [...] it is a hybrid, flexible and transdisciplinary platform that provides space for learning and development of alternative solutions”(p. 115). According to Schliwa (2013) this approach has transition management principles, which focuses on the governance of problem-solving and improvements of societal systems. Therefore, it includes a “portafolio of *tools* that have as a common objective to enable change in practices and structure ‘institutions’ directed to sustainable targets” (Nevens et al. 2013, p. 114). Therefore, this is a relevant context for the present study to test *the inclusive innovation mechanism* that were defined as mediator tools to include structurally detached low-income citizens in the innovation process (see operationalization). Consequently, this scenario contributed to the theoretical aim to complement the “*four-dimensional framework for inclusive innovation*” established by Schillo and Robinson (2017). Additionally, transition management is a useful framework to explore the deliberative² process that influence governing activities towards societal and sustainability targets (Loorbach, 2007). In this way, transition-driven ULL enables systematic governance of stakeholder’s interactions by connecting top-down and bottom-up initiatives (Baccarne et al 2014). From this perspective, the selected ULL was a relevant case to explore the deliberative process through which decisions-makers, from the top-down and the bottom-up, perceived the adoption of FI projects as something desirable and feasible (see table operationalization). Overall, the case study was useful in regard to unpacking IIM and potential frugal adoption in a transition ULL which supports the smart city development of Amsterdam (CO2 Force foundation, 2019).

The CO2 force ULL is located in Zuidoost in Amsterdam (see Figure 14), which is isolated from the rest of Amsterdam. This district consists of an agglomeration of four residential areas, which contains 84, 000 inhabitants from Suriname and the Antilles as well as Africans

² Deliberative processes: considered as a setting that is open for diversity, emergence of ideas/actions and linkages with ongoing external initiatives (Nevens et al. 2013, p.120)

(Research group cities and visitors, 2017). Therefore, it has been cataloged by the municipality as the district where specific ethnicities have made structural presence in Amsterdam. For example, Bijlmer, one of the neighborhoods, is considered to be a black district, where relative poverty, urban deteriorations and lack of public investment have enabled the emergence of drugs and crime as a viable economic activity (Research group cities and visitors, 2017).

Map 1: Map of Amsterdam Zuidoost



Source: Image taken from amsterdammap360.com, 2019

Currently, local governmental interventions have focused on security and solidarity (ibid) and infrastructural improvement. Consequently, the introduction of the ULL in the urban area is aligned with this idea of transforming a staged area close to the center of Amsterdam into an attractive area (CO2 Force foundation, 2019).

Analysis of Case Study Evidence: Explanation

In order to analyze the case study evidence, this research used exploratory building technique, which is a pattern matching technique. As suggested by Yin (2017, p.147) “this technique aims to analyze the case study data by building an explanation about the case, which is highly relevant for exploratory studies”. Thus, this study explained the phenomenon of interest by stipulating a set of casual links about it. As explained by Yin (2011) the use of this technique is useful when “when explanation require theoretically significant preposition and when explanations building occurs in a narrative way” (p. 147). In addition, this study adopted case study tactics developed by Yin (2011) to ensure the quality of the empirical research (table 13)

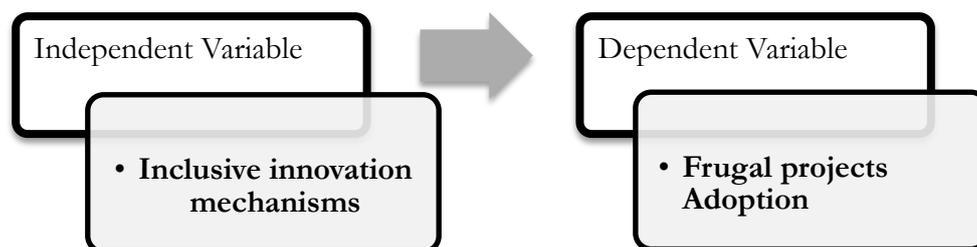
Table 12: Case Study Tactics used in the present study

TEST	CASE STUDY TACTIC	PHASE RESEARCH IN WHICH TACTIC OCCURS
CONSTRUCT VALIDITY	◆ Use of multiple sources of evidence	-Data collection
	◆ Have key informant review draft case study report	-Composition
INTERNAL VALIDITY	◆ Do explanation building	-Data Analysis
	◆ Address rival explanations	-Data Analysis
	◆ Use of logic models	-Data Analysis
EXTERNAL VALIDITY RELIABILITY	◆ Use theory in single case study	-Research design
	◆ Use case study protocol	-Data collection
	◆ Case study data base	-Data collection

Source: author's own elaboration adapted from Yin (2014)

4.8 Operationalization: Variables and Indicators

The operationalization shows the transition from the theory presented in chapter 3, to the empirical research presented in chapter 5. The concepts, indicators and variables were translating into questions not only to be asked during the interviews but also to guide the data collection by using other secondary and primary resources. Overall, the table consists in the operationalization of the two main concepts into variables, sub-variables and questions. The first concept is Urban Living Lab *inclusive innovation mechanisms*. Regarding the second concept, *the adoption of frugal projects in a single* Urban Living Lab.



Operational definitions

The following tables present the operationalization of the concepts, which will be used to analyze the information collected. Main concepts are break down into smaller units, which are the variables to be measure

Table 13: Operationalization of the Independent Variable

INCLUSIVE INNOVATION MECHANISMS OPERATIONALIZATION			
Concepts	Variables	Indicator	Source/Guiding questions
Engagement mechanisms	Formal Mechanisms	# of formal stakeholder's engagement mechanisms	Which stakeholder engagement mechanisms does your organization use or take part in? (Akhmouch and Clavreul, 2017)
	Informal Mechanisms	# of informal stakeholder's engagement mechanisms	
Coordination Participation mechanisms	Top-down or bottom up	Typology of Living labs	Which actors drive the activities of the ULL?
		(1) Provider driven ULL	What is the coordination approach of the ULL?
	Inhalation-dominated or Exhalation-dominated	(2) Utilizer-driven ULL	What is the participation approach of the ULL? Leminen, (2013)
		(3) Enabler driven ULL	
	(4) User driven ULL		
Relational mechanisms	Mutual trust	(1) the degree of trust between the partners; (2) their degree of reciprocity; (3) the extent of open communication; (4) the confidence that each party will meet its obligations; and (5) the extent to which the partners carry out their duties as promised	Is the relationship between the ULL and its partners (stakeholders) characterized by mutual trusts? Reciprocity? Open communication? Confidence? And accomplishment of each other duties? Zaheer et al. (1998) and Lavie et al. (2012)
	Relational embeddedness	(1) the extent of engagement in joint activities; (2) the frequency of interaction between the partners' employees; and (3) the emergence of interpersonal relationships between them.	In this alliance between different stakeholders' in the ULL they engage in joint field activities? They meet frequently to work together on joint activities? have they develop good interpersonal relationship that facilitate joint activities? Kale et al. (2000) and McEvily and Marcus (2005); Lavie and Khanna (2012)
	Relational commitment	(1) partners' resource investments; (2) corporate support; (3) procedures for sharing information; and (4) mechanisms for resolving conflicts	In this alliance, the ULL and its partners (stakeholders) invest the resources needed for maintaining alliance operations? Is there a supportive management that promote this alliance? Regularly change and exchange information? Have effective conflict resolution mechanisms? Cullen et al. (1995); Kale et al. (2000); Sarkar et al. (2001) Lavie and Khanna (2012).
Value co-creation mechanisms	(1) The purpose of the co-creation	(1) Making together	What are Objectives and motivations of the ULL? Puerari and de Koning, (2018); Lusch (2007); Vargo and Lush, 2006
		(2) Learning together	
	(2) The type of collaboration and participation taking place	(1) Formal: process deliberately define - heavily engaged	What is the type of collaboration process taking part in the ULL?
		(2) Informal: process on shared goals or need to work together- short-term engaged	Type of groups involved? core group, the inner circle and the outer circle? Puerari et al (2018); Lusch (2007); Vargo and Lush, 2006) Fisher et al. 2015
	(3) The ownership of the process	(1) Clear initiator	specific skills? such as defining different roles? stepping in and stepping out of these roles and processes? Mattelmäki and Sleeswijk (2011)
		(2) Initiator shared ownership	
	(4) The motivations and Incentives	(1) Intrinsic motivation	What are the main problems and resistance that the ULL has had? Puerari et al (2018); Lusch (2007); Vargo and Lush, 2006
		(2) Extrinsic motivation	
(1) Collective incentives			
(2) Individual incentives			

Table 14: operationalization of the Dependent Variable

ADOPTION OF FRUGAL PROJECTS OPERATIONALIZATION			
Concepts	Variables	Indicator	Source/Guiding questions
<p>Identification of the innovation characteristics that affects the potential adoption of FI projects</p> <p>The same factors are used to explore the deliberative frugal mindset defined as “a cognitive orientation, towards offering innovations with substantial cost reduction, core functionalities and an optimal performance” (Krohn, and Herstatt 2018, p. 06)</p>	<p>(positive or negative) Attitude towards behavior and relative advantages</p>	<p>Economic and social factors link to frugal innovation.</p> <p>(1) Access to a larger group of potential users (2) Empowering resource-constrained consumers (3) Creating sustainable products (4) Product that better fit users’ needs (5) Unfamiliarity of frugal innovation</p>	<p>Krohn, and Herstatt (2018), Ajzen (1991), Rogers (2010), Tornatzky and Klein (1982), Weigel et al (2014)</p>
	<p>Social Norma and perceived compatibility</p>	<p>The professional setting</p> <p>(1) Top management do not support FI (2) User’s motivation</p>	
	<p>Perceived behavioral control (barriers) and Perceived risk and controllability</p>	<p>(1) Lack of target market knowledge (2) Lack of local partnerships (3) Sustainability is not a key value (4) High regulatory standards</p>	

Chapter 5 Empirical Results and Analysis

This chapter interprets and examines the data collected from the six semi-structure interviews with the decision-makers in the *CO2 Force* ULL that represents the case study. Additionally, documents were also analyzed to contrast different angles of information (*table 12*). The variables subject of discussion is in the first place, inclusion innovation mechanisms which were tested producing a complementation of framework developed by Schillo and Robinson (2017). In the second place, the key influencing factors in the adoption of frugal projects and the frugal mindset, in the Transition ULL ‘CO2 Force’, were analyzed. In a third section the patterns between IIMs and the potential adoption of FI projects will be illustrated. Resulting in the both the complementation of Schillo and Robinson’s inclusive framework and the classification of successful strategies that can be replicated. This chapter is divided in order by the empirical questions is trying to answer and analyze. Below, a short context on the Amsterdam smart city, the ULL and the BoP will be given.

The Innovation Model of the ULL to include the BoP under the Amsterdam smart city principles

In EU programs such Europe Vision 2040 and Smart Cities for Europe, the ULL is considered *bests practice* in the context of Smart city planning (Paskaleva, 2011). By introducing the ULL principles to urban innovation Amsterdam *smart city* is trying to stimulate both user-innovation and the development of innovations that fit better the needs of its citizens. To reach this goal ULLs stimulate an ecosystem where innovation can be developed ‘for’, ‘with’ and ‘by’ citizens (Kaulio, 1998). Walling et al. (2017) argued that transition ULLs like CO2 Force offers two dualities, first, they are an arena of deliberation and second, they are a space for self-organizing groups. Therefore, the CO2 Force ULL proposes a new model of governance reaching groups that have been structurally detached such as low-income citizen from formal urban planning (Wallin et al 2017). However, *European commission report* (2016), argues that the European market is neither characterised through the BoP populations nor through basic needs unmet. However, non-western *ethnic minorities*³ occupy a central position. That is because they represent the BoP of the income distribution in the Netherlands. The interviewees in *CO2 Force* ULL clearly express the existence of low-income communities that have been excluded from urban planning of the city. In this perspective, the ULL is trying to include low-income communities living in Zuidooost area. However, it has been difficult to access to the targeted population “*low-income citizens focus on survival and have no attention to any higher personal goal, no time for innovation rather they prefer to attend their basic needs*’ (TB). Therefore, these communities are included in the innovation process as co-creators. However, their own initiatives are not been developed yet due to the perception that there have a lack of knowledge and skills to do it-they are not ‘smart citizens’. Currently, there are about 29 people officially involve in the ULL activities, for which 15 of them are low-income citizens from the local area. As a result, the CO2 ULL hardly connects top-down policy and bottom-up initiatives (Baccarme et al, 2014). More details of this model can be seen in the Appendix 2.

³ According to the definition used by Statistics Netherlands (CBS), a member of a minority is a person living in Netherlands at least one of whose parents was born abroad. Ethnic minorities are distinguished by country of origin and the main division is western and non-western ethnic minorities. Ethnic minorities from Turkey, Africa, Asia, or Latin America are classified as non-western ethnic minorities.

5.1 Key Inclusive Innovation Mechanisms Observed in *CO2 Force ULL*

The ULL approach facilitates or impedes participation of diversity of perspectives?

According to the coordination and Participation Mechanisms used by the ULL it is clear that the role of the ULL is taking different stakeholders together. This is done by *facilitating collaboration* (Leminen, 2013). among the different actors and different ideas shared in deliberative sections. Therefore, the *CO2 Force ULL* moves between hardly moves from social to user innovation, which is based on the idea of having “*democratic innovation process*” (von Hippel, 2005). “*This project has been developed by the municipality to help to the economic and social development of this areas of Amsterdam, which logically included the work with the inhabitants of the area, we want the locals to develop their own initiatives and we will facilitate this process for them*” (BR). Even though, the ULL ‘promotes’ a participatory design by offering a space *for deliberation and self-organizing low-income groups* (Voytenko et al, 2016), low-income citizens ‘empowerment’ is quite limited. The reason is because citizens’ own initiatives are not been developed yet because they are perceived not as skilled as other citizens. Moreover, the ULL as enabler-driven has *Exhalation as its participation approach, however, it also hast inhalation* approach attributes, which means that the ULL seek to fulfil the requirements and wishes of other stakeholders and its own (Leminen, 2013). These movements in both coordination and participation mechanisms can be explained by the ‘transition’ management that the ULL is characterized for. For example, Gerring (2006, p.91) argued that this type of ULLs are “a hybrid, flexible and transdisciplinary platform that provides space for learning and development of alternative solutions” (p. 115).

Co-creation Inclusion and Exclusion dynamics

One interesting finding was that even though the ULL is enabler-driven the purpose of the value creation was *learning together*, and not in *making together* as suggested by Leminen (2013). The reason might be that the *CO2 Force ULL is transition-driven*, which means that it *seeks to pursue a collective* move from a learning perspective to a making together approach (Costa, 2017; CO2 Force foundation, 2019). Additionally, the value creation process tries to cover both urban and societal implications (Puerari et al. 2018). However, the ULL principal groups are the *core group*, which is the *initiator*, who formalize the functioning of the co-creation process and its partnerships (Von Hippel, 2005). And the second group is the *inner circle* represented by the supervisory and advisory boards, local brokers and spiders⁴ (CO2 Force foundation, 2019). Here, semi-formalized forms of co-creation are performed. Therefore, the center of the co-creation practices between the core group and the inner circle are. Lastly, the *outsider* group are the people that are not officially associated to the ULL. However, when the core group tries to increase participation of the outside community is when informal co-creation take place in the ULL (Manzini, 2015). In addition, the *Ownership of the Co-creation process* in the *CO2 Force ULL*, is hold by core-group (Mattelmäki and Sleeswijk, 2011). In this regard, the main activities are related to inclusive innovations in the ULL are mainly focused on the **establishment of programs to popularize science and technology in low-income in the urban area of Zuidoost** (Planes-Satorra and Paunov, 2017; CO2 Force

⁴ It is a new category developed by de ULL that describes an actor able to move towards the different levels of the local networks. Often these agents have vast information about local dynamics, local actors, informal networks and potential context barriers

foundation, 2019). However, most of these activities seem to focus on economic considerations, which might represent a concern for the ULL because its inclusive mechanisms should equally focus on social outcomes. *“The activities performed include different stakeholders. However, due to the complexity of the topic we are addressing, education has been a tool to establish a dialog among the stakeholder. Hence, there is an evident process of learning boosted through experimentation, feedback and research by both researchers and citizens”* (BR).

Open atmosphere and dynamic deliberation?

The CO2 Force ULL seek to make part of the actual everyday life of the communities living on Zuidoost by, becoming a community center (CO2 Force foundation, 2019). *“the foundation stimulates initiatives to fulfil in the social energy transition, it forms legal entity for consumers groups that have not entity”*. *“In the formal we had two types of boards of director assessing the work and ensuring the equilibrium in decision making in the ULL. Therefore, In the CO2 Force ULL use formal and informal engagement mechanisms (table 16). But, Formal mechanisms of engagement have stronger presence “they are tools to give a vision and shape to the activities of the ULL”. Hence, these mechanisms allow the involvement and input of a range stakeholders and enable development of consensus or for actions in complex issues. However, the prevalence of formal tool is a constraint to develop a more ‘empowerment’ model of inclusion in the ULL. In addition, informal mechanisms are defined as “the tools that stimulate communities’ ideas that need to be shaped”* (MR)(TB). Consequently, the ULL stimulate a level of engagement characterized by *Inclusion and Collaboration* (Table 16) but not by empowerment and co-creation as it is expressed in official documents.

Mutual trust, Relational embeddedness, Relational commitment

The majority of the members of the ULL pointed out that there is a need of alignment of top-down and bottom-up interests. Therefore, *“trust is needed, because the accomplishment of each other’s duty is difficult to monitor”* (TB). Overall, trust is found central among and in the selected tools that the ULL adopt in the innovation process (Dupont et al, 2019). This is done through trust building approach *“the partnerships mainly work with strategies to building trust, to boost stakeholder participation, open communication, motive alignment for all interests, community moderation and membership management”* (MR). However, one of the ULL function is to transfer control of the innovation to the locals of the innovations (CO2 Force foundation, 2019). But it has not been possible. This situation might reflect mutual trust problems, which is problematic because it is needed to mitigating conflicts and to stimulate empowerment (Zaheer et al. 1998). The in CO2 Force ULL is working on building social attachment and interpersonal ties to stablish partnerships. However, it has been a difficult matter. *“There is an engagement in face-to-face- joint field activities - related to energy transition and both sides of its social sustainability and energy supply through the alliances. However, the processes of innovation become too complex when the actors involved started to increase”* (MR). Lastly, interpersonal activities are also stimulated, but it is difficult to aligned schedules with all the stakeholders. Therefore, there are issues when the ULL is trying to foster coordination tasks among the different stakeholders This implies potential unequal generation of value and exchange of knowledge (Dhanaraj et al. 2004). However, business do not have much presence in the innovation activities and not all stakeholders’ resources are considered in the innovation process (figure 3). Below there is table that summarizes the findings to the first empirical question of this research.

Table 15: summary of the main study results on the independent variable

INCLUSIVE INNOVATION MECHANISMS OPERATIONALIZATION					
	Variables	Indicator	Strengths	Weaknesses	Target
Engagement Mechanisms		Which stakeholder engagement mechanisms does your organization use or take part in?			
	Formal Mechanisms	Consensus building	<ul style="list-style-type: none"> –Empower stakeholders to develop an informed understanding –Bridge the gap between experts and less-knowledgeable stakeholders 	High costs for set up and recruitment of participants the selection process can be difficult.	Engagement level: Inclusion and collaboration –Users influence in the decision-making –objectives alignment –User’s involvement and participation are essential to the production of ideas –Open atmosphere and dynamic deliberation –However, formal mechanisms have a stronger role than informal mechanisms of engagement, which has been a constraint to develop a more ‘empowerment’ model of inclusion. –The outcome is access to need-information, which is useful <i>to effective innovation development</i>
		Citizens and community committee	<ul style="list-style-type: none"> –Allow the involvement and input of a range stakeholders –Allow development of consensus or for actions in complex issues 	– The range of interest must be broad enough to represent all those affected, and those with relevant interest and skills	
		Innovated contracts and partnerships	<ul style="list-style-type: none"> –Foster co-ordination and co-operation across stakeholders and potentially levels of governance 	<ul style="list-style-type: none"> –Unclear objectives and allocation of tasks lead to inefficiency –Time and labour intensive 	
		Community associations	<ul style="list-style-type: none"> –Common understanding across members of the issue at stake 	–Perceived as single-minded when they push the agenda of a singular group of stakeholders	
	Informal Mechanisms	Meetings and workshops	<ul style="list-style-type: none"> –Allow the involvement and input of several stakeholder’s dissemination of information and decisions and build credibility for the outcomes 	–Can be time and labour-intensive	
Stakeholders mapping		<ul style="list-style-type: none"> –Provide detailed stakeholder analysis (motivations and interests, interactions, scale of interventions) 	–Can be time-consuming		
Coordination Participation mechanisms	Top-down or bottom up	Typology of Living lab Enabler driven ULL (Social innovation)	Taking a bottom-up approach, the activities focus on fulfilling the needs of a local community. For example, improving the local social development where the living lab is geographically located.	The ULL moves between social and user innovation. therefore, its empowerment actions are still limited. Consequently, it moves within an <i>Exhalation and inhalation as its participation approach</i> , which means that the ULL moves between fulfilling the requirements of others and its own.	–Account for a diversity of perspectives– Quadruplex helix –Place for spontaneity, ideas and contention to top-down regulations coming from the citizens –Top-down drive and push innovation –The outcome is an environment where users can express their needs <i>useful to create innovations that fit better the needs of the users</i>
	Inhalation or Exhalation	Mainly Exhalation-dominated	It seeks to fulfil the requirements and wishes of other stakeholders that are nor the initiators		
Relational Mechanisms	Mutual Trust	(1) the degree of trust (2) degree of reciprocity; (3) open communication; (4) the confidence on meeting obligations;(5) duties commitment	<ul style="list-style-type: none"> –Trust is found central among stakeholders and in the selected tools open spaces for deliberation ensure <i>motive</i> alignment between the stakeholders and ULL team. This is done through trust building. –The ULL is in charge of most of the activities and the citizens have not central duties yet. 	However, the CO2 force ULL have to transfer control to the locals of the innovations processes if they want to stimulate empowerment. But it has not been possible. This situation might reflect mutual trust problems, which is essential to mitigating conflicts within the collaboration system	<ul style="list-style-type: none"> –Stability and intensity of the collaboration –Ensure motive alignment top-down and bottom-up –Strategic alliances, improvement of collaboration and strategic dialogue and shared learning –Build sense of community

	Relational embeddedness	(1) the extent of engagement in joint activities; (2) frequency of interaction (3) the emergence of interpersonal relationships	The <i>ULL</i> focus on building strong social attachment and interpersonal ties to establish partnerships. –The goal of <i>ULL is</i> to facilitate the vision-making and face-to-face- interaction of the community with external stakeholders to delivering social and economic outcomes	–Interpersonal activities are also stimulated, but it is difficult to aligned schedules with all the stakeholders –There are issues when the <i>ULL</i> is trying to foster coordination tasks among the different stakeholders	–Access to local knowledge and informal networks –Building regulatory standards of the partnerships –The main outcome is to generate trust between partners, useful to <i>develop more creative innovations</i> .
	Relational commitment	(1) partners' resource investments; (2) corporate support; (3) procedures for sharing information; and (4) mechanisms for resolving conflicts	<i>ULL</i> there is an 'intention' coming from the different partners to stablished reciprocal and durable partnership in behalf of social and economic outcomes. the <i>ULL</i> seems to have a supportive management towards existing partnerships. they developed a willingness to share resources	However, business do not have much presence in the innovation activities and not all stakeholders' resources are considered in the innovation process. There is not a formal protocol or formal mechanisms to resolve conflict yet	
Value co-creation mechanisms	(1) The purpose of the co-creation	(1) Making together (2) Learning together	-Even though the <i>ULL</i> is enabler-driven the purpose of the value creation was <i>learning together</i> , and not in <i>making together</i> as suggested by Leminen (2013). The reason might be that the <i>ULL is transition driven</i> . -The value creation process focuses on both urban societal implications	The focus on learning together is due to the fact that low-income citizens are perceived less skilled than the other stakeholders involved	–Inclusion and exclusion partners resources –Collaboration and strategic partnerships to mobilize resources –Involvement of different expertise and resources from different actors –Opportunity to co-create economic and social value –Co-create products for the right user –Low-income citizens as co-creators Outcome: develop social capital and mobilization of resources useful to <i>enable rapid innovation initiatives</i>
	(2) The type of collaboration and participation taking place	(1) Formal: process deliberately define -heavily engaged	participation takes place in both <i>formal and informal co-creation</i> settings. The principal groups are the <i>core group</i> , which is the <i>initiator</i> , who formalize the functioning of the co-creation process. The second group is the <i>inner circle</i> represented by the supervisory and advisory boards, local brokers and spiders Lastly, the <i>outsider</i> group are the people that are not officially associated to the <i>ULL</i> .	However, when the core group tries to increase participation of the outside community is when informal co-creation take place in the <i>ULL</i>	
		(2) Informal: process on shared goals-short-term engaged			
	(3) The ownership of the process	(1) Clear initiator	The initiator is clearly the <i>ULL</i> . <i>The Ownership of the Co-creation process</i> in the <i>CO2 Force ULL</i> , is hold by core-group	To produce empowerment in the innovation process, the ownership should be shared	
(2) Initiator shared ownership					
(4) The motivations and Incentives	(1) Intrinsic motivation	The commitment showed by the decision-makers towards the collective goals of the <i>ULL</i> makes clear that the intrinsic motivation central in the process of innovation.			
	(2) Extrinsic motivation				
	(1) Collective incentives				
	(2) Individual incentives				

5.2 Influencing factors in the potential adoption of frugal innovation projects in *CO2 Force ULL*

The research found that the ‘potential’ adoption of FI projects is strongly affected by the benefits and advantages towards economic and social factors link to frugal innovation. Moreover, the interviewees perceived frugal projects somewhat compatible with their current practices and values in professional setting. Lastly, the individuals in the ULL perceived barriers and risks for the adoption of FI projects. Additionally, these three dimensions (attitude, social norms and control) were used to explore the deliberative mindset of the individuals of the ULL. Which reveal that main focus of the ULL is ensuring accessibility in the innovation process for low-income citizens in Zuidooost. This scenario was useful to classify strategies that can be replicated or enhanced in other spaces related to innovation development to adopt a more inclusive and frugal innovation approach. As seen in table 17, the relationships were confirmed by the study.

Table 16: Summary of the results of the dependent variable

TPB and DT	Application		
Behavior	The TPB is used to predict individual’s behavior towards a particular course of action Ajzen (1991). In this case, “Adopting/supporting FI projects”	Relationship	
Intention	Intention is described as the strength of conscious plans to perform a particular (goal) behavior (Ajzen, 1991). – strength to potentially adopt FI projects		
The attitude toward the potential adoption of FI (Positive-Strongest)	Opportunity to create economic value for organizations (Ray and Ray, 2010; Hossain, 2018). – Access to a larger group of potential users (positive) (Janda et al. 2018; Prahalad, 2009)	Positive	
	Opportunity to create social value – Empowering resource-constrained consumers (Pisoni et al. 2018) – Creating sustainable products (Radjou and Euchner, 2016)	Positive Positive	
	Organizational benefits – Unfamiliarity of frugal innovation (Janda et al. 2018) – Product that better fit users’ needs (Linna, 2013)	Negative Positive	
Perceived Relative advantage (Positive-moderate)			
	Subjective norms (positive-Strong)	– Resistance against Frugal products (Park and Ohm 2015) – Top management do not support FI (Tiwari et al. 2017)	Negative Negative
	perceived compatibility (positive-low)	– Increase user’s motivation (Andel, 2013; Angot and Plé, 2015)	Positive
Perceived Behavioral control (Positive-Moderate)			
	perceived complexity (Negative Strong)	– Lack of target market knowledge (<i>constraint</i>) (Clark et al. 2017) – Lack of local partnerships (<i>constraint</i>) (Reinhardt et al. 2018) – Sustainability is not a key value (<i>constraints</i>) (Hyypia and Khan, 2018) (Agnihotri, 2015) – High regulatory standards (<i>constraint</i>) (Krohn, and Herstatt, 2018)	Negative Negative Negative Negative

Another important influencing factor in the potential adoption of FI projects was a frugal mindset.

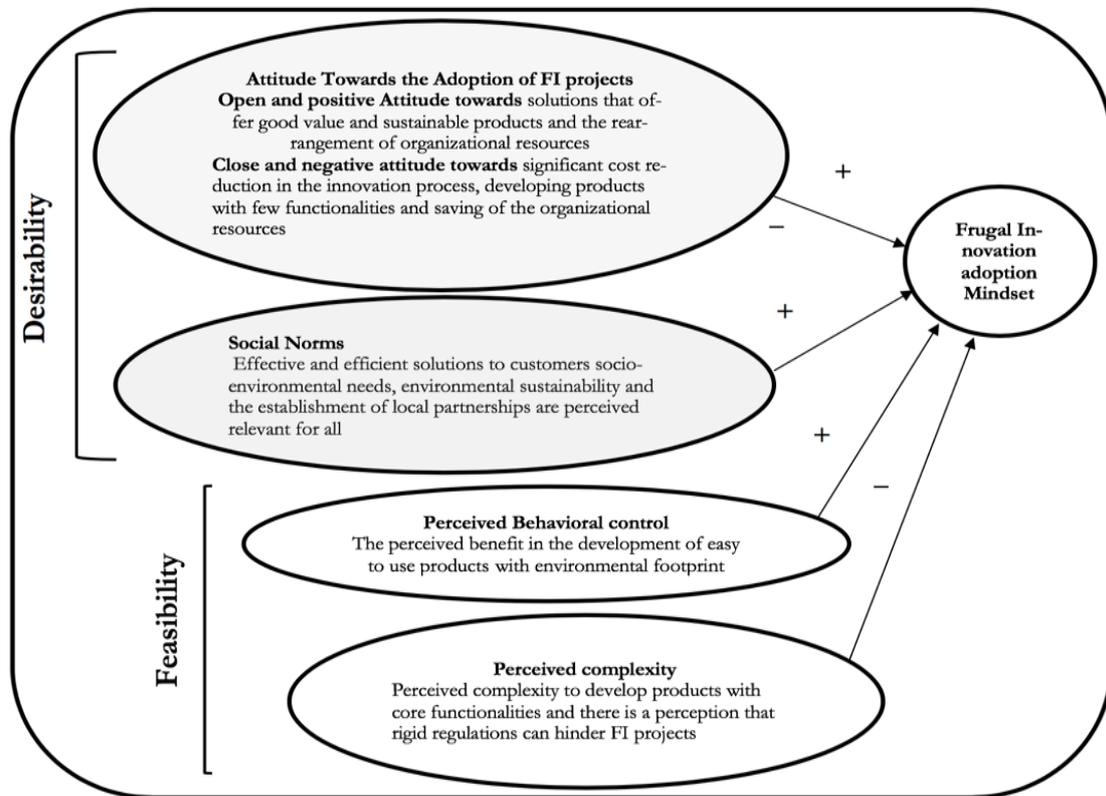
The Deliberative Frugal Mindset

The items above helped to explore the *deliberative frugal mindset* of the ULL (figure 10). Therefore, the empirical study showed that, the state of the deliberative frugal mindset in the CO2 Force ULL can be describe as:

“a cognitive orientation, which is characterized by the positive belief that co-creating innovations that offer economic and social value such as getting access to a larger and potential user, empowering resource constrain consumers, and creating product with environmental footprint. The reason is because they provide viable organizational opportunities to address social and environmental needs of low-income communities. Where the individuals and the ULL are capable of take the necessary actions to adopt some of the features of FI”.

As suggested by the EC (Kroll et al. 2016) frugal innovations may emerge as solutions in the European market. However, some aspects that define frugal innovation will be adopted. In addition, the current *deliberative frugal mindset* allows the study to suggest that transition-driven CO2 Force ULL focuses on *facilitating accessibility* to low-income citizens. The reason to make this affirmation is because the inclusive mechanisms adopted by the ULL, and the positive perception of certain characteristics FI projects, focus on improving economic and social impacts-sustainability-, which means the innovations process is characterized by the idea of developing products *for many*. The next section the patterns that link IIM and FI projects will be illustrated.

Figure 10: Model of deliberative frugal mindset and the intention to adopt in CO2 Force ULL



Source: Author's Own Elaboration

5.3 Key Patterns: How IIMs facilitate the ‘potential’ adoption FI projects In CO2 Force ULL

CO2 Force ULL a space of deliberation but not a space for self-organized groups

CO2 Force is an ULL founded with the intention to support the development of the *smart city* program for the city of Amsterdam. The city is trying to stimulate both user-innovation and the development of innovations that fit better the needs of its citizens (CO2 Force foundation, 2019). To reach this goal ULLs stimulate an ecosystem where innovation can be developed ‘for’, ‘with’ and ‘by’ low-income citizens (Kaulio, 1998). However, there exists a critical urban debate about the functioning of ‘smart city projects’. For example, Mudler (2014) argues that the well-managed sustainable energy systems and management models promoted by smart cities, do not necessarily lead to an improvement of their citizens’ lifestyle. In this regard, Datta (2015) argues that policy supporting this approach is not efficiently addressing the existing social inequalities, instead it is extending the magnitude of the exclusion space by strengthening *market-based entrepreneurial perspective*. As an illustration, CO2 Force ULL is a fund by the municipality, where the budget allocated to address urgent needs of the Zuidoost communities is used to mainly educate its low-income citizens in energy transition topics, entrepreneurial skills and corporate values. The ULL also promotes advisory and regulatory boards as a means to ensure everyone’s interests are represented. However, According to Schillo and Robinson (2017) these boards tend to reinforce existing structures of inclusion and exclusion, instead of the inclusion of excluded groups. That is because the actors invited to participate in these councils are relevant representatives in the existing value chains. Hence, IIMs are stimulating a ‘deliberation system’ around the ULL, based on consultation as a main formal mechanism of engagement (Appendix 3).

Even though the ULL has transition-driven management model it does not work as a space for self-organized groups. The reason is because informal spaces, activities and alliances allow local ideas and local initiatives to emerge and flourish. As a result, the BoP, which is often represented by the ‘informal dimension’ in the innovation process is perceived as a passive user to be included in the process. For example, the ULL is currently focused on stimulating formal spaces of exchange, which limits the actions coming from the BoP. In this regard, Alam et al (2013) showed that informality is where organizations adopt a pattern of inclusivity and that is why it is so difficult to manage. For example, Kolk et al.’s (2010) research showed that often inclusion models see low-income citizens as in need of technical education, jobs and management mindset. In this scenario, the positive perception of the decision-makers towards the organizational benefits that the potential adoption of FI might offer can slowly open spaces for BoP initiatives to take place. Consequently, the presence of FI principles in the ULL might support the mediator effect of the IIMs by boosting symmetric participation between the top and the bottom in the ULL. For example, Hayar and Betis (2017) suggest that there is an emergence of new inclusive model that allows smart city to stimulate spaces for citizens to co-create. This new model is ‘*frugal social sustainable collaborative Smart city*’, based on a frugal model towards innovation, which demands a higher levels of citizens engagement and local and informal R&D focus. In this regard, this research found that IIMs might stimulate the adoption of such a model in the ULL, but at the same time, the positive perception of FI might strengthen the performance of IIMs in the ULL (Appendix 4)

Potential adoption of FI projects?

The CO2 force is a transition driven ULL, working in a collaborative ecosystem where the idea is to improve the life in the city and boost the economy of an underdeveloped area of Amsterdam-Zuidoost-(CO2 Force foundation, 2019). However, this study reveals insights about the strengths, weaknesses and opportunities of such an initiative. For example, Baccarne et al (2014) suggest that transition-driven ULL enables systematic governance of stakeholder's interactions by connecting top-down and bottom-up initiatives. This special characteristic of the ULL allows the study to unpack the non-equal relevance of formal and informal mechanisms of engagement. Hence, the ULL is dealing with different types of challenges. For instance, while formal collaboration has been strengthened with the Quadruplex helix model, it is still hard for the ULL to integrate the target group in a sustainable way. In addition, it was difficult for the study to determine if the ULL guarantees transparency and if the ULL has a favorable policy influence. However, it is suggested by the interviewees that the role of policy has an impact in both inclusive innovation mechanism and the adoption of FI projects in a western context. In the first case, According to Schillo and Robinson (2017) "current and past policy interventions on inclusive innovation focus on science and technology-based innovations and their commercialization pathways [...]". For example, the CO2 Force ULL is an attempt to develop a smart city program which seeks to popularize science and technology (in energy transition) in an underdeveloped area in Amsterdam. However, to be really inclusive current innovation policies should re-define innovation in a broader way to produce structural changes in the innovation setting (Schillo and Robinson, 2017). In the case of FI adoption, the interviewees generally argued that this type of innovation might need a more flexible policy towards innovation.

The ULL intervention is focusing on 'energy transition affordability' and local communities' economic development (CO2 Force foundation, 2019). "*The overall intention is to generate economic and social impact in this district promoting a more sustainable and experimentation development*" (TB). To reach these goals new institutions have been created – e.g. *energie commissarissen*'-(CO2 Force foundation, 2019). Therefore, IIMs are being used to ensure economic outcomes and the effectiveness of top-down strategies. In this sense, there is a challenge in 'motive alignment' between the different stakeholders in the ULL. The reason is because IIMs are not being used as an intermediary in include everyone's interests but as a means to legitimize top-down actions (Bhatti, 2012). However, the interviewees perceived FI as a compatible and desirable innovation to improve equality in the distribution of environmental and economic outcomes, which is key to stimulate the further inclusion of the local communities as local partners (Soete, 2013). Consequently, IIMs cannot totally facilitate the potential adoption of FI projects through its capability to ensure active participation and everyone resources accountability. However, the positive perception towards FI should support the IIMs in the task of connecting and developing significant interactions between the top-down and the bottom-up activities in the innovation processes. This might be possible because FI alone enables more inclusive forms of innovation due to its polycentric nature (Knorringa et al. 2016; Heeks et al. 2014). As a result, IIMs might be reinforced by FI to mobilize networks with shared purpose to achieve a more inclusive and heterogeneous innovation dynamisms (Rao, 2009). Consequently, FI and IIMs together can represent a means towards reconstituting the poor as 'modern' active user whom are actively driving the innovation process. However, the ULL might adjust the innovation process for IIMs to boost the potential adoption of FI.

Value–cocreation: Economic and Social capital

Even though the decision-makers have expressed that the ULL seeks to empower citizens, the value creation process in the ULL focuses mainly on the economic outcomes of the innovation process (Puerari et al. 2018). Consequently, participation takes place mainly in formal co-creation settings, where the principal group is the core group –the initiator– who formalizes the functioning of the co-creation process and its partnerships (Von Hippel, 2005). “*the ULL forms a legal entity for consumers and citizens groups that have not entity,*” (TB). In addition, the center of the co-creation practices is not placed in the *outsider* group, which is defined as the local communities, informally link to the process. Consequently, when the core group tries to increase participation from the outsider group is when ‘*informal co-creation takes place*’ in the ULL (Manzini, 2015). In this regard, *The Ownership of the Co-creation process* is held by the core-group (Mattelmäki and Sleeswijk, 2011). As a result, the IIMs are used to produce a limited involvement of low-income population and their personal capabilities. Under the ‘ideal conditions’ the IIMs locate low-income citizens as co-creators co-opting their competencies. However, there is no stimulation of local strategic partnerships that can enable the transfer of resources between top-down and bottom-up. Accordingly, the ULL should be careful in adopting an ideological view on inclusion and self-proclaiming itself as a successful and novel practice under the smart city label. It was observed that the ULL keeps using old strategies that are proven to be instrumental towards reaching inclusion indicators in smart city planning rather than reaching inclusion itself. For example, education and employment are used to stimulate the development of social and human capital in the area. However, the role of human capital and education in urban development is used as an instrumental end to smart cities. The reason is according to Berry and Glaser (2015) because the most rapid urban growth rates have been achieved in cities where an educated labor force is available. However, this perspective has been criticized by scholars who suggest that the focus of smart cities should be on improving quality of life of ‘poor’ communities’ and including them within urban planning as active co-creators not as passive consumer or as cheaper labor (Guan, 2012). According to Krishna and Crutzen (2017, p. 49) “if smart cities do not consider the citizens views in their construction then it might be over ambitious to expect any contribution from them to reduce disparities”.

It was found that the ULL is locating the development of low-income communities’ initiatives that pretend to tackle sustainability issues (CO2 Force foundation, 2019) as an indirect benefit. Therefore, the bricolage system and problem-solving and creative mindset that is activated, when low-income citizens are included in the innovation process are not taking part in innovation process (Krohn and Herstatt, 2018). According to Desa (2011) by applying bricolage mechanisms citizens initiatives to flourish and IIMs become flexible and open to incorporate improvisation. Therefore, the absence of improvisation makes the process of innovation slower. Overall, IIMs and FI cannot be linked through a bricolage system as stated in the theoretical framework. However, due to **both direct economic benefits and indirect sustainability benefits that the interviewees perceived as positive from FI projects** the ULL can access not only low-income citizens but also a larger variety of citizens that are conscious about sustainability issues and willing to lower consumption (Ray and Ray, 2010; Pisoni et al. 2018). Therefore, as Radju and prabhu (2015) argue, western citizens are becoming not only value-conscious but values-conscious, referring to consumers’ willingness to switch to socially responsible environmentally sustainable products. Overall, **there is a need to develop projects that better fit the needs of both value-conscious but values-conscious citizens in the ULL** to make the smart city program sustainable and viable.

Chapter 6 : Conclusion

6.1 Can smart cities be frugal?

Policy contribution:

The research has attempted to explore the nexus between Amsterdam' smart cities and the potential adoption of FI projects. This means that FI is a mechanism through which 'smart city initiatives' reach the goal of increasing quality of life of low-income citizens. As this study has suggested to increase equality of life of low-income citizens the ULL might produce 'actual empowerment of local initiatives' to make this smart city project sustainable. On the case study of CO2 Force ULL in Amsterdam the research illustrates an example of how IIMs can be deployed with a focus on the potential adoption of FI projects. This demands a new hybrid model of governance, that allows a dynamic relationship between IIMs and FI projects. As seen in this study IIMs stimulate the potential adoption of FI projects and FI can strengthen the performance of IIMS. For example, the ULL decision-makers showed a positive perception towards some characteristics of FI adoption, which is relevant to boost a change towards developing a mindset to *cognitive bridge mechanisms* to connect decision makers priorities and citizens needs in the ULL (Krohn and Herstatt, 2018). Another important change is needed in the current policy supporting smart city development. The reason is because to produce actual inclusion in the innovation activities there is a need to go beyond only bringing structurally detached groups to urban planning for consultation and deliberation (CO2 Force foundation, 2019). In this regard, only *facilitating accessibility* of the ULL resources to the low-income citizens is not 'inclusion', citizens need to be able to co-create to be really included in the innovation process. Therefore, policy should focus on producing structural changes (Schillo and Robinson, 2017). For example, the inclusion promoted by the ULL is primarily managed from a top-down perspective, which is a consequence of the narrow definition of inclusion that policy towards innovation has. Therefore, if the ULL pretends to successfully manage IIMs and adopt FI a more flexible policy towards innovation is needed. For example, the EC report (2016) acknowledges that to enable frugal innovation in Europe "policy should encourage invention in a less regulated market by experimenting and/or tapping local knowledge, resources as well as potential customers" (p.20). Overall, policy in both cases, should stimulate organizational flexibility for citizens to learn, to experiment and develop alternative solutions.

Theoretical Contribution

Schillo and Robinson (2017) framework complementation was done by adding these innovation mechanisms as a new dimension that represented the degree of equilibrium in the innovation process that they offer when adopted as '*mediators*' to reach inclusionary goals (Elster, 1998). This study proposes a set of mechanism from *which* ULL can choose to better include citizens, their needs and capabilities (Appendix 4). As seen in the application of the IIMs in the ULL, which is a smart city project, smart city can in fact be frugal. But, as mentioned before, it might demand the critical application of IIMs and a flexible and open mindset towards frugal solutions. As shown in the study, even though the ULL is attempting to develop an inclusive smart city program, it is not an easy task to manage IIMs and adopt FI projects in a western context (Krohn and Herstatt, 2018). However, the positive perception towards some characteristic of frugal characteristics in a western context -ULL-might be a symptom that western citizens are becoming not only value-conscious (affordability) but also values-conscious (Radjou and Prabhu, 2015). In this scenario, Leadbeater (2014)

suggested that there is a new trend towards frugality in western context, which is “frugal innovation by choice”, because consumers identified themselves with values such as environmental sustainability, ‘do-it-yourself and low-consumption. However, local collaborative arrangements need to be developed including new decision-making structures (to reduce top-down participation) in order to produce higher level of inclusion in smart city planning. In this regard, FI can be seen as a new creative form of democracy in which innovation is ‘led by the people and with the people’ Radjou et al (2012) cited by Nari et al (2013). According to Radjou et al (2012) FI represents a “new form of government through which equitable, interconnected, diverse and sustainable societies can be built” (p. 224). For example, Knorringa et al. (2016, p. 148) suggests that “frugal innovation has a polycentric nature that combines top-down and bottom-up innovation processes”, this feature according to Heeks et al. (2014) imply that FI alone might enable more inclusive forms of innovation due to its polycentric nature. Agreeing with Menocal (2010), the efficiency of a model of governance depends on both top down and bottom-up processes that link the local government with society, thus working through low-income communities and its social capital. Therefore, the municipality of Amsterdam can foster economic development in the area by providing incentive systems (economic) as well by supporting grassroots initiatives that develop FI (Radjou et al. 2012). Therefore, future research should be orientated towards the application of these IIMs in other smart initiatives to prove their inclusive nature and their relationship with the potential adoption of FI projects in a western context. Additionally, it would be interesting to perform a longitudinal study in the CO2 force ULL to clearly see the effect of the dynamic relationship between IIMs and FI.

Practical contributions: Strategies

In this study, two main strategies were found relevant to the adoption of a more inclusive and frugal innovation framework.

1. This research suggests that redesigning the strategic orientation of the ULL. This might facilitate an innovation process based on knowledge, abilities, and practices embedded in the communities outside of the formal structure of the ULLs (Jain and Verloop, 2012). Therefore, the incorporation of FI projects and IIM, is a strategic decision that ULLs might make to get all the benefits mentioned before. For example, Radjou and Prabhu (2014) suggest that marketing departments should focus on working with *small-scale projects* and alternatives that are connected with *local knowledge* and *local needs*, which might positively contribute to innovation system.

2. This study recommended to cultivate a new mindset that meets low-income consumer’s needs. The reason is because this target group have great potential. But, before these organizations should stimulate a change in their mindset, they should re-examine their current mindsets prepositions in areas such as R&D (Altmann & Engberg, 2016). This new mindset can be produced not only by getting information of the user but also understanding the contexts and the limitations that those impose over the consumers (Hyvärinen et al. 2016). In this perspective the frugal mind-set can be seen as a facilitator for ULL to implement more inclusive model of innovations, towards a more open-minded organizational decision-making.

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Appendices

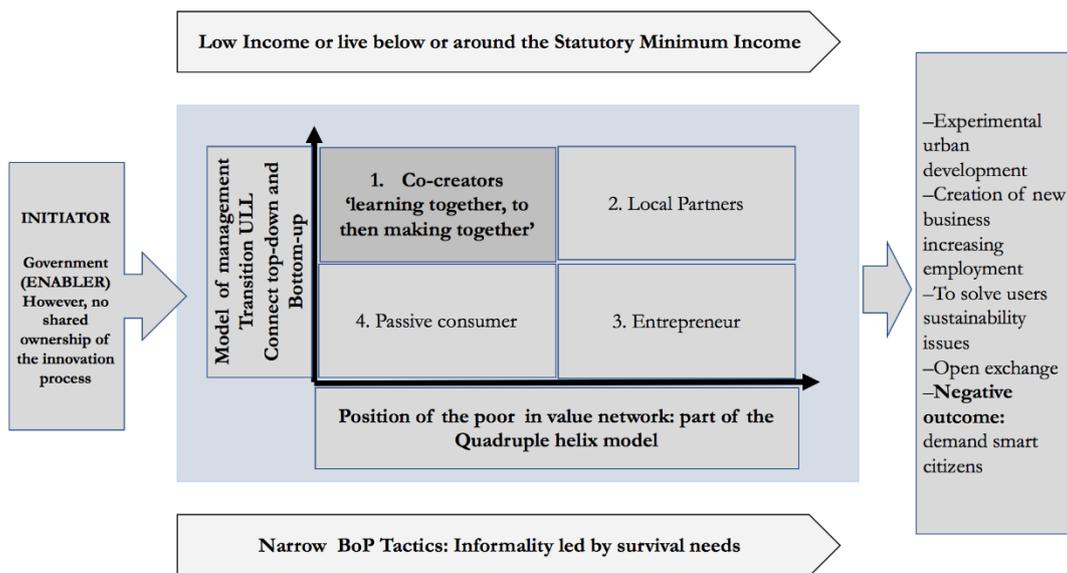
Appendix 6: Formal and informal Stakeholders Engagement Mechanisms adapted from OECD, 2015

Formal Mechanisms of Engagement		
Mechanisms	Strengths	Weaknesses
Citizens and community committee	<ul style="list-style-type: none"> –Allow the involvement and input of a range stakeholders –Allow development of consensus or directions for actions in complex issues –Provide opportunities for exploring alternative strategies 	<ul style="list-style-type: none"> –Principal selection if a major consideration. The range of interest must be broad enough to represent all those affected, and those with relevant interest and skills –member may not achieve consensus
Consensus conference	<ul style="list-style-type: none"> -Empower stakeholders to develop an informed understanding and make some contributions to the development of policy and projects 	<ul style="list-style-type: none"> –High costs for set up and recruitment of participants the selection process can be difficult. Mapping stakeholders is critical to

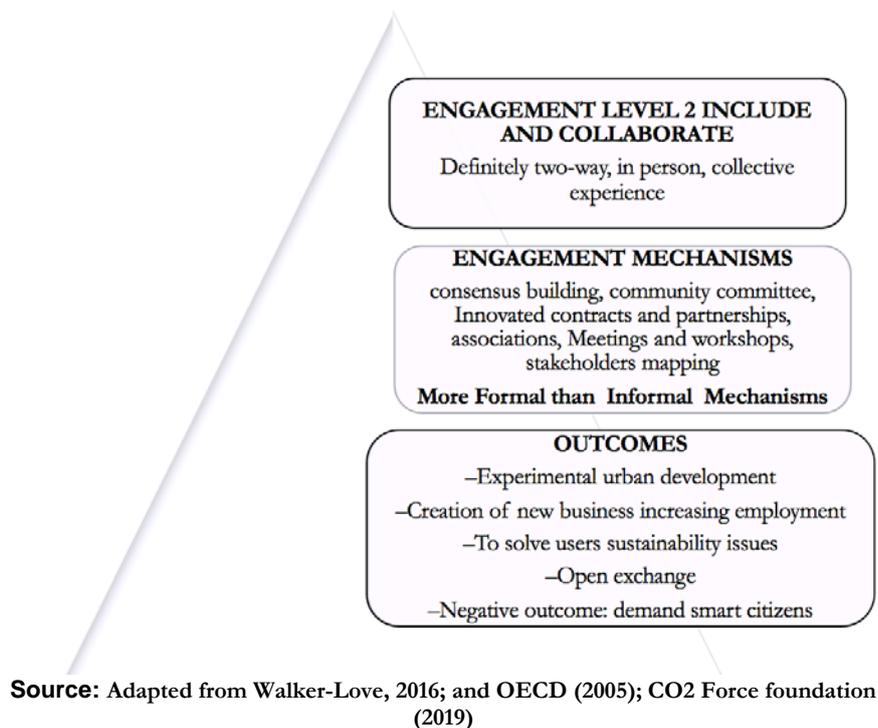
	–Bridge the gap between experts and less-knowledgeable stakeholders	determine who are the relevant groups
Innovated contracts and partnerships	–Foster co-ordination and co-operation across stakeholders and potentially levels of governments –can solve institutional weaknesses	–Unclear objectives and allocation of tasks among partners may lead to inefficiency –Can be time and labor intensive
Pull-survey	–Provide traceable data Can serve as an educational purpose	–poorly constructed service surveys produce poor results
Referendum	–provide representative view of a population’s opinion on a specific issue	–stakeholder not often have the capacity of information to make informed decisions
Stakeholders democracies	–Stakeholders groups have a direct say in all decisions taken by the assembly	–Risk of low participation –stakeholder in the assembly have to be well organized
Community associations	–Common understanding across members of the issue at stake –Often, high level of expertise from experienced practitioners	–Can be perceived as single-minded when they solely focus on pushing the agenda of a singular group of stakeholders
Informal Mechanism of Engagement		
Expert panel	–useful when an issue is complex and contentious –useful when conflict exists to provide opinions which may have more credibility	–Expertise in relevant and complementary areas may be needed to produce a credible expert opinion –Skilled moderator is often required
Focus Group	–Produce ideas that would not emerge from surveys and questionnaires	–Such as small groups may not be representative of the community response to an issue
Information Hot-lines	–offer an inexpensive and simple advice for publicity, information and public input	–Must be adequately advertised to be successful
Meetings and workshops	–Allow the involvement and input of several stakeholders –Disseminate detailed information and decisions –Can build ownership and credibility for the outcomes	–Can be time and labor-intensive
Stakeholders mapping	–Provide detailed stakeholder analysis (motivations and interests, interactions, scale of interventions)	–Can be time-consuming –Can be based on subjective data and may vary according to the place
Traditional Media	–Can disseminate information quickly	–Difficult to retract
Web-based technology	–Capable of reaching very large numbers of	–Many people cannot access the internet

	stakeholders with a very large amounts of information	
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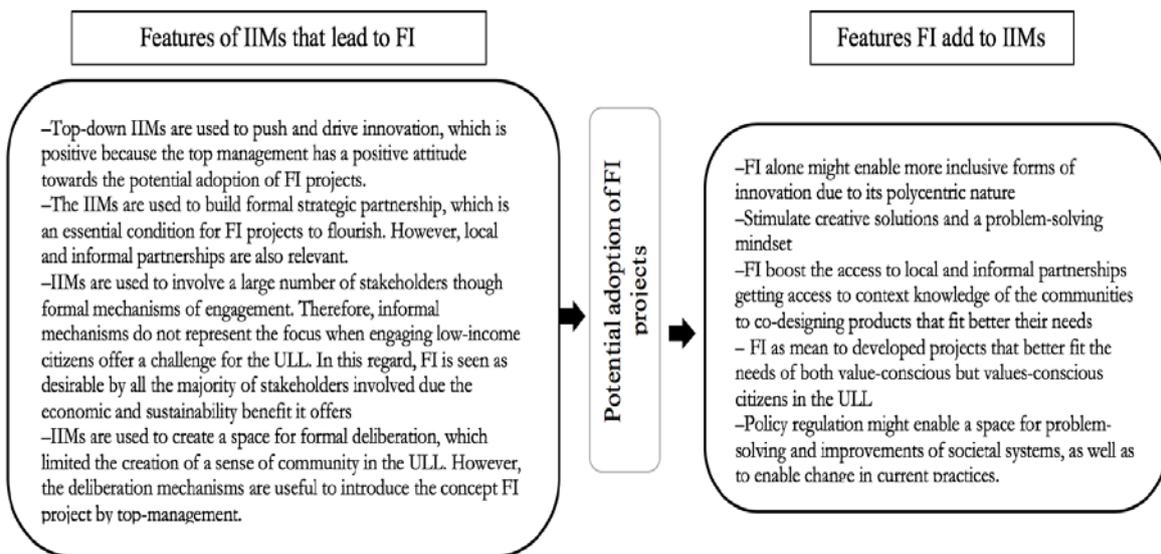
Appendix 7: Management model of CO2 Force ULL–Inclusion of the low-income citizens



Appendix 8: Pyramid of Citizens engagement, Mechanisms and Outcomes



Appendix 9: Summary of IIMs and the potential adoption of FI projects, and the features of FI that can positively influence IIMs



Appendix 10: Adjusted framework of dimensions of inclusive innovation in CO2 Force ULL

