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# Earth architecture in Uruguayan mutual-aid housing cooperatives – Assessing barriers and perceptions among the main urban actors in Uruguay

**Dissertation**

**Master of Science in Innovation, Human Development and Sustainability (IHDS)**

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*Architecture is more related to political action than to beauty*

Rem Koolhaas[1]

*People seem to change fundamentally when they gain the added security that comes from knowing they are capable of providing their own shelter. When a community of people posses that confidence and come together to help create one another's homes, it necessarily makes the world a better place to live.*

Bill Steen[2]

*El técnico tiene un saber interesante, importante, pero no es el dueño de toda la verdad, como dicen los viejos, ¿no? En realidad, me parece que hay que reivindicar la experiencia de los que de alguna manera aprendimos en el andar.*

Silvana Delfino, cooperativist of Guyunusa

[1] IV International Congress of Architecture, Pamplona

[2] Steen, A., Steen, B., Bainbridge, D. & Eisenberg, D. (1994) The Straw Bale House. Vermont: Chelsea Green Publishing, p. xvi

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## Abstract

This study aims to investigate the perceptions and barriers around the use of earth architecture in mutual aid housing cooperatives in Uruguay and to assess how this option could be a viable implementation in such collectives. Several interviews were carried with different actors in Uruguay, namely architects specialized in earth architecture, academia, government, Uruguayan Federation of Mutual-Aid Housing Cooperatives (FUCVAM) and Technical Assistance Institutes (IATs). Moreover, in the context of mutual-aid housing cooperatives, equally important is the investigation among cooperativists on the perceptions, reasons and barriers for adopting this mode of construction on their own cooperatives. After assessing those factors, recommendations will be provided in the context of Uruguay and Uruguayan mutual-aid housing cooperatives.

# List of abbreviations

| | |
|---|---|
| ANV | Agencia Nacional de Vivienda/ National Housing Agency |
| CIVIS | Cartera de Inmuebles de Vivienda de Interés Social |
| CMTV | Cartera Municipal de Tierras para Vivienda en Montevideo |
| CVAM | Cooperativas de vivienda por ayuda mutua/ Mutual-aid housing cooperatives |
| DAT | Documento de Aptitud Técnica/ Document of Technical Aptitude |
| DINAVI | Dirección Nacional de Vivienda |
| ENFORMA | Escuela de Formación en Cooperativismo de FUCVAM |
| FUCVAM | Federación Uruguaya de Cooperativas de Vivienda por Ayuda Mutua |
| IATs | Institutos de Asistencia Técnica/ Technical Assistance Institutes |
| ICA | International Co-operative Alliance |
| MEVIR | Movimiento para la Erradicación de la Vivienda Insalubre Rural |
| MVOTMA | Ministerio de Vivienda, Ordenamiento Territorial y Medio Ambiente |
| MLP | Multi-Level Perspective |
| SPH | Social Production of Housing |

# List of figures

# Table of Contents

# Introduction

While the world faces one of its biggest challenges, climate change, cities in the global south have been subjected to a great and on-going increase of population (Bredenoord, 2016). The rapid urbanization led – and still leads – to complex problems at the urban scale while exerting an enormous impact in the environment (Céron-Palma et al., 2013). On one hand, millions of people lack decent housing and access to public services due to government inability to better plan its urban networks; on the other hand, 75% of global energy consumption and 80% of greenhouse gas emissions comes from cities (Ash et al., 2008). In order to achieve the sustainable development goals, cities must strive to provide solutions for its pressing and urgent social issues while minimizing environmental footprint, without prioritizing one over the other in the name of development.

Regarding the environmental aspect, one of the main pillars in the design of sustainable cities is sustainable construction. Across all industrial sectors, the built environment is the one putting more pressure on the natural environment (Pomponi & Moncaster, 2016). Moreover, according to UN Environment, "the building and construction sector is one of the most important areas of intervention and provides opportunities to limit environmental impact as well as contribute to the achievement of sustainable development goals" (UN Environment Programme, n.d.). A building can impact the environment during several different processes, from the extraction of materials to its demolition – that is, impact should be reduced across all life cycles stages of a building.

Earth architecture re-emerges as a potential alternative for more environmentally friendly buildings. Such architecture responds environmentally well to all stages of a building's life: from extraction (made with locally available materials) to construction done in situ (avoiding transportation), to destruction and recycling which do not pollute or contaminate and can serve as new material for further constructions. The thermal properties of such material also allow for savings in the operational phase of buildings, since it requires less use of heating and cooling, for instance. With a millennial tradition, earth architecture has been greatly abandoned with the advent of industrialized construction. However, given the climate crises, such alternative has been the focus of research of renowned institutions, such as CRATerre, developing high quality research and disseminating the vast possibilities of use when it comes to earth.

At the social sphere, alternatives have also emerged trying to provide solutions for problems that were not addressed neither by the State nor the private sector: the right to decent housing. With a bottom-up imprint, housing cooperatives try to provide affordable housing for the most vulnerable population, with the most diverse experiences and models all over the world. In Uruguay, mutual-aid housing cooperatives, represented by the Uruguayan Federation of Mutual-Aid Housing Cooperatives (FUCVAM), have had a long history of tradition and fight for the right to decent housing. With state financing and support from technical institutes, housing cooperatives have provided access to decent housing for more than 50 years and are collective forms recognized by law since 1968 through the National Housing Law.

The focus of this research lies on mutual-aid housing cooperatives in Uruguay – a social innovation, as it comprises a restructuring of the social institutions of housing and not necessarily a technological one (Seyfang & Smith, 2007). However, as Seyfang and Smith

(2007) states, social innovations can serve as an important ground for sustainable technologies to take place. Given the urgency of sustainable cities in the global context, such cooperatives could therefore perform as *green niches* in the transition to sustainability – providing solutions not only from the social perspective, but also from an environmental one. The research proposes to investigate what are the general perception and barriers around the use of earth architecture by those collectives. In other words, it intends to explore the perceptions and main obstacles around the implementation of earth architecture in Uruguayan mutual-aid housing cooperatives with the hopes to understand how those collectives could indeed perform as green niches in the transition to sustainability. Therefore, the main research questions of this study are:

1. What are the perceptions and barriers around earth architecture in Uruguay and around the implementation of such construction method in mutual-aid housing cooperatives among the main Uruguayan urban actors?
2. How do different regimes and landscape play on the choice of building materials in mutual-aid housing cooperatives?
3. What is the potential for mutual-aid housing cooperatives to become green niches in the transition to sustainability and the obstacles it must overcome in order to do so?

To answer those questions, the research included 14 semi-structured interviews, trying to approach urban actors working in different sectors of Uruguay: academia, government, technical assistance institutes, FUCVAM and cooperativists – all with an important role in the development of mutual-aid housing cooperatives. The idea was to gather the perceptions of different actors who play a role and are part of different regimes in Uruguayan society – therefore, following a specific set of rules which can partially influence their habits and perceptions (Geels, 2004; Geels, 2011). In short, the goal in interviewing a variety of different actors was to obtain the most broad and complete view around earth architecture and its implementation on mutual-aid housing cooperatives.

Moreover, this study comes with the intend to fill an important lack of academic research regarding housing cooperatives as well as earth architecture – and the even less explored link between the two. Uruguayan mutual-aid housing cooperatives were chosen as the focus given it is a very well-stablished model in Uruguayan society as well as for its the great influence in other parts of the world. Moreover, studying the implementation of earth architecture in such collectives provided for a precious understanding on the particularities of mutual-aid housing cooperatives and its internal dynamisms and limitations. The results of this research, therefore, went beyond the expected answers to the research questions, giving as well important insights into Uruguayan mutual-aid housing cooperatives.

Chapter 1 provides an in-depth literature review around the definition and importance of earth architecture given the global climate emergency (part 1) as well as the concepts and relevance of the Social Production of Habitat and housing cooperatives in the fight for the right to housing and the right to the city (part 2). Chapter 2 explores the theoretical framework that explains how housing cooperatives could perform as green niches and how a system transition takes place through the lens of the Multi-Level Perspective (MLP) theory. Chapter 3 presents the rationale of the research and the methods used to test the hypothesis and answer the research questions as well as relevant considerations and adaptations on the research method given the current global pandemic. Chapter 4 covers the history of the

mutual-aid housing cooperatives in Uruguay and the main actors involved in the development of such collectives. Chapter 5 presents and discusses the results obtained in 14 different interviews with Uruguayan actors whereas Chapter 6 discusses the results while referencing back to the theoretical framework and while presenting a case study in Uruguay.

# Chapter 1 – Literature Review

## 1.1 Earth Architecture and Sustainable Construction: tradition as a tool for climate response

### 1.1.1 Urbanization, sustainable construction and earth architecture

In the past decades, the Global South has seen a great and on-going increase of urban population (Bredenoord, 2016). According to the United Nations, the urban population on the developing world alone will reach 5.1 billion by 2050, from 2.7 billion in the year of 2011 (Population Division of the UN Department of Economic and Social, 2012). The rapid urbanization has led to complex problems and cities are currently exerting an enormous impact on the environment (Cerón-Palma et al., 2013). According to the United Nations, 75% of global energy consumption and 80% of greenhouse gas emissions comes from cities (Ash et al., 2008). Those numbers are expected to arise, as cities continue to grow and expand. Therefore, the design and planning of sustainable cities is of fundamental importance to address the global environmental problems and challenges we have ourselves created.

One of the main pillars in the design of sustainable cities is sustainable construction. The massive influx of population from rural areas creates a high demand for housing and infrastructure (Lee & Zami, 2009), which makes urbanization closely linked to the construction industry and highlights the crucial role of the latter to sustainable development (Shi et al., 2014). Indeed, across all industrial sectors, the built environment is the one putting more pressure on the natural environment (Pomponi & Moncaster, 2016). Moreover, according to UN Environment, “the building and construction sector is one of the most important areas of intervention and provides opportunities to limit environmental impact as well as contribute to the achievement of sustainable development goals” (UN Environment Programme, n.d.).

To better comprehend the contribution of buildings to climate change, it is necessary to understand the life cycle stages of a building. According to Crawford (2011), there are six stages involved in the building life cycle: raw material extraction; manufacturing; construction; operation & maintenance; demolition; and disposal, reuse or recycling. According to the author, each of these stages consumes natural resources, energy and water as well as releases greenhouse gas emission and other pollutants into the environment, all along producing waste (Crawford, 2011).

Moreover, the carbon dioxide emissions from the building sector can be divided into two categories (PBMC,2018). The first refers to *operational carbon*, which accounts for the carbon emissions coming from the occupancy phase of buildings – including energy for the use of

appliances, heating/cooling, cooking, etc. (Pomponi & Moncaster, 2016; PBMC,2018; Chau et al., 2015). The second refers to *embodied carbon,* meaning all carbon emissions coming from all other stages of a building's life – material extraction, manufacturing, construction, demolition and disposal, reuse or recycling (Pomponi & Moncaster, 2016; PBMC,2018; Chau et al., 2015).

So far, focus has been given on reducing operational carbon by improving energy efficiency in buildings, since it is said that operational energy (and carbon) accounts for the greatest amount of life cycle energy (and carbon) of a building (Pomponi & Moncaster, 2016). However, according to Pomponi & Moncaster (2016), there is now strong evidence showing that the embodied carbon of a building can significantly contribute to global emissions (Pomponi & Moncaster, 2016). In order to reduce embodied carbon impact, Pomponi & Moncaster (2016) cite 17 mitigations measures that include, among others, the use of alternative materials with lower embodied carbon, the use of local materials to reduce transportation, adequate design, use of waste and by-products, etc.

An alternative that could account for reduced impacts in all life cycle stages of a building comes from bio-based materials. Those materials combine many different mitigation strategies, presenting the potential to reduce not only embodied carbon but also operational, since they allow for better thermal performance when compared to conventional materials. Bio-based materials have low embodied energy, can be locally accessed in all parts of the world and are renewable as well as available as waste and by-products (Paiva, Caldas & Toledo Filho, 2018). Traditionally, settlements were constructed with locally available, simple materials, with low environmental impact, but construction has gradually migrated towards cement, PVC, aluminum – all materials possessing greater environmental impact and being increasingly used all around the world (Bribián et al., 2009) On this study, focus will be given to a specific bio-based material – earth, in all its forms and applications.

Earth architecture is the concept known and accepted, in general, referring to all manifestation in the built environment in which earth is the main or sole material (Rotondaro, 2007). With a large history of use, dating back to millennia, earth buildings were constructed with locally available materials, extracted with environmentally friendly techniques (Schroeder, 2016). When deconstruction was needed, "recycling" of the buildings was done with no problems, as earth building materials could be used indefinitely or returned to the natural environment without pollution or damage (Schroeder, 2016). Moreover, for the occupancy phase, it is proved that earth buildings possess good thermal properties, better than conventional materials, balancing the relative humidity in the indoor environment and therefore promoting increased comfort and health to the inhabitants (Paiva, Caldas & Toledo Filho, 2018). With an appropriate design, it is known that improved thermal performance can minimize the use of heating, ventilation and air conditioning, possibly decreasing energy consumption (Paiva, Caldas & Toledo Filho, 2018). All in all, all those attributes can be summarized today in what is called "sustainable building" (Schoeder, 2016).

As it is clear from above, earth architecture responds environmentally well to all stages of a building's life: from extraction (made with locally available materials) to construction done in situ (avoiding transportation), to destruction and recycling which do not pollute or contaminate and serve as new material for further constructions. Moreover, the techniques for construction are simple and do not require technological and industrial appliances, being therefore accessible to all the population, particularly to self-building processes (Minke, 2006).

Earth carries not only a potential for sustainable, low-cost buildings but also brings thousands of years as a human heritage forgotten by the advances of industrial times.

Indeed, earth has been used as a building material for millennia, with evidence of its use dating back to ancient civilizations (Schroeder, 2016, Dethier, 2020). The material was not only used for houses but also to construct fortified defensive walls, temples and palaces (Dethier, 2020). Indeed, the famous tower of Babel was built with earth in 1970 BCE rising up to 70 meters on height and constituting the first "skyscraper" in history (Dethier, 2020). Moreover, archeologists have found evidence of mud brick buildings dating back to ten thousand years ago in Middle East and North Africa (Niroumand et al., 2013a). Within individual regions, the knowledge, practical experiences and building rules were passed down for generations leading to construction methods which were affordable and adapted to the respective climates (Schroeder, 2016). Therefore, earth architecture is one of the most ancient cultural expressions of civilization, with which great urban centers were built across the world – some still standing today (Pocero, 2016).

Nowadays, almost one third of global population inhabits buildings made with earth, most of which constructed and maintained by its own inhabitants (Rotondaro, 2007; Niroumand et al., 2013a). However, in the course of the centuries, the knowledge around traditional earth construction was progressively lost in many parts of the world (Schroeder, 2016). Marginalized from conventional construction by industrially mass-produced building materials, earth has been associated more and more with poverty (Schroeder, 2016). Modern building materials, such as concrete and cement, have taken the space of earth construction and are used as building materials by people as soon as it is possible to afford them (Schroeder, 2016). Earth construction is not only associated with poverty, but a rather large number of misconceptions has been formed around it at the same time traditional knowledge faded away. Even the most recent books of architecture lack on traditional and contemporary art of raw earth construction, producing a lack of reliable information that undermines the use of earth as a building material while evidencing a sustained and profound crisis of cultural amnesia (Dethier, 2020). Common beliefs say earth is not durable through time, not resistant to water, has a poor mechanical resistance, require a lot of time and efforts in maintenance and poses structural limitations, among others.

### 1.1.2 Barriers and drivers for the adoption of earth architecture

Given the necessity of a more sustainable building industry, studies have been developed in order to investigate which factors could promote sustainable construction in general and which barriers it faces in its implementation from several sectors of society. However, there is an important lack of literature when it comes to earth dwellings, even more when related

to drivers and barriers of earth architecture specifically (Morel & Charef, 2019; Zami, 2010). See figure 1.

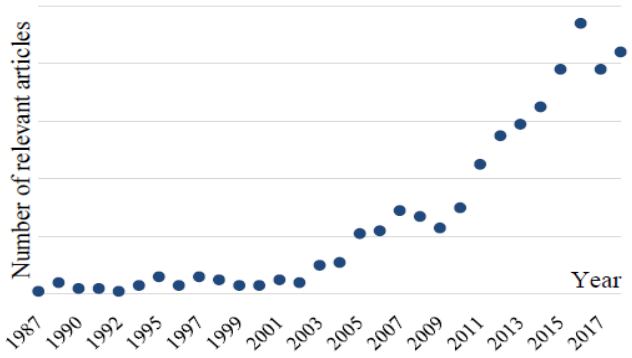


Figure 1: Publication of journal papers related to earth architecture every year in Scopus. Retrieved from "What are the barriers affecting the use of earth as a modern construction material in the context of circular economy?" by J.C. Morel & R. Charef, 2019, IOP Conf. Series: Earth and Environmental Science **225** 012053. CC BY 3.0

In Zami (2010), the author identifies potential drivers in the adoption of stabilized earth construction to address urban low-cost housing crisis through the method of critical literature review and validation through a Delphi technique with the participation of different earth construction experts. According to the study, six main drivers can potentially help in the adoption of stabilized earth construction in urban low-cost housing (in order of importance): "promotion through public media; technological development and innovation; organizing training for the stakeholders; introducing it in university degree programs; setting earth building codes and standard; organizing conferences, publishing books and articles" (Zami, 2010).

In the views of my research and according to Morel & Charef (2019), Niroumand et al. (2013b) is the most substantial journal paper found to date exploring the actual barriers of modern earth architecture in the current context. The authors performed online questionnaires in six countries evaluating critical parameters around earth architecture and earth buildings, among them triggers, drivers, obstacles and reasons in the development of earth architecture and earth buildings (Niroumand et al., 2013b). The questionnaires were answered by several members of the International Council on Monuments and Sites (ICOMOS), totaling 763 survey responses (Niroumand et al., 2013b). As pointed by Morel & Charef (2019), the fact of limiting the sampling to people interested in earth as a material in cultural heritage constitutes the major bias in the research, as modern earth architecture includes other interests than those of cultural heritage monuments. However, this paper will be the main source of inspiration for the design of interviews in my research, given the considerable lack of other researches in this particular topic.

The authors in Niroumound et al. (2013b) identified nine barriers inhibiting earth architecture and earth buildings: perceived higher upfront costs, lack of education, lack of awareness, no fiscal incentive, different accounting methods, no coordination, politics, payback periods, education of "non-sustainable" people. The authors also identified sixteen drivers for earth architecture and earth buildings: rising energy costs, government regulation, lower life-cycle costs, client demand, independent rating system, government rating system, competitive

advantage, superior performance, structural conditions, materials performance, increased education, environmental conditions, attraction and retention of staff, increased emphasis on productivity, international trends show it's a smart business, disruptive/enabling technology. When comparing to Zami (2010), it is possible to see a clear agreement among both papers regarding the drivers of earth architecture. It is clear that those barriers and drivers may vary in the context of Uruguay, even more given the focus of this research – earth architecture in mutual-aid housing cooperatives. Therefore, the interview with Uruguayan actors will be extremely important for assessing the reality of the country, even more in such specific urban context.

In the context of mutual-aid housing cooperatives, the cooperativists play a decisive and central role in all the construction processes. However, there is an important lack of relevant journal papers exploring the owners' perspective in the implementation of sustainable construction, even more so in earth architecture (Gan et al., 2015). An empirical study was found investigating the critical factors inhibiting the adoption of sustainable construction from the owners' point of view (Gan et al., 2015). After performing an extensive literature review and interviews with industry professionals, twenty-five critical factors were identified in Gan et al. (2015). After that, the authors performed questionnaire surveys to collect owners' opinions on the relative importance of those factors, identifying seven most critical components that present a barrier for the adoption of sustainable construction: economic feasibility; awareness; support from project stakeholders; legislation and regulation; operability of sustainable construction; resource risk; and project management model (Gan et al., 2015).

In the context of mutual-aid housing cooperatives and earth architecture, those critical factors may again vary, given the specificity of context. There are, however, multiple examples in Latin America of grassroot initiatives which implemented earth architecture in the building of their houses, even though it was not possible to find any academic study evaluating them. Those community-led initiatives can be found, for instance, in Mexico, Nicaragua and El Salvador and count with the support of organizations such as urbaMonde, Multipro R.L, We Effect, FUNDASAL and HIC-AL (HIC-AL, n.d.; Action pour l'Habitat, 2018; Moncada, 2016; We Effect, n.d.; Multipro R.L, 2020). Moreover, it is equally important to highlight the role of several different institutes and research centers throughout the world fostering earth as a building material and increasing the available knowledge on earth construction techniques, such as CRATerre and Amàco as well as the important work of several organizations supporting the use of earth as a building material in local initiatives.

## 1.2 Urban poor, Social Production of Housing and Housing cooperatives: the solution from the bottom-up

### 1.2.1 Segregated cities and the problem of urban-governance in Latin America

Even though cities were born more than 10 thousand years ago, it was only until the Industrial Revolution at the end of the XIX century that the world saw massive migrations of rural workers to cities (Nahoum, 2012). By then, London counted with 6 million inhabitants – six

times bigger than the population of Rome when it was capital of the world –, and the huge concentration of people in cities that were not ready to accommodate them brought together a series of necessities that did not exist by then at this scale: drinkable water, energy, transportation, sanitation – to name a few (Nahoum, 2012). The role of the State gained a different meaning, initially assuming the responsibility of providing those services, while, in doing so, it has favored richer sectors in despite of the working class (Nahoum, 2012).

In Latin America, however, the rural-urban transition took place in less than 30 years – from 1940 to 1970 (HIC-AL, 2017). Therefore, the urbanization process has been very rapidly: while it took Europe over 150 years, it took only 50 for Latin America to reach Europe's current level of urbanization – moving from 41 % in 1950 to 75% in the year 2000 (Rojas, 2015). Nowadays, Latin America is the most urbanized developing region in the world (Rojas, 2015). As it is expected, this rapid urbanization put a burden on the cities' capacities to accommodate newcomers with housing and urban services (Rojas, 2015). Traditionally, middle- and high-income families were able to secure housing through profit-seeking private real estate developers, which, in turn, benefited from financing from government-sponsored mortgage banks or savings and loans institutions (Rojas, 2015). However, the great majority of workers arriving in the cities were not benefited with a structured urban plan neither were financially able to access private housing, and were eventually expelled to the peripheric zones once the cities got saturated – zones which were hilly, subjected to flooding and deprived of essential infrastructure and services (HIC-AL, 2017; Rojas, 2015).

Land appropriation and the rise of informal land markets came into place, giving origin to what is known as "favelas" in Rio de Janeiro or "villas" in Buenos Aires, and neither the State nor the market had the capacity of ensuring the right of adequate housing to all (HIC-AL, 2017). By consequence, there was the formation of a dual structure of housing production and consumption that exists until today in Latin America: a formal and informal housing markets (Rojas, 2015). On one hand, the formal housing sector provided regularized housing, in accordance with government regulations, to households with savings capacity or eligible to long-term mortgage financing (Rojas, 2015). On the other hand, the great majority of low-income households, with low purchase power and not contemplated with access to financing, had to resort to informal housing, either by squatting on land, building houses incrementally in illegally acquired subdivided land or by doubling-up with other households in informal settlements, usually located in the periphery of the city or in slums (Rojas, 2015). In the late 1970s, between 50% to 70% of the urban population could not financially access the formal housing market (Van der Rest & López, 1980 cited in Rojas, 2015). Today, the informal sector contributes on average to one out of four houses added to the housing stock, in some cases adding up to two out of four (Bouillon, 2012 cited in Rojas, 2015).

Latin American cities have then become increasingly segregated and fragmented, and the informal settlements multiplied all over Latin America in the 1960s. Given the high concern around the growth of entire informal neighborhoods, States tried to design solutions. The first responses had taken forth the ideas of modern architecture and *La Charte d'Athènes,* promoting the construction of high-density departmental blocks and incorporating new construction techniques, while on the other hand, using the politics of bulldozer to eliminate informal settlements (Romero, 2002). Given the inefficacy of those, States continued searching for other alternatives for the housing problematic, launching several different housing programs, all failing to understand the complexity of informal housing processes, which, in some cases, ended up marginalizing even more the urban poor (Romero, 2002). The

situation was made even worse with the arrival of neoliberalism in Latin America in the second half of the XX century. By then, the idea that "the smaller the State, the better", promoted by multilateral credit organizations, entitled private enterprises with the task of providing the basic services to society – a task most transformed into business (Nahoum, 2012). Moreover, as stated by Rojas (2015), government housing policies have been implemented to a large extend with little or no consideration of their urban impacts as well as with little regard for other policies and plans affecting the urban development (Rojas, 2015).

Therefore, millions of families all around the world face the consequences of uncoordinated public policies and private sector profit-seeking, living without services, in high-risk zones, far from their place of work, deprived from most of facilities, occupying a land that do not offer neither the tangible (health, education, civic facilities) nor the intangible (the history, the landscape, the views) aspects in the urban net (Nahoum, 2012). As Beijamín Nahoum brilliantly puts:

*"In the majority of cases, this is not possible to solve, or it is solved too late and poorly, and when it is solved, it is at a very high cost: the State pays twice as much for trying to arrange what would have costed half had it acted in a planned way"* (author's translation) (Nahoum, 2012).

### 1.2.2 Social Production of Housing[3]

In his book "Producción Social de la Vivienda", Enrique Ortiz Flores discusses in general terms the causes for the serious housing crises the world has been facing. He points out that housing is seen as an expensive item, given the materials and specialized heavy labor it requires (Flores, 2012). This, in turn, is aggravated by several other factors: macroeconomic policies, comprising the reduction of the purchase power of incomes, lack of regulation in land and materials market and absence of subsidies; expensive and inadequate technologies, which inhibits the participation of inhabitants and requires a specialized workforce and machinery which turns very expensive; demographic aspects, such as migration, gentrification, etc.; increasingly more regulations related to the construction; and costly and complex procedures (Flores, 2012). All those costs have, in turn, to be borne by the income of those who search for housing (Flores, 2012).

In order to open space for other ways of producing the habitat and answering housing needs, it is necessary a change on the way we understand housing: as commodity, regulated by supply and demand, or as a human right (Flores, 2012). As a commodity, housing can only be accessed through the market by those with enough purchase power and saving capacities, that benefit from financing, subsidies, exemptions, etc. (Flores, 2012). Moreover, the offers proposed by the market do not take into consideration the specificities of the buyer, such as the size of the family, accessibility to public services, proximity to its place of employment, etc. – the only criteria is the client's economic situation (Flores, 2012). On the other hand, if seen as a human right, it allows for a recognition that housing constitutes a condition for a

[3] In the majority of cases, this term is used as "Social Production of Housing and Habitat", including all the processes that promote changes not only in housing units, but also in communities, neighborhoods, facilities and public spaces. For the purpose of this study, focus will only be given to the Social Production of Housing (SPH).

dignified life and its absence constitutes a structural social injustice amplified by the unequal distribution of income and increasingly inequality (Flores, 2012).

There are several other differentiations one can understand housing, as exposed by Ortiz: Housing as a social satisfaction, as a commodity or as an useable good; as a finished product or as process; as a scarce economic product or as a potentially abundant social good; as an object or as an act of inhabiting; as a formal or informal product (Flores, 2012). The way housing is perceived can make it more or less accessible, participative, inclusive and sustainable and can contribute or aggravate the current housing crises experienced all over the world. More importantly, there are as well different ways of producing housing: through public authorities (social housing), by private markets or through society itself, which is called *Social Production of Housing.*

The Social Production of Housing (SPH) is the term used to explain the production of housing that is neither led by the state nor the private sector (Varnai, 2015). In Latin America, the majority of housing produced is through self-help processes carried out by individuals, families and organized groups of inhabitants (HIC-AL, 2004 cited in Varnai, 2015). Indeed, in most of the Global South, between 50% and 75% of housing and housing components emerge outside the private market and social housing programs (Ortiz, 2012). In this process of production, the final users detain control of some or all stages of production as opposed to State-led housing (Varnai, 2015). Besides, contrary to the dynamics of private markets, the final users and other social agents operate in a non-profit basis and the final "product" is not intended for the market, speculation or rent-seeking activities, but has the sole intent to satisfy the needs of those who built it – housing produced *by* and *for* its residents (Ortiz, 2012; Varnai, 2015). In this perspective, the "use value" of housing is prioritize over its "exchange value" – as opposed to market-led production – and housing becomes a potentially abundant product instead of a scarce resource given that its production is focused on its user's needs and capacities (Ortiz, 2012; Varnai, 2015). As discussed in the beginning of this section, the way housing is produced is in a constant dynamic with the way housing is understood – and those dynamics, in turn, affect the accessibility of housing to the most vulnerable sectors.

Moreover, according to Ortiz (2012), it is also very important to note that the process of Social Production of Housing can not only be originated by individual families, but also by groups informally organized, social enterprises (as it is the case of cooperatives and housing associations), NGOs, professional associations as well as charitable institutions working on emergencies and with vulnerable groups. As defined by Ortiz (2012), SPH consists of all processes that produce housing in a non-profit basis under the initiative and control of self-producers or civil society agents, as stated before. Moreover, SPH can refer to both individual self-help housing and to organized and collective forms of housing production (Varnai, 2015).

Varnai (2015) discusses the broadness in the definition of SPH, which is meant to include in a single scope a diversity of housing processes in the real world. Varnai (2015) also points to the fact that the term has not arisen in an academic context. In fact, the term emerged in the particular context of multi-stakeholder interaction in the process leading to Habitat I in 1976: birth of Habitat International Coalition in Latin America, which brought together NGOs, grassroots social movements and organizations, human rights activists and academic groups

from various countries in this region. (Di Virgilio & Rodriguez, 2013; Varnai, 2015). On the other hand, academic literature remains unclear on how to define the scope of this form of housing production, and the almost exclusive Latin-American use of the term limits its expansions to other parts of the world (Varnai, 2015). In my literature review, it was hard to find academic papers contributing to this discussion and most of the sources found around this thematic comes from articles and books published by HIC-AL with Latin-American experts on housing.

For the sake of this study and given the complexity of the term SPH, it is important to highlight that Housing Cooperatives in Uruguay – my focus on this work – correspond to a formal self-help production of housing made by legally constituted groups of inhabitants being assisted by a formal institution of technical assistance and, in most of the cases, organized in a National Federation of Cooperatives with legal recognition and financing by the State.

### 1.2.3 Housing Cooperatives

The International Co-operative Alliance (ICA) defines housing cooperative as "a housing business that is a consumer co-operative mutually owned by its members, which complies with the International Co-operative Alliance's (ICA) Statement of Co-operative Identity and operates in accordance with the ICA's Co-operative Principles and Values" (Cameron, Thorogood & Wood, 2012). The Statement on Co-operative Identity characterizes a cooperative as an "autonomous association of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly owned and democratically-controlled enterprise" (International Co-operative Alliance, n.d.). The values in which cooperatives are based are self-help**,** self-responsibility**,** democracy**,** equality**,** equity and solidarity, and its principles include 'voluntary and open membership', 'democratic member control', 'member economic participation', 'autonomy and independence', 'education, training and information', 'cooperation among cooperatives', and 'concern for community' (International Co-operative Alliance, n.d.).

More generally, including all different types of cooperatives (housing, production etc.), Reyes & Harnecker (2013) define a cooperative as a group or association of natural and legal persons who, through a jointly owned, democratically managed, autonomous and open enterprise, seek to fulfil common needs and aspirations. Those groups and associations can also be formed by other cooperatives – giving origin to higher-tier cooperatives.

Even if it is relevant to define this particular mode of housing, it is of crucial importance to understand that housing cooperatives assume different and diverse institutional and organizational forms according to each geographical and historical context, having the lowest common denominator of members collectively managing and/or owning the housing in which they live (Vidal, 2018). According to Vidal (2018), one aspect that can determine this difference lies on whether or to what extent members can capitalize on their housing's equity. Members can either reside in a cooperative through a lease or rent agreement with the cooperative or, otherwise, own a share in the collective property while granted the right to

use a housing unit (Vidal, 2018). In the first case, members cannot capitalize on the equity of their housing; while on the second case there are three possibilities (Vidal, 2018; NASCO, n.d.):

1. membership shares can represent the equivalent of a fixed, modest and refundable membership fee (non-equity or group equity);
2. membership shares are price-regulated - the cooperative and the member each have a stake in the equity of the property and the change in the value of membership is shared according to a rate defined by the cooperative – (limited-equity);
3. membership shares are allowed to fluctuate according to the market rates (full equity or market equity).

The group equity model is the one that mostly aims to keep affordable housing, while limited-equity models try to discourage profit-seeking through its shared-stake. Apart from that, housing cooperatives can vary greatly both within and across countries, but it is not in the scope of this study to explain and understand those differences. Of utmost importance for this research is to present how and why housing cooperatives have emerged as a possible solution for the housing problematic discussed along this chapter.

The housing cooperative movement emerged as a way of producing housing beyond State intervention, which dramatically reduced with economic liberalization policies over de 1990s, and market-led solutions, which were not able to answer to the needs of lower-income groups (Ganapati, 2010). Among other third-sector organizations, housing cooperatives gained ground among urban actors, policy makers and activists both in the North as in the Global South (Ganapati, 2010). Over the past recent years, there is a renewed political and academic interest in housing cooperatives as a provider of affordable housing (Lang & Roessl, 2013). However, even though housing cooperatives have a long tradition and examples can be found all across the globe, housing cooperative practice is little-known and is just being rediscovered given its potential to serve as an innovative alternative for property rental, especially with the increasingly high demand for affordable housing (Lang & Roessl, 2013). Over the literature, it is possible to find a range of advantages with which housing cooperatives are presented as an effective solution for the provision of affordable housing (Barenstein, 2019).

Several authors state that housing cooperatives offer access to housing at a cost below market-price of a similar home, given that the intend of cooperatives is to provide quality housing for its members instead of maximizing profits of real-estate developers (Cameron, Thorogood & Wood, 2012; Saegert & Benítez, 2005). Besides, housing cooperatives can also be an instrument to limit speculation and to lower prices of private rental market in general, maintaining stability and affordability (Cameron, Thorogood & Wood, 2012). In lower-incomes groups in developing countries, membership in cooperatives also help pool resources, in which members might have restrained access to financing and credit, for example (Ganapati, 2014). At the neighborhood level, housing cooperatives contribute to a stable, economically and ethnically diverse environment and the residents' commitment to keep rents at a low cost while ensuring high-quality housing generates spill-over effects on the housing stock throughout the city (Saegert & Benítez, 2005; Lang & Roessl, 2013). Given the cooperative principles and values, residents engage in social entrepreneurship, civic

commitment and democratic practices – which not only strengthens their social relationships and enhance their personal skills – but also constitutes key aspects of sustainability in urban development (Lang & Roessl, 2013). Furthermore, cooperativists tend to have a good relationship with its neighbors and engage in neighborhood activities, which can significantly contribute to social cohesion and community sustainability (Cameron, Thorogood & Wood, 2012). Housing cooperatives also have the potential to reach out to different categories with special needs, such as the elderly, single parents, migrants and refugees (Lang et al., 2018 cited in Barenstein, 2019). Literature on the field of collaborative housing in Europe – in which housing cooperatives are integrated – suggests that such initiatives can promote sustainable lifestyles and empirical studies indicate the success of co-housing for social and environmental sustainability (Tummers, 2016). Co-housing initiatives can also provide pragmatic answers to societal needs, such as energy and cost savings, accessibility and everyday services (Tummers, 2016). Finally, it is also very important to mention – particularly for this study – how community housing initiatives can implicate on architectural innovation (Baresntein, 2019).

However, it is crucial to highlight that, even though housing cooperatives present several societal benefits, it also counts with a number of critical issues (Barenstein, 2019). First, given the differences among such initiatives across different regions and the strong influence of different institutional contexts on their nature, their advantages may be restricted to some of them (Barenstein, 2019). In fact, according to Barenstein (2019) most studies highlighting the benefits of housing cooperatives are based on a limited number of single-country case-studies and may not be representative. In many different countries, institutional contexts, housing regulations, changing market conditions and cooperatives' internal management may lead to a non-compliance of core cooperative values (Baresntein, 2019). Even their role in contributing to sustainable architecture is very context specific (Barenstein, 2019). According to Tummers (2016), evidence from single-case studies of collaborative housing should be supported with quantitative and systematic studies so that those processes can have relevance for present-day European cities. It is not in the scope of this study, however, to explore and explain the limitations of the housing cooperative movement worldwide – the sole focus of the research concerns the mutual-aid housing cooperative model in Uruguay.

## 1.3 Housing Cooperatives as a social innovation and the potential for architectural innovation

There are several types of innovation, and it is not in the scope of this research to enter in detail when approaching this subject. However, it is important to clearly understand what 'social innovation' stands for, since it is a term that has come into common parlance in recent years and yet has no agreed definition (Pol & Ville, 2009). Pol & Ville (2009) analyzed several definitions of 'social innovation' and, by capturing the common denominator of those existing definitions, have then proposed a possible new one. All in all, the existing definitions revolve around new ideas that lead to an improvement of human welfare (Pol & Ville, 2009). According to Pol & Ville (2009), "an innovation is termed a social innovation if the implied new idea has the potential to improve either the quality or the quantity of life".

As has been previously discussed on the last sessions, housing cooperatives can therefore be considered a social innovation, since they have emerged as a (new) third-way – led nor by the State nor by private market – to provide housing, envisioning the implementation of the right to housing, and therefore, an enhanced quality of life for citizens. Indeed, as stated in Lang & Roessl (2013), housing cooperatives have the potential to be innovative solutions to property rental.

Social innovations as creative bottom-up initiatives have a significant role when it comes to social transformations since they are often the first steps towards institutionalization (Novy, Hammer & Leubolt, 2009). It is important to specifically highlight that social innovation is a necessary condition for the efficacy of technological innovation (Schumpeter, 1932 cited in Novy, Hammer & Leubolt, 2009). Moreover, social innovations can implicate on architectural innovation (Barenstein, 2019).

Based on the above, housing cooperatives can have an important role on technological and architecture innovation and the scope of this research aims to contribute with this possibility by analyzing the barriers and general perceptions around the implementation of earth architecture in mutual-aid housing cooperatives in Uruguay. In the context of the climate emergency, one must take into account that innovation and community action are two important lines for sustainable development (Seyfang & Smith, 2007). Therefore, when making a transition to sustainability, it is of great importance to understand the roles of community-action, grassroot-initiatives and innovation.

In the next chapter, the theoretical rationale around the links between grassroot initiatives and innovation will be further developed while exploring how socio-technical transitions take place in our society – a process important to be understood in order to grasp the interlinkages that arose in the findings of this research.

# Chapter 2 – Solutions from the bottom-up: grassroot initiatives contribution to innovation and sustainable building

## 2.1 The Multi-Level Perspective (MLP) on systemic change

Contemporary environmental problems present daunting societal challenges (Geels, 2011). To effectively address those problems, deep structural changes are necessary in several sectors of society, such as transportation, energy and agri-food. (Elzen et al., 2004). To understand those challenges, my study will use concepts such as socio-technical systems and the multi-level perspective framework.

In this research, when investigating the possibility of adopting earth architecture in mutual-aid housing cooperatives, I am investigating the conditions and pre-requisites for a *transition* to happen in mutual-aid housing cooperatives in Uruguay – that is, from the use of conventional construction methods (e.g., using cement, concrete, iron, bricks) to alternative

ones (e.g. bioconstruction[4] and earth architecture). Elzen et al. (2004) use the Webster's Dictionary definition in which the term 'transition' is defined as "a passage from one state, stage, subject, or place to another" or "a movement, development, or evolution from one form, stage, or style to another".

When talking about transiting on construction modes it is necessary to think much beyond technological[5] transitions, given that such change has a much broader impact in society and demands, in turn, a wide set of pre-stablished conditions for it to happen, which are not necessarily only linked to technological aspects but also to user practices and institutional structures. Therefore, such a transition is at the level of societal functions, and consequently involve changes in socio-technical systems (Elsen et al., 2004).

According to Elzen et al. (2004) socio-technical systems "comprise a cluster of elements, including technology, regulations, user practices and markets, cultural meanings, infrastructure, maintenance networks and supply networks". They are actively created, (re)produced and refined by several different social groups, from civil society to universities and public authorities (Geels, 2005). Each of those groups, equipped with their own interests, values, perceptions, preferences, strategies and resources, constantly reproduce the elements and linkages on socio-technical systems (Geels, 2005).

Moreover, according to Geels (2004) socio-technical systems are defined "as the linkages between elements necessary to fulfil societal functions (e.g. transport, communication, nutrition)". In modern societies, technologies are essential to fulfill those functions, which makes it relevant to distinguish the production, distribution and use of technologies as subfunctions (Geels, 2004). Further on, to fulfill those subfunctions, there must be necessary elements, which can be characterized as resources: (Geels, 2004). In the subfunction of production, for instance, resources are scientific knowledge, education, labour/human resources, design knowledge, capital, tool/machines, natural resources; regarding the subfunction of the use of technologies by users, the resources are cultural meaning, facilities for repair, complementary artefacts; on the other hand, in the subfunction of distribution, the resource is regulation (quality norms, property rights, laws), which produces 'trust' – consisting of a resource also common to all three subfunctions (Geels, 2004).

Therefore, according to Geels (2011), socio-technical transitions "involve alterations in the overall configuration of transport, energy, and agri-food systems, which entail technology, policy, markets, consumer practices, infrastructure, cultural meaning and scientific knowledge" and, therefore, comprise multi-actor processes and interactions between various social groups – which is precisely what a transition to another construction mode implies. Therefore, transitions are complex and long-term process which involve a multitude of different actors (Geels, 2011). This explains why it was of utmost importance for this research

[4] Bioconstruction is a term used to refer to a constructive way that respects the environment and the surroundings as well as the health of the residents (Picazo, 2019). It proposes a balance throughout all the life-cycle stages of a building – therefore, making use of non-toxic materials, renewable energy, ecological heating, green roofs, solar collectors, etc. – all taking into account the health of its residents and the balance between residents, buildings and environment (Picazo, 2019).

[5] As Rip & Kemp (1998) explain, the traditional meaning of 'technology' refers to the study of arts and crafts. On the XVIII and XIX, however, the meaning shifted to include and emphasize purposeful inventions and the strategic application of such (Rip & Kemp, 1998). It is in this sense that the term 'technology' and 'technological' will be used in this chapter.

to interview and engage with diverse urban actors working in different sectors around housing cooperativism in Uruguay.

To understand such transitions, the multi-level perspective on socio-technical transitions was chosen, given it goes beyond the study of single-technologies or individual actions and views transitions as non-linear processes, accounting for change at three analytical levels: niches, socio-technical regimes and an exogenous socio-technical landscape (Geels, 2011).

At the first level, niches are defined as "'protected spaces' such as R&D laboratories, subsidised demonstration projects, or small market niches where users have special demands and are willing to support emerging innovations", involving the seeds for systemic change (Geels, 2011). In other words, *niches* can be further seen as the locus in which learning and experimentation with radical innovation is done – and while such innovations deviate from existing regimes, niche-actors hope they are adopted by regimes or even replace it (Elzen et al., 2011; Geels, 2011). Even if niches are crucial for systemic transitions, such an adoption or replacement comes very hard given that regimes are stabilized by many lock-in mechanisms (explanation further below) and some of those innovations lack sufficient compatibility with existing regimes, such as lack of necessary infrastructure, regulations or user practices (Geels, 2011).

At the second level lies the *socio-technical regime*[6], which can be seen as a 'deep structure' and explains the stability of a given socio-technical system (Geels, 2004; Geels, 2011). It can be understood as "relatively stable configurations of institutions, techniques and artifacts as well as rules, practices, and networks that determine the 'normal' development and use of technologies" (Smith et al., 2005).

This semi-coherent set of rules guides the activities and actions of the social groups that reproduce the elements of socio-technical systems (Geels, 2011). However, in the same way rules configure actors, so does actors enact, implement and apply rules in concrete actions in local practices – evidencing that such rules are both the medium and outcome of actions (Geels, 2011). Socio-technical regimes can be further seen as the meta-coordination between sub-regimes (see footnote 6) (Geels, 2004). While socio-technical regimes do not encompass the entirety of sub-regimes, it incorporates those rules that are aligned and common to each

[6] A regime can be understood as a set of rules followed by actors within a particular group. Different groups share different rules and, therefore, it is possible to distinguish different regimes, e.g. technological regimes, policy regimes, science regimes, societal regimes, etc., which can also be called sub-regimes (Geels, 2004; Geels, 2011). As described in Geels (2004), "Actors in these different communities tend to read particular professional journals, meet at specialised conferences, have professional associations and lobby clubs, share aims, values and problem agendas etc.".

other (Geels, 2004). Such configuration indicates that even if sub-regimes have their own dynamics, they interpenetrate and evolve with each other (Geels, 2011).

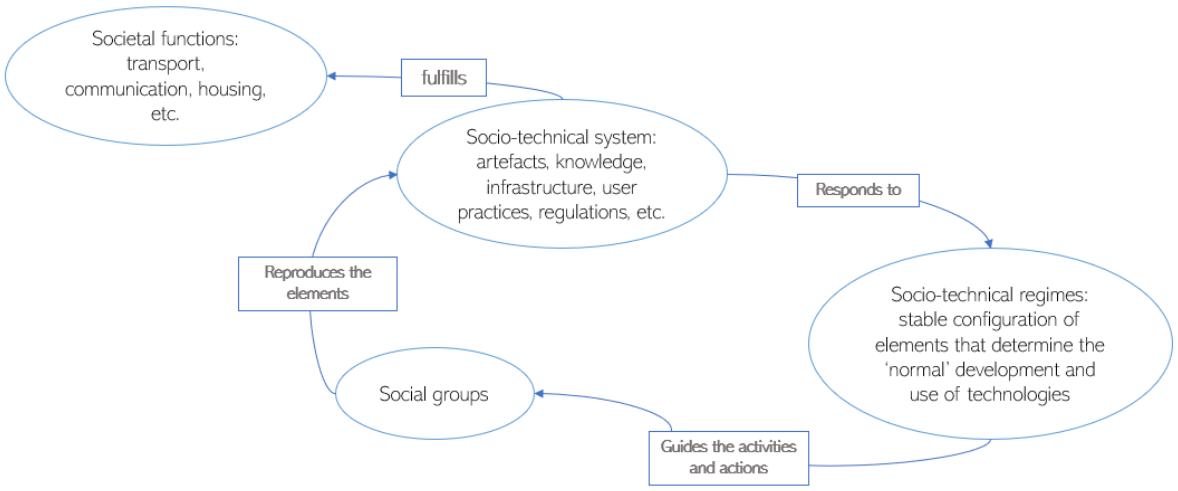


*Figure 2: Understanding the dynamics between societal functions, socio-technical system and socio-technical regime. Source: author, based on Geels, 2011; Geels, 2004; Smith et al., 2005.*

At the third level lies the socio-technical landscape, which according to Rip & Kemp (1998), "is a landscape in the literal sense, something around us that we can travel through; and in a metaphorical sense, something that we are part of, that sustains us". The socio-technical landscape is the macro-level in the MLP theory – an exogenous environment, which involve factors that are external to regimes, such as macro political systems, material and spatial arrangements, societal values and macro-economic factors (Elzen et al., 2011; Geels, 2011; Sahakian, n.d.). Those external factors can be seen as a 'single-landscape', since they form an external environment/context, which cannot be changed by niches and regimes in the short-run (Geels, 2011). On the other hand, the socio-technical landscape directly influences the dynamics in niches and regimes (Sahakian, n.d.). When there are tensions at the landscape level, opportunities for change are created (Sahakian, n.d.).

A change or an innovation in socio-technical regimes happen in terms of small increments and adjustments occurred in several dimensions (technological, cultural, political, etc.), which are accumulated into stable trajectories (Geels, 2011). As Rip & Kemp (1998) states, "regimes are outcomes of earlier changes and they structure subsequent change" – thus highlighting the dynamic characteristics of such regimes. However, due to the rigidity of economic, social, cultural, infrastructural and regulative norms such transitions occur very slowly.

Concepts such as 'path dependence' and 'lock-in' are used when it comes to describing the stability of socio-technical systems. Systems are stabilized by a variety of lock-in mechanisms while path dependence refers to the variety of configurations that contribute to lock-in and stability of certain technologies over others (Geels, 2011; Geels, 2005). Lock-in mechanisms can refer to infrastructures, competencies, scale economies, habits, historical conditions, etc. (Geels, 2011; Sahakian, n.d.). To facilitate visualization of such concepts, Geels (2005) cites several situations that contribute to system stabilization: cognitive routines can make experts look in a particular direction and not others; legally binding contracts imply in systems' stabilization; firms have sunk investments in infrastructure and skills which are not intended to be lost by a switch; the embeddedness of systems in society – people adapt their lifestyles

and routine to particular systems while favorable institutional arrangements and regulations are put in place as well as accompanying infrastructure. All those elements combined – namely, the cognitive, social, economic, institutional and technological processes – contribute to system stabilization, locking us into trajectories, and making transitions a hard and long process given the many interlinkages and path dependencies that exists in socio-technical systems (Seyfang & Smith, 2007).

However, socio-technical systems do undergo transitions and the MLP theory tries to understand how those transitions take place through the above-mentioned concepts, that is, how the interaction between processes at niches, socio-technical regime and socio-technical landscape levels produce a systemic transition. As we have discussed, when socio-technical regimes are aligned, radical innovations are very unlikely to take place, remaining therefore in niches (Geels, 2004). Only when tensions and misalignments begin to happen in the activities of social groups and in socio-technical regimes, there is the creation of windows of opportunity which facilitate the emergence of radical innovations (Geels, 2004). Such tensions can be caused by a variety of factors thoroughly explained at Geels (2004): changes at the landscape level may pressure socio-technical regimes (e.g., climate change is currently putting pressure on the provision of various services); internal technical problems that (may) compromise the effectiveness of certain technologies can trigger actors, such as engineers and firms, to search for new technological solutions and directions; negative externalities upon other systems, such as health risks and environmental damage, may pressure regime actors when pointed out by consumers (civil society) and regulatory measures; change in users' preferences and the lack of established technologies to meet such demands; investments in a radical innovation by a certain firm may trigger other competitive businesses to make the same investments if the innovation is seen as promising on the long-run, which ultimately accelerates the development of new technologies – and so on.

In short, during transitions, the processes at the niche level involve innovations building up an internal momentum while changes at the landscape create pressure on the regime, which, in turn, is suffering a destabilization and creates windows of opportunities for innovations coming from niches (Geels, 2011). New socio-technical regimes are, then, formed.

## 2.2 Grassroot innovations as niches for systemic transformation

For a transition to more sustainable consumption and production modes to take place and given the urgency that the global current situation demands, radical innovation is required to happen, and it does so at the level of niches – as it was discussed in the previous section. However, an important niche-actor who is often neglected lies at communities and their potential for innovative activity (Seyfang & Smith, 2007). As stated in Seyfang & Smith (2007) "innovation and community action are two important strands for sustainable development".

When it comes to sustainability, it is important to notice that grassroot innovations significantly differ from mainstream, business reforms, given that their notion of sustainable development – as well as their values, interests, perceptions, networks, etc. – are greatly different (Seyfang & Smith, 2007). Such a difference becomes quite clear when comparing, for example, a community-driven scheme of vegetable box to the organic section of vegetables in large-chain supermarkets – the trade-offs among the three dimensions of

sustainability (economic, social and environmental) play out significantly different in both cases (Seyfang & Smith, 2007). It is precisely on promoting and facilitating grassroot innovations that lies the motivation for this study, and not the latter.

Seyfang & Smith (2007) applied the concepts of 'transition management' theory to community-led initiatives, conceptualizing grassroot innovations as innovative niches with the potential for systemic transformation and defining them as "networks of activists and organisations generating novel bottom-up solutions for sustainable development and sustainable consumption; solutions that respond to the local situation and the interests and values of the communities involved. In contrast to mainstream business greening, grassroots initiatives operate in civil society arenas and involve committed activists experimenting with social innovations as well as using greener technologies''.

Here it is important to differentiate market-based innovations to grassroot innovations. According to Seyfang & Smith (2007), "sustainable innovation traditionally deals with niches within the market economy", often benefiting from a system of tax breaks and subsidies to make such innovations more competitive in the market. Such green market-based niches have profit as their driving force and will only prosper if in possession of a highly profitable potential when compared to other opportunities for capital (Seyfang & Smith, 2007). The basic organizational form of market-based innovations are firms, which use their income from commercial activity as a resource base (Seyfang & Smith, 2007). On the opposite hand, lies 'grassroot innovations', which are inserted in the context of social economy and are driven by two main motives: social need and ideology (Seyfang & Smith, 2007). Grassroot innovations are determined to answer social and environmental needs that cannot be met by the market while having an ideology based on doing things on alternative ways – with reordered priorities and values (Seyfang & Smith, 2007). Grassroot innovations can take distinct forms, such as of voluntary associations, cooperatives, informal community groups, and often benefit from grant funding, voluntary input, mutual exchanges and limited commercial activity as resources (Seyfang & Smith, 2007).

The focus of this research lies on mutual-aid housing cooperatives in Uruguay – a social innovation, as it has been defined in the previous sections, since it comprises a restructuring of the social institutions of housing and not necessarily a technological one (Seyfang & Smith, 2007). However, as Seyfang and Smith (2007) states, social innovations can serve as an important ground for sustainable technologies to take place. According to the authors, using the example of co-housing initiatives, residents "can pool resources for the use of small-scale renewable energy technologies, rainwater harvesting, grey water recycling, and more sustainable construction materials and designs unavailable to individual households. In short, social innovations and the diffusion of technological innovations are intimately linked".

Social innovations can therefore act as green niches if they decide to engage in the pursue of more sustainable production and consumption practices, exploring problem framings, such as mobility and construction, and searching for solutions (Seyfang & Smith, 2007). If such niche-practices resonate with the demands of civil society at a higher level, such practices may be adopted, adapted and spread (Seyfang & Smith, 2007). If, for instance, Uruguayan mutual-aid housing cooperatives start decreasing construction's carbon footprint by using local materials, they will perform as green-niche actors promoting a grassroot innovation; such innovation, if aligned with widespread public concern and the other necessary elements for a transition to happen, may drive systemic transformation.

Moreover, there are different ways in which niche sustainable housing practices could influence the wider housing regime, namely through replication at the same scale, upscaling and translation of ideas to the mainstream regime (Seyfang, 2009).

By replication at the same scale, new individual green buildings are built at the same owner-builder scale, allowing for tailored designs and variations since constructions take place through learning and experimenting (Seyfang, 2009). This development-within-the-niche can also expand its work through the publication of manuals, books and articles and workshops, sharing experiences and expertise (Seyfang, 2009). Such methods are very useful for spreading ideas among people and communities interested in green buildings while searching for an alternative way of life, allowing for the growth of niches locally, nationally and internationally (Seyfang, 2009). Such expanding, however, can face several constraints depending on the locality given the restrictions on building permissions and the unfamiliarity of planning offices with such construction techniques (Seyfang, 2009). As Seyfang (2009) states "one of the main barriers facing green sustainable housing niches is posed by planning regulations and buildings standards which were not designed with these building methods in mind".

A second route for niche sustainable housing practices to impact the broader housing regime is through scaling-up – which means transitioning from a small scale, self-builder mode to industrial mass-production (Seyfang, 2009). Such a transition is often not possible and/or practical given that some green building niche projects rely heavily on manual labor, cheap land or local materials, making this route structurally limited (Seyfand, 2009).

The third way refers to the translation of niche ideas and practices to the regime, adapting them to the settings of mainstream building industry (Seyfang, 2009). However, for such a translation to happen, pre-existing conditions putting pressure on existing regimes must be in place – which is currently the case given the urgency climate change poses in finding solutions for the developing of low-carbon housing, giving opportunity for niche practices to emerge (Seyfang, 2009). For such a translation to happen, governments can encourage greener building standards – however, such an incremental improvement do not fully challenge and transform the regime (Seyfang, 2009). According to Seyfang (2009), another way for such a transfer to happen would be in the adaptation of the niche itself to resemble the regime, responding, for example, to regulatory pressures and striving to meet regime standards. However, while niches could indeed become more accepted by regulators and gain familiarity with planning committees, it could also imply on loosing on accessibility and affordability, for example, loosing certain social benefits (Seyfang, 2009). In that case, one could think of modern methods of construction incorporating elements of sustainable housings – such as filling prefabricated wall panels with straw, hempcrete or another sustainable material – therefore adapting green niche practices to mass-production (Seyfang, 2009). An initiative, called Cycle Terre, has precisely such strategy: it uses the 'waste' land produced in excavations to construct new neighborhoods in the great Paris area while developing partnerships with architects and real-estate developers (Cycle Terre, n.d.b). It aims for a significant production of scale, targeting the real-estate market in order to demonstrate its viability while working to obtain building certification (Cycle Terre, n.d.a).

In this study, the research will concentrate on the potential use of earth architecture in mutual-aid housing cooperatives in Uruguay, that is, the potential for mutual-aid housing cooperatives (as a social innovation) to become grassroot innovation niches in the field of

sustainable housing and the obstacles such an implementation face through the lens of various urban actors in Uruguay.

# Chapter 3 – Research Design and methodology

## 3.1 Research questions and research objectives

Given the lack of literature on housing cooperatives' use of sustainable building materials and the importance such phenomenon has in Latin-American countries in providing access to housing for the most vulnerable population, this study aims to contribute to a better understanding of how housing cooperatives might play an important role in the transition to more sustainable building materials and the many challenges such transition imposes. Focusing in Uruguay, the research tries to explore general perceptions around the implementation of earth architecture in mutual-aid housing cooperatives through the lens of different urban actors. Ultimately, the goal is to assess the barriers for mutual-aid housing cooperatives to become green niches in the promotion of sustainable building materials and what are the conditions – social and institutional – for this to happen. In such analysis, the intention is to also gather insights on the Uruguayan model of mutual-aid housing cooperatives and its openness to innovation and reinvention – which can ultimately provide even greater understandings of the model's limitations, beyond the topic of earth architecture. In order to do so, this research will analyze the following questions:

1. What are the perceptions and barriers around earth architecture in Uruguay and around the implementation of such construction method in mutual-aid housing cooperatives among the main Uruguayan urban actors?
2. How do different regimes and landscape play on the choice of building materials in mutual-aid housing cooperatives?
3. What is the potential for mutual-aid housing cooperatives to become green niches in the transition to sustainability and the obstacles it must overcome in order to do so?

The hypothesis, based on the theory developed in Chapter 2, is that the choice of building materials in mutual-aid housing cooperatives is influenced by a multitude of factors and different actors from several sub-regimes as well as culture and tradition in Uruguayan society. Therefore, for mutual-aid housing cooperatives to adopt earth architecture there must be a series of pre-conditions in several different sub-regimes that participate on the development of such collectives, making earth architecture "more attractive". The pressure from the landscape – such as the urgency of climate change – could incentivize and guide such transition.

It is important to highlight that given the strength of the Uruguayan mutual-aid housing cooperative movement, nationally and internationally, such uptake of earth architecture could influence broader practices in the regime, beyond the cooperative movement and beyond the Uruguayan borders – therefore, constituting an important green niche actor in

the transition to more sustainable building practices – and highlighting the importance of this research.

## 3.2 Methods and the pandemic limitations

In order to gain a meaningful insight of the questions above, the chosen method for this research was to gather qualitative data through in-depth, semi-structured interviews. Since the beginning, the goal was to have interviews with urban actors engaged at different levels in the "universe" of housing cooperatives as well as professionals specialized in earth architecture. In Uruguay, the model of housing cooperatives involves a great participation of federal and municipal governments, technical assistance institutes, the federation of mutual-aid housing cooperatives (FUCVAM) and university research and extension – all sectors working together at different levels so that cooperativists can access decent and affordable housing. It is, therefore, of utmost importance that the research gathered the different opinions of people working at those various sectors, since each provide for particular perspectives of the model and contribute to its implementation differently. Equally important was to assess the views of cooperativists, which are the ones ultimately responsible for all the decision-making process in the cooperatives, including the choice of building materials. Architects specialized in earth architecture were also included in order to have a greater insight of how earth architecture develops in Uruguay – all of them also aware of the cooperative housing model. In that way, 14 in-depth interviews were carried among a wide range of professionals with a background in one or more of the aforementioned sectors. Refer to Annex 2.

According to Berg & Lune (2012), "Particularly when investigators are interested in understanding the perceptions of participants or learning how participants come to attach certain meanings to phenomena or events, interviewing provides a useful means of access". Moreover, the format of semi-structed interviews allowed me to pursue further information – not previously expected in the interview script nor in the literature – that could contribute to my understanding, not only of my topic of interest, but also of the reality in which housing cooperatives are inserted in Uruguay. With findings from previous interviews, I was able to refine other interview scripts and pursue information that was not previously found in literature given the freedom embedded in semi-structured interviews. Such freedom comes essential in topics with so little background on literature, allowing for readjusts at the course of data collection. However, in all interviews, I have always intended to explore the meanings each interviewee attributed to earth architecture and their perceptions on the role of IATs, government, university and FUCVAM in the promotion of earth architecture in mutual-aid housing cooperatives. In that way, many common points arose in an interest way and the different perceptions around earth architecture gave richness to the study.

Since the ultimate goal of this research is to assess the barriers preventing housing cooperatives to become green niches in a transition to sustainability through the implementation of earth architecture in the construction of houses, it was imperative to

immerse myself in the perceptions of Uruguayan urban actors, remaining open to adapt any previous general theory already formulated, given the specificity of the context and the lack of literature. However, it was equally important to understand and grasp the theories around system transitions and grassroot innovations given that no fieldwork was possible in face of the global pandemic. Therefore, I have intended to pursue an inductive and explanatory approach to the research, apprehending the Uruguayan reality through the lens of my interviewees and connecting the dots that have emerged from those encounters with the chosen theoretical framework.

An interest description of the role of the researcher, which I have tried at my best to incorporate, is given by Marshal (1981): "It's my assumption that there is some sort of order in the data that can emerge. My job as a researcher is to be an open and receptive medium through which this order comes out". The data gathered was then subjected to a thematic analysis, from which emerged several common remarks on the perceptions and limitations, not only in the implementation of earth architecture in housing cooperatives, but also related to the CVAM model itself. Refer to Annex 3.

While developing my research, I have also been part of urbaMonde, a Swiss and French NGO working in the field of participative cities, which provided me even greater insight in bottom-up and community-led dynamics and various initiatives promoted by collectives. urbaMonde has an important collaboration and partnership with FUCVAM, which helped me to access different contacts engaged in the housing sector in Uruguay[7].

At the beginning, the research would count with a field trip of 5 weeks in Uruguay to perform the interviews and visit different cooperatives. However, due to the current COVID-19 pandemic, the field trip had to be cancelled and the interviews performed online, through platforms such as Skype and Zoom.

According to Berg & Lune (2012), "while this type of interview interaction is not identical to a more traditional face-to-face interview, it does approach it in a number of ways". For instance, online interviews with a video camera allows for face-to-face contact (even if body language perception is very limited), giving a sense of proximity. Such synchronous environment also allows for instant interaction, allowing the researcher to ask probing questions to elicit additional information as well as to change the direction of the interview (Berg & Lune, 2012). Moreover, the practicality of such method allowed the contacts flexibility to fit the interviews in their busy schedules, sometimes at the middle of the day, during lunch time or between different appointments. All interviews were recorded with previous consent and, in the case of Skype, the recordings could be easily accessed by the interviewees at the chat, providing an additional security. Moreover, such online contact facilitated previous and post communication with the interviewees, most of which reinforced their availability in case I had further questions or demands, and even suggested a second session in case necessary.

[7] A special thanks to Fernando Zerboni, working at ENFORMA, which has kindly provided me hours of valuable lessons on mutual-aid housing cooperatives through inspirational conversations and Skype meetings during many weeks, and has also recommended me several contacts with great relevance for this research.

The downsides of performing the data collection online lies on the inability to experience the environment in person. The visits to cooperatives and to FUCVAM would have certainly provided important insights to the dynamics of the cooperative movement in Uruguay. It would also have allowed me to interact with a further great number of actors – especially through informal interviews and conversations, which are of equally great importance in such studies. Moreover, visits to cooperatives performing construction works would have tremendously apported to the thematic of this study, allowing for observation and possible limitations that might not have arisen during the interviews. All those factors have imposed limitations to the results of this study.

Another important bias corresponds to how contacts were gathered: around 8 interviewees were recommended and/or contacted through my network in FUCVAM and the others were spontaneously contacted, with their names coming up through research around bioconstruction and around Guyunusa cooperative. Even so, it was still possible to have interviewed a variety of actors working in different dimensions and sectors. Some of those have even been themselves in different spheres of the cooperative movement: for instance, to illustrate, one interviewee have had work experience in a IAT and a government agency while having also lived in cooperatives and militated in FUCVAM in young age – therefore providing for an important broad vision of the cooperative movement. Thus, even with the aforementioned limitations, the research did not lack to assess the views of different actors belonging to different sub-regimes around the CVAM model.

## 3.3 Justification of case study

I have chosen Uruguay as my focus for this study for a variety of different reasons. First, one of my main goals with my master thesis was to develop an impactful research that could be useful to urbaMonde's line of work, which actively develops international cooperation projects in the field of participative cities and community-led housing. In Latin America, urbaMonde has developed an important partnership with FUCVAM, carrying out training, visibility and systematization of the CVAM model, with the aim of contributing to the dissemination and consolidation of such model in South America. Having access to that network has greatly benefited me with knowledge about the model and the social and political relevance of Uruguayan housing cooperatives as well as with pertinent contacts in Uruguay.

Moreover, Uruguayan housing cooperatives are a model worldwide, being internationally recognized through the World Habitat Award. In a country with 3.5 million inhabitants, housing cooperatives provide affordable and decent housing to around 30.000 households (Barenstein, 2019). Uruguay is also committed to share its knowledge and experience with other countries through international cooperation. In fact, for over 15 years, FUCVAM has been directly involved in the transfer of the CVAM model to 14 Latin American countries through south-south cooperation initiatives. Therefore, contributing somehow to a possible innovation in mutual-aid housing cooperatives in Uruguay comes with the potential of

promoting innovation in other countries, given the respect and prestige those collectives have worldwide.

Given all previous points, the research intends to contribute and complement studies on Uruguayan mutual-aid housing cooperatives, with the hopes that the results found can also permeate other Latin-American realities while providing a reference for cooperative's use of sustainable construction materials and best-practices that could stimulate innovation and contribution of housing cooperatives to sustainable development.

# Chapter 4 – The movement of mutual-aid housing cooperatives in Uruguay

## 4.1 Urbanization and housing in Uruguay


*Figure 3: Departments of Uruguay. Source: Wikipedia, n.d.*

Uruguay is a highly-urbanized country with 95% of its population living in urban centers, marked by a very slow demographic growth, relatively high life expectancy (75,4 years) and aging of its population – typical characteristics of industrialized countries (Eguino & Adler, 2009; Macchio, 2017). The last census, made in 2011, counted 3.286.000 Uruguayans while the 1996 census counted 3.164.000 – thus, highlighting the very slow demographic growth of the country (Couriel & Menéndez, 2014). Uruguay is divided among 19 departments, one of which includes Montevideo (Eguino & Adler, 2009). Such particularities make Uruguay very unique in the context of Latin American countries, which explains in part the nickname attributed to the country: *La Suiza de América* (The Switzerland of America).

Housing production in Uruguay is done in its majority through the initiative of Uruguayans themselves (Couriel & Menéndez, 2014). According to Couriel & Menéndez (2014), the most common access to housing is done through formal and irregular renting, purchase of plots and subsequent self-construction, purchase of new or used houses, occupation in the formal housing fabric and occupation in informal settlements.

One of the main characteristics of Uruguay is the concentration of activities in the capital and its peripheries: indeed, most transports networks (rail, road, air, sea) converges to Montevideo and the capital concentrates 40% of all the population (Eguino & Adler, 2009; Couriel & Menéndez, 2014). Such concentration becomes staggering when comparing the different population densities of each department: while Montevideo presents a density of 2537 inhabitants/km², the average in the rest of the country stands at 18.1 inhabitants/km² and in countryside departments it can be as low as 10.4 inhabitants/km² (Eguino & Adler, 2009). It is, therefore, of utmost important to understand the dynamics in the capital and its peripheries, especially since it is where great part of housing cooperatives is concentrated:

in 2017, out of 2,041 housing cooperatives registered nationally, 953 were located in Montevideo (INACOOP, 2017 as cited in Barenstein & Pfister, 2019).

In the past, the migration towards Montevideo from the countryside was generally motivated by the greater opportunities the capital offered for social mobility, and such growth was reasonably controlled for many decades (Eguino & Adler, 2009). In fact, as of 1930s, due to the industrialization period, Montevideo together with other departmental capitals received a flow of migrants from rural areas attracted by the possibility of employment, industrial dynamism and access to services (Macchio, 2017).

However, from 1960 onwards, after a prolonged crisis in Uruguay, the migration processes began to change. The 1963, 1975, 1985 and 1996 censuses showed a stagnation of the population growth in Montevideo (due to a decrease in internal migrations), the displacement of its own population towards Canelones (outside the departmental boundaries) and the international emigration that settled in the city of Montevideo (Macchio, 2017). Indeed, between 1963 and 1975, there was a decrease in the total migratory balance for Montevideo while Canelones doubled it in the same period (Macchio, 2017). As Macchio (2017) explains, such a tendency indicated the expansion of the city towards residential zones located in Canelones, together with a progressive emptying of the city's historic urban center and other traditional neighborhoods.

Therefore, the metropolitan area around Montevideo also plays a major role in the urban dynamics. Called Gran Montevideo, the area comprises Montevideo and the metropolitan areas surrounding it from Canelones and San José departments (Couriel & Menéndez, 2014). According to the last census, the percentage of houseowners in Gran Montevideo stands at 59% (against 60% for the rest of the country) while 23% are tenants (against 15% for the rest of the country (Couriel & Menéndez, 2014). On the other hand, 9% of Uruguayans in Gran Montevideo live in informal settlements while the average for the rest of the country stands at 2% (Couriel & Menéndez, 2014). In fact, Montevideo is the department with higher percentage of people living in informal settlements, reaching 10% (Couriel & Menéndez, 2014).

The first generations of informal settlements happened in 1982, trigged by an economic crisis in Uruguay (Couriel & Menéndez, 2014). In fact, the trend towards socio-territorial segregation was installed from the end of the 1980s as a result of the change in the Uruguayan development model, the fall of the Welfare State, the informal dynamics of the private sector regarding the use of plots and the discoordination in the provision of urban services – all of which aggravated the situation of informal settlements (Martínez, 2011).

Informal settlements, however, is not the home of the majority of urban poor. In Gran Montevideo, poverty[8] is not uniformly distributed in space (Couriel & Menéndez, 2014). Poverty is concentrated in irregular settlements, but the majority of poor people live in the formal sector, that is, the part of the city where houses respect building norms, land tenancy and with access to services, such as telephony and water (Martínez, 2011; Couriel &

[8] Here, poverty is associated with the level of income.

Menéndez, 2014). In other words, 53% of people living in informal settlements are considered poor against 12% of people living in the formal sectors – however, given that the formal sector hosts a greater number of population, the 12% is bigger in quantity than the 53% (Couriel & Menéndez, 2014). In numbers, out of 100 poor people, 70% live in the formal sector while 30%, in informal settlements (Couriel & Menéndez, 2014). All of which highlights a higher rate of irregular land occupation than the increase in poor families (Martínez, 2011).

As expected, such metropolitan area is highly divided according to socio-economic factors and quality of life and housing varies according different neighborhoods, highlighting the indissociable links between the social and the territorial. To highlight those differences, Couriel & Menéndez (2014) refer to three different zones in Gran Montevideo: high-income city, the intermediate city and the periphery, which locates in space populations with different levels of income. See figure below. Those three different zones are not only different in relation to their level of household income, but deep social and housing inequalities emerge from this spatial segregation (Couriel & Menéndez, 2014).

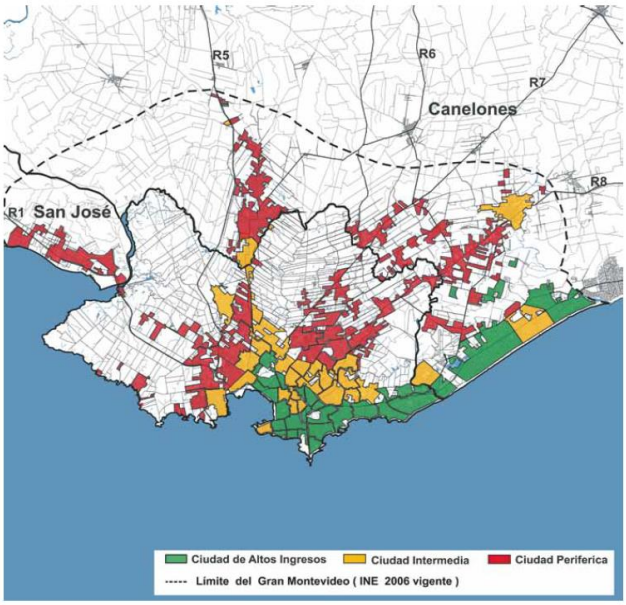


*Figure 4: Gran Montevideo and its three divisions/zones divided based on the level of income of inhabitants. Retrieved from Vivienda: Dónde vivimos los uruguayos (p. 14),by J. Couriel & F. J. Menéndez, 2014, Montevideo: Colección Nuestro Tiempo.*

Between the 1996 and 2011 censuses, the socio-urban segregation increased in the department of Montevideo: its periphery grew in population while its intermediate and high-income zones, decreased (Couriel & Menéndez, 2014). On the other hand, at the level of Gran Montevideo, even if all three zones increased in population, the one that grew the most in absolute numbers of inhabitants was the peripheral city (Couriel & Menéndez, 2014).

However, such suburban dispersion in-the-making since the end of 1980s and its counterpart - the deterioration of consolidated areas - are not the result of the demographic increase but of particular dynamics in occupation of land (Martínez, 2011). Two phenomena greatly contributed to such tendency: 1. wealthier sectors' preferences for residence in exclusive neighborhoods and the coastal region invaded rural-agroproductive environments with services in situ; 2. waves of chronic poverty resulting from income stability, lack of (or limited) access to basic services along with the precarity of slums and the uptake of irregular settlements (Martínez, 2011).

Regarding the quantitative housing deficit in Uruguay, 38.000 houses would have to be built so that every family nucleus had access to housing (Couriel & Menéndez, 2014). When it comes to the qualitative housing deficit, this number explodes: considering the lack of proper sanitation, lack of electricity, overcrowding, maintenance problems, lack of piped water, lack of cistern bathrooms, the housing deficit reaches 470.000 (Couriel & Menéndez, 2014).

On the other hand, the rest of the country presents several indicators that show a higher deprivation when compared to Gran Montevideo: greater absence of kitchen, water of inadequate origin or that does not arrive at the interior of the house through pipes and inconvenient elimination of excrements (Couriel & Menéndez, 2014). Moreover, the process of socio-urban fragmentation also happens in other departments in the interior of Uruguay, especially in the departments' capitals – thus, presenting an important challenge in the relations between society, market, State and territory in all Uruguay (Couriel & Menéndez, 2014).

## 4.2 The Mutual-Aid Housing Cooperative Model (CVAM model)

### 4.2.1 Uruguayan housing cooperatives models

Uruguay has two different housing cooperative models: 1. owner's cooperatives (cooperativas de proprietarios), which produce housing that, after construction, become of private ownership of the cooperative members; 2. user's cooperatives (cooperativas de usuarios), which are characterized by the collective property of both the land and the dwelling (Barenstein & Pfister, 2019). Mutual-aid housing cooperatives are part of the second group together with previous-savings cooperatives (cooperativas de ahorro previo) (Barenstein & Pfister, 2019).

In the case of previous-savings cooperatives, the members contribute with their own savings the equivalent of 15% of the total investment of the project; in the case of mutual-aid housing cooperatives, such 15% equivalent is provided through the members' own workforce in the construction of their houses – that is, the 15% financial contribution made by previous-savings cooperatives are replaced by the labor of cooperatives' members in the mutual-aid approach (Barenstein & Pfister, 2019).

Therefore, such model allows low-income sectors, with no savings capacity, to access decent housing with a quality standard that would not be possible otherwise. It also represents the majority of housing cooperatives in Uruguay and are organized through a specific Federation: Federación Uruguaya de Cooperativas de Vivienda por Ayuda Mutual – FUCVAM (Uruguayan Federation of Mutual-Aid Housing Cooperatives. According to Barenstein & Pfister (2019) "(…) the fact that FUCVAM counts with 630 member cooperatives, and FECOVI, the federation of *ahorros previos* cooperatives, only 111, indicated that the mutual-aid approach continues to be the prominent one".

Born in Uruguay, this model became internationally recognize and many efforts were made to spread mutual-aid housing cooperatives to other countries, especially in Latin-America, as discussed before. In the next sections, the history and more specific characteristics of the CVAM model are presented in detail.

### 4.2.2 Historical Context

Uruguay and especially Montevideo, as other Latin American cities, have grew and expanded through self-construction processes (Nahoum, 1984). As Nahoum (1984) defines, "[Uruguay is] a country of self-builders, then. Of people willing to build their homes with their own hands (…)" (author's translation). Such tradition was in place since the beginning of XX century when workers bought plots in the suburbs of Montevideo, paid in small installments, and constructed their houses with their own strength and own hands, often supported by friends and family and, in the most difficult stages that required expert knowledge, with the help of masons (Nahoum, 1984). Therefore, the tradition of purchasing plots and the posterior self-construction of houses undoubtedly contributed to the rapid adoption of mutual-aid cooperativism in the country (Couriel & Menéndez, 2014).

Besides the self-construction tradition, Uruguay has had another important factor that contributed for the triumph of the mutual-aid model: its strong work unions and social organizations. Even if at first stages the union movement distrusted the housing cooperative model, a highly organized civil society indicated that the people were ready to fight for their right to decent housing, decent work conditions and quality health and education (Di Paula, 2008). Particularly, the *Congreso del Pueblo* (People's Congress, author's translation) – which brought together professional, student and trade union organizations – raised awareness for the necessity of a housing plan and indispensable infrastructure works (Di Paula, 2008). Therefore, the movement of mutual-aid housing cooperatives brought together the experience of self-builders and of civil society organizations, particularly those of the workers' unions, uniting efforts in order to better obtain cost savings, fight for better loan conditions and making those efforts more effective and efficient (Nahoum, 1984).

The trigger for such social innovation to emerge was an important economic crisis that deeply affected the access to housing of the vulnerable sectors. At the end of Korean War, Uruguay has suffered a deep economic deterioration, with inflation levels reaching up to 137% in 1967 and the price of the dollar in the financial market increasing from around $3 in 1955 to $249 in 1968 (Terra, 1969 as cited in Nahoum, 1984). As expected, the serious crisis permeated the housing sector and the construction of new houses: the square meters built per year fell from more than one and a half million in 1956 to half in 1963; investment in housing in relation to GDP fell by 50% in the same period; the loans granted by the housing financing body in Uruguay (Banco Hipotecario del Uruguay) fell from around 10 billion pesos in the period of 1955-1958 to only 350 million in 1968 (Melgar & Cancela, 1983 as cited in Nahoum, 1984).

In face of such crisis, new responses had to be given to the problematic of housing – if not by the State nor the private sector, workers themselves were about to construct a third way of accessing decent housing through the mutual-aid housing coops. The first experiences

happened in Uruguayan countryside promoted by the *Centro Cooperativista Uruguayo* (CCU) (Uruguayan Cooperativist Center, author's translation) and financed by the Inter-American Development Bank as part of a large-scale national program that involved both the private and public sector in the construction of 4,100 housing units (Di Paula, 2008; Nahoum, 1984; Barenstein & Pfister, 2019). It consisted of three pilot projects emerged in 1966 composed by three different groups of workers – totaling 95 families – who decided to constitute cooperatives in order to answer their need for decent housing (Nahoum, 1984). The experiences happened in Salto, Fray Bentos and Isla Mala and were constituted as Consumer Cooperatives given the lack of legal status for Housing Cooperatives at the time (Nahoum, 1984). Those experiences – which were not only constructing their own houses, but a whole model and form of organization – faced innumerous difficulties in the process, but managed to achieve very positive results, corroborated by official documents at the time, and served as a key milestone (Nahoum, 1984). Moreover, they have managed to promote a high degree of social cohesion and solidarity among themselves and such positive results contributed to the rapid growth and adoption of the model with the number of cooperatives multiplied by 100 in less than a decade (Barenstein & Pfister, 2019; Nahoum, 1984).

### 4.2.3 *Ley Nacional de Vivienda* (The National Housing Law)

The National Housing Law of 1968 marked the transition from dispersed/uncoordinated policies to a logic of planned policies in Uruguay and constituted an important achievement for the cooperative movement (Couriel & Menéndez, 2014). It intended to unify the public intervention in the framework of Housing and created a single National Housing Fund (Fondo Nacional de Vivienda y Urbanización) while specifying a detailed regulatory framework for housing cooperatives (Di Paula, 2008; Barenstein & Pfister, 2019; Couriel & Menéndez, 2014). It is important, however, to understand the context in which cooperatives were inserted in the 1968 Law.

According to Couriel & Menéndez (2014) there are important factors behind the 'how' and 'why' the National Housing Law came into place:

1. The housing crises described in the previous section greatly affected the construction industry and its powerful businessman, both linked to the construction of housing and the production of building materials – it was, therefore, necessary to provide some economic viability for such sector while at the same time reactivating the economy, given the many employment posts in the construction industry;
2. Given the social and territorial inequalities in Latin America and the fear of a revolutionary political change, the United States promoted the "Alliance for Progress" with the proposal of financial loans for Latin-American and Caribbean countries and demanded, in turn, that such countries possessed clear development plans;
3. Given such demand, the *Comisión de Inversiones y Desarrollo Económico* (CIDE) promoted the development of such development plans hiring several and diverse professionals with expert knowledge regardless of their political positioning. One of

them, the architect Juan Pablo Terra, which participated in such rigorous work as part of the CIDE plan, was one of the most significant promoters of the 1968 Law and, together with the CCU, fought so that the chapter 10 of the Law constituted the legal recognition of the CVAM model (Gonzáles, 2013). The contents of the Law are only explained through the rigorous work previously done at CIDE from 1963 to 1966. Moreover, Juan Pablo Terra have also investigated the pilot experiences of the three mutual-aid housing cooperatives in 1966, which highly influenced the chapter on housing cooperatives. International experiences also influenced and were also a topic of study for J. P. Terra, such as the housing cooperatives' experiences in Sweden and the technical institutes in Denmark which were private institutions with non-profit and social goals.

Even if the National Housing Law was elaborated based on CIDE's directives, it had to include housing cooperativism as an alternative outside the market given the enormous social crisis and strong revindications from civil society (Di Paula, 2008). In that way, the Law provided cooperatives with legal status, ensured the provision of professional assistance through the *Institutos de Asistencia Técnica* (IATs – Technical Assistance Institutes) and recognized the collective property of previous-savings and mutual-aid housing cooperatives (Di Paula, 2008; Couriel & Menéndez, 2014). Moreover, it also installed a new currency, called *Unidad Reajustable* (UR, Readjustable Unit), which has its value adjusted annually according to the average wage index (Couriel & Menéndez, 2014). Most importantly, the 1968 Law recognizes the right to decent housing and, according to Valadares & Cunha (2018), "establishes as a principle of national policy that every family, regardless of their income, is assisted with adequate housing. It is the State's responsibility to create the necessary conditions to provide access to housing".

After the National Housing Law was approved, between 1968 and 1973, 69 cooperatives were registered, totaling 4338 individual housing units, which counted with low-interest, long-term loans from the newly created National Housing Fund (Frens-String, 2011).

## 4.3 The main actors involved in the Mutual-Aid Housing Cooperative movement in Uruguay

### 4.3.1 Uruguayan Federation of Mutual-aid Housing Cooperatives (FUCVAM)

The creation of housing cooperatives federations was sanctioned by the National Housing Law, which allowed cooperatives to form higher-level organizations – constituting an umbrella organization (Barenstein & Pfister, 2019). The Federation of Uruguayan Mutual Aid Housing Cooperatives (FUCVAM) was formed in early 1970 by the first three pioneer cooperatives together with another 8 that were formed after the National Housing Law (Frens-String, 2011; Machado, 2017). Since the beginning, with the aim of assembling mutual-aid housing cooperatives, FUCVAM has had an important role in the formation of new cooperative groups and in facilitating the communication, not only inside the movement, but also with public

authorities (Machado, 2017). Even if Uruguay counts with other cooperatives' federations, such as FECOVI (the Federation of previous-savings cooperatives), FUCVAM is the only one with such magnitude and public influence, with its trajectory recognized nationally and internationally (Machado, 2017). According to Bredenoord (2017), FUCVAM can be characterized as "the ideological, organizational, and educational motor of the cooperative mutual-help housing movement" which has "contributed significantly to the expansion of the cooperative movement in Uruguay".

Even during the years of dictatorship, from 1973 to 1985, FUCVAM remained active, continued the fight for the survival of cooperatives and established itself as one of the main political actors in the fight against the dictatorial regime (Barenstein & Pfister, 2019; Gonzáles, 2013). According to Gonzáles (2013), "mutual-aid housing cooperatives were 'islands of freedom' during the dictatorship and at their center was developed a community and territorialized culture of resistance to the regime" (author's translation). During such period, users' cooperatives suffered with the suspension of legal status for new cooperatives as well as the grating of new loans, and the modification of the loans' conditions, increasing interest rates – which highlights how important and necessary was the fight of FUCVAM for the survival of the CVAM model until today (Machado, 2017).

Nowadays, FUCVAM counts with 630 member cooperatives, representing more than 23,500 families (Barenstein & Pfister, 2019). According to Barenstein & Pfister (2019), even if FUCVAM defines itself as political independent organization, "it represents a powerful social movement whose strategies and activities are highly political". Among such important initiatives led by the Federation, Barenstein & Pfister (2019) highlights: collaboration with a various range of civil society organizations and progressive political groups; organization of mass demonstration in order to fight for the right to decent housing and better conditions on government loans; organization of solidarity days (jornadas solidarias) in which cooperative members who already have their houses constructed help other cooperatives in building their houses; provision of several courses and trainings on mutual-aid housing cooperativism; legal consultations for cooperatives already established; mediation of conflicts among cooperativists or between cooperatives and IATs.

FUCVAM has also formed its own technical department (Departamento de Apoyo Técnico de FUCVAM) which intends to transmit the accumulated knowledge so that previous mistakes can be anticipated and prevented – a work of great relevance especially given the expansion of the movement both nationally and internationally (Nahoum, 2013a). Another important pillar of the Federation is its national training center – ENFORMA – which offers several different courses, from cooperative management to social development issues, and aims to provide an education to cooperativists aligned with the values of the movement, deconstructing ideas and practices that go against the collectives (ENFORMA-FUCVAM, 2018; Barenstein & Pfister, 2019). Moreover, for FUCVAM, the mutual-aid cooperative model goes much beyond a way to access decent housing: it is essentially a way of life based on the community and the collective – "a collective that allows and demands, not only debating and solving housing issues, but also face numerous aspects of life; it becomes a way of life based

on the on-going construction of the community and solidarity ", as described in ENFORMA-FUCVAM (2018) (author's translation).

In response to innumerous social problems emerged from the years of dictatorship followed by neo-liberal government, FUCVAM has also acted in support of impoverished communities, who have suffered with loss of employment, forced evictions and the growth of informal settlements – therefore, showing awareness on the importance of the access to livelihoods, infrastructure and services in order to attain quality of life (Barenstein & Pfister, 2019).

At the international level, since 2000, FUCVAM is engaged in bringing the CVAM model to other Latin-American countries, such as El Salvador, Honduras, Guatemala, Nicaragua, among others, adapting such model to the realities of each country while transporting the pillars of the mutual-aid model (Bredenoord, 2017; Nahoum, 2013b ).

It becomes hard to summarize in one section the role and importance of such Federation – and it is not the attempt of such study to try to. However, to finalize, it is worth mentioning the international recognition FUCVAM has gained winning the first prize at the World Urban Forum in 2012 and the World Habitat Awards in the same year (Barenstein & Pfister, 2019; World Habitat Award, 2012).

### 4.3.2 Technical Assistance Institutes (IATs)

Even if housing cooperatives have gained rapid adoption in Uruguay, the complexities of forming such collectives should not be underestimated: obtaining legal status, complying with several requirements, presenting innumerous documents, managing large government funds while performing construction works – all by people who, most of the time, do not possess previous experiences with construction work and business management – can certainly impose many challenges. Given such complexities of managing human and material resources, the National Housing Law sanctioned the creation of the Technical Assistance Institutes (IATs, Institutos de Asistencia Técnica) (Barenstein & Pfister, 2019).

IATs are not-for-profit, private and independent organizations composed by a multidisciplinary team, which has the goal of advising housing cooperatives and are hired by them (Gonzales, 2013). Such interdisciplinary team counts with a wide range of professionals, and it was created "not to combine different types of technical support in different disciplines, but to build teams capable of providing comprehensive guidance services", as Nahoum (2013b) explains.

According to the National Housing Law, IATs must comprise at least four different domains: social organization, accounting, legal assistance and architectural planning – which, therefore, implies in teams that can count with architects, engineers, social workers, psychologists, accountants, lawyers, etc., highlighting its multidisciplinary character (Barenstein & Pfister, 2019).

IATs are essential for the well-functioning of housing cooperatives. They are responsible for ensuring that such collectives comply with the institutional framework and regulations required for cooperatives to access government loans (Barenstein & Pfister, 2019). They provide assistance from the formation of cooperative's committees, management of funds to designing of architectural projects, being an integral part in all processes since the formation of cooperatives until the end of the construction processes. It is important, however, to highlight that cooperatives' members are the ones responsible for all final decisions and should be capacitated in decision-making in order to better attain good results. Especially, the architectural projects should involve a participatory design and collaborative processes between IATs and members – with cooperatives having the ultimate power to approve or change IAT's proposals (Barenstein & Pfister, 2019). All in all, IATs must fulfill two different roles: 1. Social project, which entails trainings in management, social participation of cooperativists, formation and integration of the cooperative, etc.; 2. Architectural project, which comprises all the technical aspects in the construction of the buildings.

IATs need to be officially registered at the government level and are paid the 7% of the total capital investment in the housing project (Barenstein & Pfister, 2019). An additional 2% can also be charged if IATs engage in additional services, such the hiring of sanitary engineers, electricity technicians, etc., but the housing cooperatives also have the choice of administrating those 2% themselves.

### 4.3.3 Municipal and Federal Governments

One of the most important pillars of the housing cooperative movement is the state support. Indeed, only with the support of land, services and financing, can low-income families access plots and housing of such quality as the ones provided by Uruguayan housing cooperatives – especially when those families earn minimum wages or a little more (Nahoum, 2013a).

Through the National Housing Law in 1968, the government has provided cooperatives with a whole framework, regulations and the assurance of technical support and provision of financing and it has defined specific roles for the state while specifying several different preconditions for housing cooperatives and its members (Barenstein & Pfister, 2019).

Regarding the state, the National Housing Law entailed the creation of the National Housing Department (DINAVI, Dirección Nacional de Vivienda) – today, one of the three main departments of the Ministry of Housing, Territorial Organization, and Environment (MVOTMA) (Nahoum, 2013a). DINAVI, supported by the National Housing Agency (ANV, Agencia Nacional de Vivienda), mainly oversees the granting of loans (which involves project analysis, budgets, credits, property, legal documentation, etc.) and the administrative follow-up once the loans are granted – all in all, ensuring the well-functioning of cooperatives and the complying of regulations in a number of different aspects, such as democratic decision making, financial transparency, detailed analysis of the projects proposed from technical, financial and legal points of view, regular meetings, elections, etc. (Nahoum, 2013b; Barenstein & Pfister, 2019).

When it comes to funding, government loans are provided in instalments on the basis of completion of building phases and only after a government inspection – with installments corresponding to the cost of constructing such particular elements of the buildings (Barenstein & Pfister, 2019). In other words, once the cooperative has built certain stages of the project, government technicians come to inspect such construction and check if it's according to the project presented by the IATs and the collective. Afterwards, the corresponding amount of the total loan is given – all of this done many times during the different phases of the construction process. Such procedure ensures the government that the cooperative will not mis-spend the money provided while demanding from cooperativists a high-level of organization, financial management and planning to ensure there will be enough cash-flow for the next construction stages.

When it comes to accessing plots, cooperatives dispose of different options: privately (very rare given the high-market prices), through a national government portfolio (Cartera de Inmuebles de Vivienda de Interés Social- CIVIS) and, if located in Montevideo, through the municipal portfolio of Montevideo (Cartera Municipal de Tierras para Vivienda en Montevideo - CMTV), which requires that CVAM are affiliated to FUCVAM. For being eligible for government funding, cooperatives must already have their plot with a preliminary architectural project already designed with the IAT of their choice.

In that way, the government portfolios "lend" the plots for cooperatives for the designing of such projects without requiring initial payment. Once the loans are granted, the national government directly pays the plots. Such arrangement greatly facilitates the access to land for cooperatives, especially given their limited economic capacity. Those plots also have a great relevance on the city's urban planning, since it determines where housing cooperatives will be established. Recently, given the large number of empty and decaying buildings in the center of Montevideo, housing cooperatives have engaged in the recycling of such buildings, prioritizing high-density constructions, closer to urban services and infrastructures. However, during many years, cooperatives have established in the outskirts of Montevideo, where land is much cheaper. In such cases, construction consisted mainly of one-two story dwellings – a type of construction that became characteristic of mutual-aid housing cooperatives (Barenstein & Pfister, 2019). In the figure below, it is possible to see the spatial distribution of FUCVAM's cooperatives in the capital, Montevideo – with hatched circles representing cooperatives in the process of construction, and black ones, cooperatives already inhabited. The variation in size of the circles represent the population size of cooperatives (quantity of members per cooperative). When comparing this map with figure 4, it is possible to see that most cooperatives were indeed established in peripheric zones.

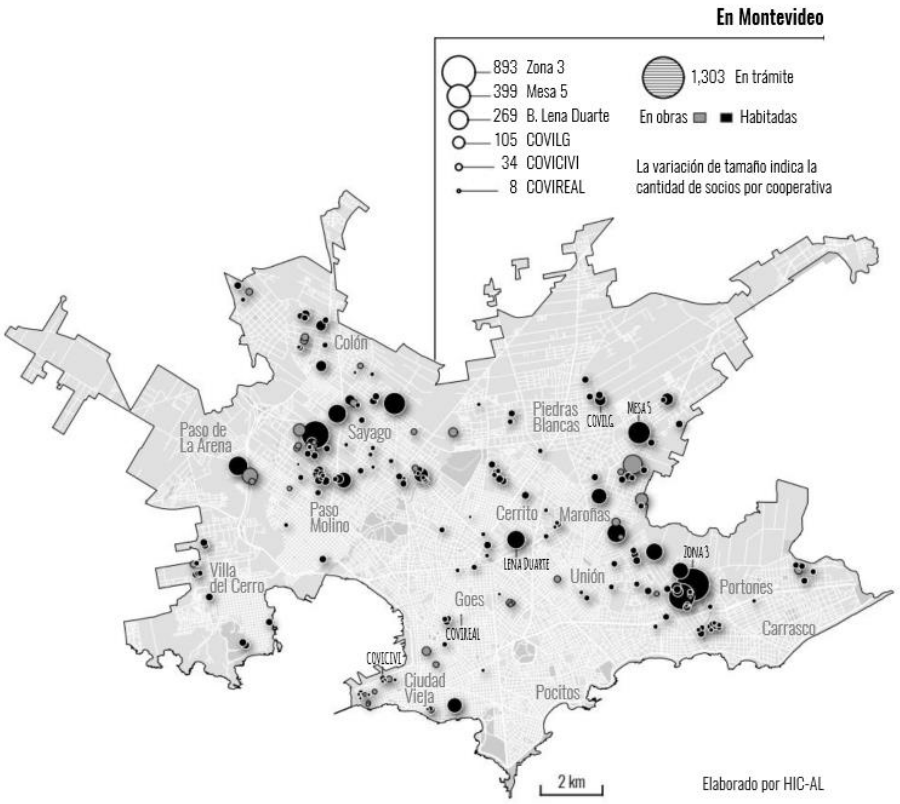


*Figure 5: Spatial distribution of FUCVAM's cooperatives in the capital, Montevideo. Retrieved from "Experiencia transformadoras de Producción Social del Hábitat en América Latina", p. 10, by HIC-AL 2016.*

Moreover, government funding imposes another series of restrictions and steps for mutual-aid housing cooperatives to follow, detailed in the next section. Among them, the state defines what income groups are entitled to financial, be Uruguayan citizens and permanent residents of the country, possess no other real estate property, etc. (Barenstein & Pfister, 2019). For cooperatives' architectural projects, there are limitation to the houses' square meters, quantity of dormitories, disposition of the collective spaces, quantity of housing units, etc. Moreover, housing cooperatives' statutes must be aligned with the regulations of the National Housing Law, even though there is a certain freedom to add specific guidelines to reflect their particular requirements (Barenstein & Pfister, 2019).

Before receiving the government loans, cooperatives must be legally registered, have a valid contract with an IAT of its choice, have received an initial capacitation by the IAT, possess a plot of land with a complete architectural project designed (including its connection to necessary infrastructure and services) and possess a permit of construction – all in all, such processes can take 5 years or more (Barenstein & Pfister, 2019).

Government loans are paid in 25 years counting from the end of the construction project, with an interest rate of 5%. For the families unable to repay their corresponding installment, a subsidy is provided to the cooperative by the National Housing Fund (Caballero, 2017). Recently, FUCVAM has been engaged in the fight for the decrease of such interest rate to 2% - which would certainly provide better conditions for cooperativists in the repayment of loans.

Finally, it is also important to highlight that the development of housing cooperatives have varied a lot throughout the years in accordance with government support (or lack thereof) – therefore stressing the importance of state support to the movement.

## 4.4 Mutual aid-housing cooperatives – from formation to conviviality

### 4.4.1 The basis

The CVAM model comprises four main bases which are indissociable of the movement: self-management, mutual-aid, collective property and direct democracy, all aligned with the seven principles of cooperativism (ENFORMA, 2020).

1. direct democracy implies that every member in mutual-aid housing cooperatives have one vote. As explained in FUCVAM (1999), direct democracy constitutes a fundamental element in the process of social transformation inherent to the cooperative movement. More than a decision-making process, "Direct Democracy is an awareness-raising exercise in which decisions must be taken at all times on the different problems that arise in the daily life of cooperatives" (FUCVAM, 1999).
2. self-management implies that the cooperativists are the protagonists, having the final say in all decisions from the formation of cooperatives to conviviality, from choosing technicians to paint colors, while being responsible for managing all processes inside cooperatives (DiPaula, 2008; Nahoum, 2013b). Moreover, as mentioned in Nahoum (2013b), "self-managing the entire process increases members' sense of belonging and commitment to the work that is being carried out" and "other cases of mass housing construction using mutual-aid but not self-management have produced significantly poorer results".
3. the collective property not only reinforces the group identity of the movement, but also ensures that all houses remain accessible to the most vulnerable sectors and are not subjected to the market forces. Most importantly, it allows the materialization of housing as a right and not as a commodity (Caballero, 2017).
4. mutual-aid consists on the amount of workforce invested by cooperativists themselves in the construction process, which allows for considerable costs reductions and, in turn, makes it possible for larger sectors of society to access decent housing (Di Paula, 2008; Nahoum, 2013b). However, mutual-aid goes much beyond an economic resource: it plays a profound social transformation and repercussions, creating "very important values of unity and solidarity within the collective, as well as the conviction that unified efforts make it possible to overcome otherwise insurmountable obstacles", as pointed out by Nahoum (2013b). Mutual-aid do not only happen during the construction process – in those cooperatives, everything is mutual-aid (ENFORMA – FUCVAM, 2016).

Mutual-aid housing cooperatives must be formed by different bodies, as the National Housing Law stipulates. Nahoum (2013a) provides a detailed description of those bodies and their corresponding functions: 1. General Assembly, which is the highest body in the Cooperative

and where all decision are taken regarding the cooperative's life; 2. Board of Directors, comprising the functions of President, Secretary and Treasurer, constituting the representative, managerial and executive body of the Cooperative; 3. Development Commission, in charge of the social relations and integration between members and the collective as well as between the cooperative and the local community; 4. Fiscal Commission, responsible for the financial and management aspects; and 5. the Electoral Commission, responsible for the election processes that take place in the cooperative life.

During the construction processes, the Board of Directors counts with two sub-commissions: 1. Work Commission, responsible for the organization and management of the mutual-aid workforce among cooperativists and 2. Construction commission, responsible for the organization and coordination of the construction work with the participation of the construction foremen and the lead architect from the IAT (Nahoum, 2013b).

### 4.4.2 Understanding the main processes and the choice of building materials in Mutual-Aid Housing Cooperatives [9,10]

The first step after a collective decided to form a cooperative is to draw up its statute and apply for its legal status with the assistance of a notary public. The statute must be approved by all members in the General Assembly.

With an IAT already elected by the cooperative, the collective must then register the housing coop in the Housing Ministry (MVOTMA) and require the Certificate of Regularity (Certificado de Regularidad). In this step, the cooperative must present a document containing the social details of the cooperative – that is, details concerning the family composition, occupation, etc., of each family in the cooperative. Moreover, it must also present an economic file, combining the social details with the economic situation of each family. Each year, the cooperative must re-submit such file. With the cooperative registered at MVOTMA, the collective will be provided with a chronogram containing the steps it has to follow in order to apply for government funding.

After registered, the cooperative must search for a plot of land through the options detailed in section 4.3.3. The plot must be subjected to a feasibility study in order to ensure that it complies with state regulations, that is, if it is not subjected to flooding nor contaminated, if it has access to water and electricity, what is the composition of the soil, etc.

After that, the designing of the architectural and construction project begins – a fundamental step of coordination between the cooperativists and the IAT's technical professionals. Such

[9] This section aims to summarize the main process undergone by mutual-aid housing cooperatives. It intends to provide the reader with a general view of the processes followed by cooperatives and, therefore, it is not exhaustive and has left aside many different details. For such details, look at https://www.anv.gub.uy/cooperativas

[10] This section is formulated based on various conversations with Fernando Zerboni – who has kindly provided me with hours of lessons on mutual-aid housing cooperatives in Uruguay. It also counts with important findings from interviews 6, 8 and 12.

preliminary architectural project contains the drawing of each housing and common spaces as well as the electric, sanitary and water systems. The project is, then, presented to the National Housing Agency (ANV, Agencia Nacional de Vivienda), which will evaluate if the project complies with the Ministry's regulations.

It is in during this process that the building materials are decided by the cooperative assisted by the IAT. If such materials are non-traditional, the IAT must present a series of other documents to ANV and follow several other requirements. For instance, if choosing to build with pre-fabricated elements (a non-traditional constructive system), ANV requires that a workshop is given to the cooperative by the IAT on the specificities of such non-conventional building material – its advantages, disadvantages, characteristics. The cooperative and the IAT must, then, present a document to ANV attesting that the cooperative has followed the workshop, evaluated different constructive systems, finally opting for the chosen one. Moreover, it is also required from non-traditional constructive systems (SCNT, Sistemas Constructivos No-Tradicionales) the presentation of the Document of Technical Aptitude (DAT, Documento de Aptitud Técnica).

As stated in MVOTMA (2020a), "For the inclusion of non-traditional technologies in housing construction, MVOTMA created a system of Technical Suitability that allows the development of evaluative, technical and administrative instruments for such non-traditional construction systems. The Document of Technical Suitability (DAT) which enables the proponent to offer its constructive system to the population with the aim of constructing projects through the financing programs implemented by the Ministry" (author's translation). A non-traditional constructive system passes through a series of evaluations (DINAVI – MVOTMA, 2019): first, by the Construction Institute of the Faculty of Architecture, which issues a Technical Evaluation Report (ITE, Informe Técnico de Evaluación); in the possession of the ITE, the procedures for request of the DAT before MVOTMA can begin. Once the solicitation is complete and equipped with all the required documents and specifications, it will then be evaluated by the Department of Construction Technologies in MVOTMA. It is important to highlight that such process does not have to be necessarily carried out by a housing cooperative – it can be done by private proponents or construction companies. More importantly, if a given non-traditional construction system do not possess an approved DAT, housing cooperatives cannot adopt it in the construction of its houses.

Going back to the main stages of a housing cooperative's life, once the preliminary architectural project is designed, it is submitted to the National Housing Agency, which will evaluate if it fulfills regulations and requirements. Afterwards, the housing cooperative is finally able to participate in the government lottery – finally having a chance to access government funding. Such lottery happens two times per year, and the available loans are assigned to the winners. Housing cooperatives can participate in those lotteries for a maximum of three times – after which the loan is automatically allocated (Barenstein & Pfister, 2019). As specified before, government loans cover for the 85% of the total cost of the project – the other 15% is allocated by mutual-aid housing cooperatives though their workforce.

Equipped with a loan, housing cooperatives have three months to present the executive project – the definitive one. The construction process can, then, finally begin. Each member

in the cooperate will work around 21 hours per week in the construction site, transforming their workforce into equity equivalent to 15% of the total project cost (Barenstein & Pfister, 2019).

The construction of a housing complex can take around 2 years (Barenstein & Pfister, 2019). During such period, government technicians and professionals make several visits to the construction site to verify and approve the construction – after which, the cooperative receive the corresponding loan installment, as mentioned before. At the very end, the government technical team assures the construction followed what was designed and planned.

It is important to highlight that due to the long process and bureaucratic procedures, some of the members can eventually drop out of the collective – giving place to new members in the cooperative. It is, therefore, of utmost important that continuous training and capacitation is given both in the social and technical spheres, through the IAT and FUCVAM.

Once the construction is finished, it begins the process of conviviality and the loan repayment processes. The monthly installments are calculated and allocated among families. If some families are not able to pay for their respective shares, the cooperative can further request subsidies from the government. Moreover, after the construction is finished, it is of utmost importance that the members continue practicing the cooperative principles through its activities, general assemblies, and integration with the community. The values of solidarity and community must be continuously reinforced in the collective, implementing and practices the ideals of cooperativism. As stated on ENFORMA-FUCVAM (2018):

*In housing cooperatives, more than in any other form of cooperativism, the role of the social group, the role of community is fundamental. Remember that it is not the case that the member spends some hours in the cooperative and then she or he leaves for her/his private life. He/she lives in the cooperative with his/her family and is permanently in it and leaves it to carry out personal tasks: work, study, sport, etc. (…) One always returns to the collective. (author's translation)*

# Chapter 5 – Earth architecture and Mutual-Aid Housing Cooperatives: interlinkages or incompatibilities?

## 5.1 Uruguayan earth dwellings: a dynamic journey from refusal to acceptance

Earth architecture in Uruguay has had several different phases, but it is difficult to establish a detailed and complete chronogram-like trajectory given the important lack of literature in such topic for Uruguay. Based on the interview's findings, however, it is clear that the construction of earth dwellings under different circumstances greatly influenced society's perception and adoption of such construction mode. Therefore, this section is mainly structured based on such interview's findings.

According to one interviewee, unlike other Latin-American countries, the native people in Uruguay did not have a tradition of constructing with earth since they were mainly nomads. Therefore, their housing was transitory and there was not the necessity of settling down and building with more durable materials. However, after the Spanish and Portuguese conquest, there was the introduction of earth construction techniques, such as adobe. Meanwhile, other activities began taking place, such as agriculture, cattle raising, etc. – which demanded the construction of settlements for larger periods of occupation. For that, the use of local materials – such as stone, wood, earth – began taking place, giving start to the constructive tradition and traditional construction knowledge in Uruguay. Indeed, it is mentioned in Del Pino & Estramil (2014) that earth architecture techniques were "introduced by Spanish and Portuguese immigrants and adapted to the local conditions by the criollo" (author's translation). Today, most of those traditional constructions were already replaced by modern buildings, especially in the cities. However, the tradition of building with earth lasted longer in Uruguayan countryside but has been greatly lost with the advent of industrialized constructive systems in the middle of XX century.

In Uruguay, a government program called "Movement for the Eradication of Unhealthy Rural Housing" (MEVIR, Movimiento para la Erradicación de la Vivienda Insalubre Rural) was created in 1967 to respond to the precarious housing conditions in rural Uruguay, operating consistently until today (Couriel & Menéndez, 2014). According to Couriel & Menéndez (2014), the agriculture modernization and industrialization, dating back to the XIX century, has led to a great decrease in employment in the rural area. Consequently, the farms have stopped housing their rural workers and their families, which had been the case until then (Couriel & Menéndez, 2014). Regular work became temporary work, and those displaced from the farms began constructing their settlements (hereafter, *ranchos*) in marginalized spaces (Couriel & Menéndez, 2014). The *ranchos* were very precarious dwellings and counted with several health and hygienic problems, especially in zones with the presence of *vinchucas* – insect that transmits the Chagas disease (Couriel & Menéndez, 2014). Isolated from decent infrastructure and public services, the *ranchos* were constructed with locally available materials – such as earth, cane, straw, etc. – and were built with a simple internal organization, counting with one or two different living spaces and without proper ventilation nor sanitation (Couriel & Menéndez, 2014).

Created to respond such rural precarity, MEVIR articulates in three areas as described in Couriel & Menéndez (2014): 1. building of housing complexes in rural areas; 2. building of housing complexes in villages and small cities of the countryside; 3. since 1990s, implements productive units in rural areas across all country.

Many different interviews have cited MEVIR and its eradication of earth dwellings and the consequent association by general society of such buildings with precarious and unhealthy housing, especially linking it to the Chagas disease. It was mentioned that earth architecture started being linked to the idea of *ranchos*, with such prejudice preventing the adoption of earth architecture until very recently.

> At the time, [earth dwellings] were associated with something of poor quality, very linked to certain traditional construction practices mostly developed at the rural level, which at a given moment were

> subjected to eradication, so to speak. There is a very large history to tell - but here in Uruguay there is a history linked to the *vinchuca*, which was greatly combated, and gave place to a Movement for the Eradication of Unhealthy Rural Housing – which had this vision that certain constructive practices were not suitable for development (Gerardo Sarachu, interview 5, author's translation)

The association between *ranchos* and *vinchucas* should not be necessarily linked to the material, but, instead, to the social and economic conditions that permeated rural Uruguay at such time. As Rosario Etchebarne states "(…) it was not the fault of the *ranchito* but rather the poverty of that person" (interview 2, author's translation).

Even with such prejudices, earth architecture re-emerged in Uruguay in the 1980s, influenced by the European trends of revisiting and rethinking such architecture while making important improvements to its structure (Del Pino & Estramil, 2014). According to Del Pino & Estramil (2014), during this period, individual houses were built in Uruguay using earth architecture techniques with the assistance of architects. Such experiences might be perceived with the intention to revive the image of rural housing but with important improvements in design and construction (Del Pino & Estramil, 2014).

At the end of the dictatorship, many Uruguayans who were previously in exile returned to Uruguay. In such return, they have brought with them different forms of production, organization and ways of life which were not the norm in Uruguay (Del Pino & Estramil, 2014). It was with this premise that, based on counter-culture values, one of the main pioneers in earth architecture and bioconstruction was established in 1990: *Comunidad del Sur* (Del Pino & Estramil, 2014). Consisting of an ecovillage in the outskirts of Montevideo, such collective has used earth construction techniques in the building of houses and a communal hall as well as developed practices in permaculture, raising an important debate and awareness around the environmental issue (Del Pino & Estramil, 2014). Interestingly, such constructions were done by the collective itself, through mutual-aid and assisted self-help. *Comunidad del Sur* has also played an important role in disseminating the experience as well as in education and training in bioconstruction (Del Pino & Estramil, 2014).

Similar experiences have emerged and counted with the participation of foreign architects, such as Heiner Peters and Gernot Minke (Del Pino & Estramil, 2014). In fact, several interviews pointed that earth architecture is nowadays greatly linked to ecological groups with a high awareness on environmental questions and living outside big city centers.

Other important projects using earth architecture and involving university extensions programs and/or government support were: 1. Rehabilitation of *La Tablada* neighborhood in Salto; 2. Hornero project in Progreso; 3. Terra Uruguay project in Artigas, Rivera and Montevideo, 4. Participative construction of a kindergarten in a Child and Family Care Center (CAIF) in Montevideo (Del Pino & Estramil, 2014).

Moreover, there is also an increasing demand by the middle- and high-income sectors for houses at the ocean coast. In fact, several interviews pointed that earth architecture is highly associated with higher-income sectors, which, motivated by an increased environmental awareness, choose to construct their private houses with earth. When comparing the number of projects, two interviews pointed that earth construction has been more adopted by higher

income classes than as a solution for popular housing. However, one interview (interview 1, Alejandro Ferreiro) mentioned that earth architecture was not associated to any particular group in Uruguay and examples of its use could be found in different sectors regardless of their economic level. Such point-of-view could be explained by the vast and more recent experience of Alejandro Ferreiro, part of the new generation of architects specialized in the use of earth, having graduated at 2005. Alejandro Ferreiro, besides being an active professor at the University, develops several projects as a private architect and has written a book which encompasses modern examples of the use of earth architecture in Uruguay – therefore, having a very complete view of earth architecture in today's Uruguay.

All in all, according to five interviews, earth architecture has been growing in numbers and there are much more references of families adopting such construction mode nowadays. However, it is important to point out that such view is shared mainly among interviewees who work with earth architecture (interviewees 1, 2, 9) or live in an earth dwelling (interviewee 14) – which can indicate a bias.

Moreover, the construction of earth houses in Uruguay is authorized and houses built with earth do obtain a construction permit from the government (interview 1, 2, 9). However, there is no official normative or manual for earth architecture. In the literature, Zami (2010) points that "setting earth building codes and standard" is an important driver for the uptake of stabilized earth construction in urban low-cost housing. Additionally, Niroumound et al. (2013b) also states that a government regulation and a government rating system are drivers for the uptake of earth architecture. Regarding the importance of regulations and manuals, a very interesting finding came out of interviews 1 and 2:

> I believe that, for the moment, [not having an official earth architecture manual] is an advantage, in part. Because, for me, it allows working with more freedom or flexibility. Perhaps if there are specification that say, well "the walls have to be like that, with such width, with such material…", perhaps the possibilities start to narrow down a bit. For the moment, I believe that not having a specific regulation can give place to a certain flexibility. But it would be also good to have a certain control as to avoid some things being in a way that, maybe, go against the good dissemination of practices (…) (Alejandro Ferreiro, interview 1, author's translation)

> (…) Sometimes I say, luckily the state does not support it, because, if it did, perhaps it starts imposing limitations and so on. The great majority of houses that are being built with earth is legal. It means, a building permit is presented. And, here in Uruguay, earth dwellings are approved. In other countries where there are earthquakes, well, more things are required. (…) I tell you, those 70 houses we have built are all with approved building permit – and well, this is exciting, no? (…) (Rosario Etchebarne, interview 2, author's translation)

Therefore, even if official regulations/manuals/standards can be regarded with importance in the literature for the development of earth architecture, architects specialized in such construction mode in Uruguay point that limitations on their practice might arise with government regulations and manuals.

On the next sections, however, the main barriers pointed by interviews are analyzed and, among them, comes out the importance of officially registering such construction practices while proving that earth can comply with government regulations on social housing.

## 5.2 Perceptions, main barriers and limitations: a bumpy and winding road for earth architecture in mutual-aid housing cooperatives

The next sections aim to expose and discuss the main barriers and perceptions that came out during the 14 interviews developed with the main urban actors involved in cooperative housing in Uruguay as well as with experts in earth architecture. It is important, however, to not see each of those following sections as independent barriers as they are all interlinked and mutually influence the development of earth construction techniques in mutual-aid housing cooperatives. One is not consequence of the other – all are linked and mutually reinforcing.

### 5.2.1 The cultural barrier: from prejudices to traditions

Described in the previous section, the government program MEVIR, the combat to the unhealthy rural housing in Uruguay and the association of the *vinchuca,* transmitter of the Chagas disease, to earth dwellings have contributed to the links made by general population between earth architecture and poverty. Such perception is shared among several interviewees, who pointed the existence of a cultural barrier in Uruguay, in which many people associate earth dwellings with poor settlements, with the *rancho* house.

> The first barrier [to a wider use of earth architecture in Uruguay] is the cultural one. People have imprinted in their experience that the *rancho* – which was a historical traditional construction in Uruguay – is the house of the poor (Diana Spatakis, interview 3, author's translation).

Such association is not exclusive of Uruguay – even though its particular history and unique circumstances have shaped this perception in Uruguayan society. As pointed by Schroeder (2016), the advent of industrialized construction materials together with the loss of traditional construction knowledge have contributed to an important loss of expertise in earth architecture and the emergence of prejudice and misconceptions. In Uruguay, for example, part of the solution against precarity at the rural level was reallocating families who lived in *ranchos* to housing complexes built with conventional materials. Such practice, which had important social implications on the dynamics of rural areas, might have as well contributed to the association of "better life conditions" with houses built with cement, bricks and other industrialized materials.

In line with that, there is an important belief that decent housing is the one built with conventional materials, such as cement, concrete, bricks, etc. As several interviews indicated, the parameter of "decent housing" is associated with "hard" construction materials, which may also explain the resistance towards earth architecture and the use of other non-traditional construction materials. Indeed, in one interview to *Revista Vivienda Popular*, the former Minister of Housing, the architect Frascisco Beltrame, highlights: "(…) there are a number of things that have been put aside given the imposition of cultural patterns that have

won us over, and that lead to the fact that if we do not see pillars and beams and concrete, it is no longer useful (…)" (Beltrame, 2013) (author's translation).

Tradition plays an even bigger role in mutual-aid housing cooperatives. Bricks have a long tradition of use in mutual-aid housing cooperatives: it is very well-regarded for its quality, long-durability and low-maintenance properties. Therefore, one to two-story housing complexes built with bricks and other conventional materials have become a characteristic of mutual-aid housing cooperatives – a model desired by many. As Patricia Petit (interview 7) resumes:

> Competing against our bricks is not easy, because the brick has shown that it works well, it is very economically feasible, it doesn't require much maintenance, it can be found all over the country, it adapts well to our climate… They say: "why should I choose something else if I have this?" (…) If I offer you something, it has to compete with other things that are already in place. (Patricia Petit, interview 7, author's translation)

Furthermore, the fact that many interviewees pointed the adoption of earth architecture by more pungent sectors in society as well as by ecological groups with a high awareness on environmental questions, living outside big city center, also indicates a fragmentation in the use of earth architecture by very particular groups. Marginalizing and labelling earth architecture – either associating it with poverty, with "hippie" communities or with richer sectors – clearly indicates a cultural barrier, more related to stereotypes than to the proper limitations of the material. However, a common characteristic pointed to all groups which currently construct with earth is the environmental awareness and the willingness to live more sustainably.

Moreover, such stereotypes might also have their roots on another pillar: lack of awareness and knowledge around the properties of earth as a building material. As pointed out by Gerardo Sarachu (interview 5), such lack of awareness and knowledge is indeed another barrier towards the adoption of earth architecture – topic to be discussed in the next section.

> (…) given the type of sector which has been constructing with these technologies, it is also associated with something more expensive, more elitist, more fashionable. Perhaps the cultural resistance nowadays is associated with this sector – which used to be more "ah, this is a house of the poor, of peasants". But nowadays, it seems to me that the resistance is another one, more towards "will this effectively work?", "won't this complicate our lives?". In this case, there are more doubts related to the complexities of working with such technologies than related to the prejudices, which at some other moment were more present (Gerardo Sarachu, interview 5, author's translation)

### 5.2.2 The awareness barrier: misconceptions around earth architecture

The perception presented in the previous quote is also shared among several other interviewees:

> I believe that not valuing earth dwellings has to do with a lack of awareness, not knowing about this material. (…) I believe there is a lack of awareness on what the material is, on the advantages of this material, on the economic savings but also on everything that has to do with climate, heat, thermic

> isolation, the possibility of avoiding not only economic costs but also technical costs (Isabel Zerboni, interview 8, author's translation)

As an evident example mentioned before, the association of the *vinchuca* with earth dwellings clearly represents an important misconception of such building materials and its properties by general society. To demystify such belief, Mazzeo et al. (2007) and Del Pino & Estramil (2014) cite an article on Chagas' disease published in the *Vivienda Popular* magazine, based on a research carried out in Paraguay[11]: the article indicated that the appearance of *vinchucas* is associated with poor ventilated and poor illuminated rooms - creating a warm, dark and humid environment propitious to *vincuchas* – as well as to poor terminations of walls, such as the lack of plaster, cracks, which can accommodate the insects, and lack of paint, which makes the visualization of bugs more difficult. Therefore, the origin of such problem is not on the building material as it is commonly thought – instead, as a solution, it is recommended the plastering of walls, bright painted walls and openings that allow a good ventilation and lightening and not the change of building materials (Mazzeo et al., 2007; Del Pino & Estramil, 2014).

Therefore, it is possible to say that the *vinchuca* problem was more associated with the poverty experienced by families who did not have enough resources or technical assistance to build their houses. Blaming earth as the building material, thus, highlights a misconception and lack of awareness by general society on the properties of earth.

Such lack of awareness and education is presented in the literature as one of the main barriers for the development and adoption of earth architecture (Niroumound et al., 2013b). Accordingly, Niroumound et al. (2013b) proposes an increased education as a driver to earth architecture. Similarly, many interviews suggested that the dissemination of work and examples of earth architecture could help strengthening its use across society and in housing cooperatives. For instance, when asked how it would be possible to stimulate the uptake of earth architecture in housing cooperatives, Rosario Etchebarne responded:

> Well, you have to generate a process of going to give talks, that they can visit different earth dwellings (…). The process must be started. In general, the process begins and it goes by looking, going to earth dwellings, inviting people to come and show pictures of earth dwellings, do workshops – it can be demonstrative workshops of two days, right. (Rosario Etchebarne, interview 2, author's translation)

Indeed, Zami (2010) mentions the promotion through public media as the most important potential driver for the adoption of stabilized earth construction in urban low-cost housing, which indicates the importance of bringing awareness and closing the information gap around this type of construction. Zami (2010) also mentions the importance of organizing conferences, publishing books and articles.

Even so, the great majority of interviewees on this research have shown knowledge and awareness on the advantages and characteristics of earth architecture, as demonstrated below. All the following points were mentioned as advantages of earth as a building material

[11] The article's title was "El mejoramiento del hábitat como vía de control de la enfermedad de Chagas" in the Revista Vivienda Popular Nº 4.

in Minke, G. (2006), a prestigious book of earth architecture (with exception of point 6, given it's not related to the physical characteristics of such material).

1. Thermal capacity of earth, which maintains houses warm during winter and cool during summer. Cited in interviews 1, 2, 3, 4, 5, 6, 8, 9, 10, 14.
2. The fact that earth consists of a natural and local material. Cited in interviews 1, 2, 3, 5, 8, 9, 10, 12, 13, 14.
3. It is a material highly compatible with self-building processes, given it's a "live" material that allows for experimentations and reuse, and the technique can be easily appropriated. Cited in interviews 1, 2, 6, 7, 10, 12, 13, 14.
4. It regulates humidity, which is a very important feature given the high humidity levels in Uruguay. Cited in interviews 1, 2, 3, 6, 9, 10, 14.
5. It is a low-cost material[12]. Cited in interviews 2, 8, 10, 14.
6. It implies on a recover of traditional knowledge. Cited in interview 12.

Moreover, awareness of the advantages and characteristics of earth architecture at the professional level in Uruguayan institutions is equally important for its development – thematic addressed in the next session.

### 5.2.3 The Know-how barrier: Lack of capacitated professionals and institutional systematic experiences

Since the uptake of industrialized building materials, not only construction components have changed but also the way humans relate to and build their own houses (alternatively, on the industrial era, do *not* build their *own* houses). Indeed, such revolution allied to the emergence of powerful construction companies have changed the way humans acquire their housing and the techniques applied by construction professionals.

Dethier (2020) when referring to the loss of traditional knowledge on earth architecture and the absence of such techniques in the majority of recent books of architecture, uses a very interesting term: a cultural amnesia. In his words, such "dearth of information is the result of a sustained and profound crisis of cultural amnesia".

The lack of expertise in building with earth and absence of construction professionals with know-how on earth architecture can be seen as some of the main barriers to the uptake of earth as a building material, as pointed out by Niroumound et al. (2013b). Indeed, different interviewees mentioned the lack of technical knowledge on earth architecture in construction professionals, such as masons, foremen and architects. In addition to that, several

[12] There is a discrepancy when it comes to price-advantages of earth architecture. While some authors state that the use of earth implies on cheaper costs (Minke, 2006; Sameh, 2014), others affirm that the cost is dependent on a number of variables, such as the availability of materials in situ, the chosen technique, labor costs, etc. (Mazzeo et al., 2007; Pacheco-Torgal & Jalali, 2011). Such discrepancy was observed in this research: interview 1 points that the costs can vary according to different variables and the economic difference might, in some cases, not be as big as expected by common imaginary, even if earth architecture is usually cheaper; on the other hand, interviews 2, 8, 10 and 14 indicate that earth is a low-cost material.

interviewees also declared that technical professionals at IATs do not have the expertise on how to work/build with earth architecture. Raúl Vallés (interview 6) cited such barrier in the implementation of earth architecture in mutual-aid housing cooperatives:

> (…) They (cooperativists and technical professionals) have a very large experience with traditional materials, of traditional construction. Therefore, perhaps one barrier is to incorporate – a process of incorporating in the construction personnel, people themselves, and technicians, the efficient management of an earth constructive system. And while this does not happen, while this is not the case, it can be an important barrier. One can have the intention and propose to develop a way on that side, but it turns out that the only person who knows about it, is the architect. The foreman doesn't know about it, the users don't know about it either – and might even distrust the system as well… Therefore, all the chain is, somehow, if you like, a bit on the outside and that can be a barrier (…) (Raúl Vallés, interview 6, author's translation)

However, Kareen Herzfeld (interview 9), mentioned that there is a great number of very-well capacitated personnel trained in bioconstruction in Uruguay. Such contrasting perception might come from the fact that Kareen herself provides a great number of workshops and trainings, which are very well attended, besides of being very active in the bioconstruction arena, aware of the innumerous trainings and activities also developed by her colleagues. Moreover, it is likely that other interviewees are referring to the lack of training and capacitation inside formal institutions and not those given independently as well as to professionals directly working with earth architecture in the market. Indeed, those formed on independent bioconstruction workshops might not necessarily work with it or be construction professionals. Yet, Kareen acknowledges that the architects capacitated in bioconstruction might not have the profile to work on an IAT, given the many bureaucracies involved in such and the high economic investment one must make to formally found an IAT. Such discrepancy is evidence of the problematic around the incorporation of earth architecture by formal institutions even though there can be a great interest on earth architecture by some sectors of civil society.

Indeed, a simple search on Facebook shows a variety of different groups and pages promoting workshops in bioconstruction and sharing experiences (Bioconstrucción Uruguay, n.d.; Bioconstrucción Comunitaria Uruguay, n.d.; Construcciones ecológicas Uruguay, n.d.). For instance, the Facebook page Bioconstrucción Uruguay (n.d.) is actively sharing different workshops on bioconstruction, which address a wide range of topics, including techniques to construct with earth, ecological sanitation, techniques of plastering, green roofs, vermicompost, etc. Only in 2020, an atypical pandemic year, the page has advertised around 14 different workshops and activities on bioconstruction, highlighting the dynamism and interest on such topic. Even if those different trainings and experiences might not come from formal institutions, such as university and government programs, it does show a movement and appropriation of earth constructive techniques by certain groups of civil society.

Based on the majority of interviews and literature, it becomes evident the importance of training and formation for the better development of earth architecture in Uruguay. Indeed, such aspect is mentioned in several interviews which cite the importance of formation and training in earth architecture in educational institutions. According to those, universities and other training centers should include techniques on earth construction in their courses. As a

matter of fact, according to Zamil (2010) organizing training for the stakeholders and introducing earth architecture in university degree programs can be main drivers for the appropriation of such architecture.

While some interviews agreed that University can play an important role in the uptake of earth architecture in Uruguay, through capacitation and/or research, other interviewees pointed that the University role in the promotion of earth architecture has been so far either punctual, marginal or inexistent. On the other hand, regarding students and graduates' demand, there is a positive indication that earth architecture is a topic of interest: interviews 1 and 7 mentioned that the optative course given at the University of the Republic on earth architecture is very well attended and attracts many participants. The apparent high-number of bioconstruction workshops also reveal an interest by some publics of civil society – which could be further explored by universities if intending to further promote earth architecture.

Nonetheless, even if the movement has had important examples and initiatives, they have remained very marginal and punctual and/or were not incorporated by institutions as discussed previously – a point of view shared even among some professionals working with earth architecture. For a significant uptake of earth architecture, it is necessary a systematization of experiences and the incorporation of earth as a building material at the institutional level. As Alejandro Ferreiro highlights when asked about drivers of earth architecture:

> I believe that dissemination and making sure that those topics permeate the institutions – but at the institutional level and not at the level of people who work for those institutions. I mean, for instance, at University, in the first years when work on this topic had started, it was carried out by a team of architects who worked on the north region, in Salto. But, once those people either retired or moved, there was no continuity. Because, partially, even though it was an institutional project, it was sustained by those people. (…) That is, if those concepts, those ideas, are not incorporated at the level of institutions, once the people who have the leadership are gone, they are lost (…) (Alejandro Ferreiro, interview 1, author's translation)

Rosario Etchebarne also highlights that such construction mode has not yet permeated institutions. When asked if government regulations could facilitate the uptake of earth architecture, she says:

> (…) We have worked with adobe in the city of Salto. It was 10 houses financed by the Housing Ministry. And those houses are spectacular. All with the university thinking this would be the beginning of an institutional path. The institution hasn't taken it – but so did the people – and that is what matters the most to me. (…) (Rosario Etchebarne, interview 2, author's translation)

Therefore, generating more systematized experiences and institutional projects on earth architecture might also produce a greater accumulation of knowledge and facilitate that such architecture permeates society, beyond certain groups, demystifying misconceptions and prejudices, as discussed on previous sections. However, generating more experiences on earth might come with restrictions on the locality of projects, which is the discussion of the next session.

> (…) the clients who have come to our studio are people who already have followed a cultural path, independently of having money or not. In general, they might have money, but they have already chosen a culture that prioritizes the ecological, the care for the environment, and already know what it

> is an earth dwelling (…) In general, there are prejudices even from the higher institutionalized people, and the people who approach earth dwellings is because they are already on a cultural path, because they no longer want to live in a city (…) (Rosario Etchebarne, interview 2, author's translation)

### 5.2.4 The geographical barrier: the (in)compatibility of urban centers and densification with earth architecture

Mazzeo et al. (2007) highlights an important view shared among some interviewees:

*"(…) We understand that architecture provides specific solutions to specific problems. In the environment of the rural area of the Experimental Station (where it is located the prototype of Proyecto Hornero) the idea of constructing with earth is accepted, but that doesn't mean that in all places this same idea will be accepted. We understand that for every situation there is a solution. We do not defend that everything has to be with earth nor that it should not exist. If in the city one wanted to do something but had to spend a lot on transporting earth or wood, it would certainly cease being sustainable even if earth is being used (…)"*, pp. 29, author's translation

Indeed, the research findings indicate that building with earth in city centers is seen with doubts by several different interviewees, especially in the framework of public policies. Consequently, the fact that many housing cooperatives are located at (or nearby) urban centers can be seen as a constraint for the adoption of earth architecture by those collectives.

At the framework of public policies and the access to city services, housing cooperatives have traditionally been established at the peripheries due to cheaper prices of land, which difficulted their access to infrastructure and services (Barenstein & Pfister, 2019). On the other hand, expanding public networks and infrastructure poses a great burden on government budgets and densifying the urban center became an essential strategy – also to assure the right to the city for more segments of population. Therefore, more and more, housing cooperatives are given land at the city centers, which implies on constructing multi-storey buildings, as well as engaging on the rehabilitation of the abandoned housing stock in the city center.

> (…) There is the matter of constructing multi-storey buildings, the type of plots cooperative access… In this case, there is a double movement: on one side, in the past cooperatives used to be formed on the outskirts of the cities where larger plots were available. But, then, all the city services had to be taken towards them. Afterwards, FUCVAM itself began demanding plots in central locations, where they could have all the services. And for the urban development it also became key to densify the central areas and not to continue extending the city to the periphery. And well, bioconstruction at height has other complexities… In this case, there is another obstacle that is more structural, let's say, that has to do with the plot, the type of access to the plot, and where these experiences can work better (…) (Gerardo Serachu, interview 5, author's translation)

According to the findings, the experiences on earth architecture in Uruguay seem to be mostly outside urban centers and consisting of individual houses. There was no mention to multi-

storey buildings made with earth in Uruguay, which leads to the believe that most expertise developed in the country on earth architecture does not comprise the construction of multi-storey buildings. In order to check such hypothesis, emails were sent to interviewees specialized on earth architecture in Uruguay, which confirmed that most houses built with earth are not located at urban centers and do not have more than 2 levels.

On the other hand, there is a clear priority on government public policies to work on the densification of urban centers, which can indeed pose challenges for the adoption of earth architecture in government programs, given the competitiveness and tradition of conventional materials in Uruguay. In an interview given to Revista Dinámica (2016), Salvador Schelotto, former National Director of Housing, affirms the importance of densification in urban centers and states that, given the lack of plots, there is a greater openness at the national level for projects which imply on higher densities.

Additionally, Rodrigo (2015) highlights the importance of projects that reinforce urban centrality while citing its many different positive outcomes. Such zones count with several advantages – services, infrastructure, landscape quality, historical memory – which make them appropriate for housing programs (Rodrigo, 2015). Working on urban centrality also implies on a rehabilitation and revitalization of depreciated zones while promoting important economic savings for the city and contributing to diversified neighborhoods (Rodrigo, 2015). Therefore, housing cooperatives play an important role on such process.

Interestingly, Rodrigo (1015) makes a pertinent remark for this research: “It is also necessary to review and consequently adapt or adopt constructive systems [(5)] relevant to these types of programs, to those locations and in line with a coherent economic-financial projection. They should be able to minimize the costs of workforce and inputs, the implementation, the adequacy to the site and must harmonize with the possibility of real contribution from mutual-aid, mostly unskilled and with understandably low performance for several factors”. On note (5), Rodrigo (2015) adds that technological offers should be systematic evaluated according to economy, speed and simplicity.

At this research, while recognizing the potential of earth architecture techniques for housing coops, an interview raised the importance of not obstructing the process of urban centrality neither in time nor in costs, highlighting that the use of the most appropriate technology must be made on those cases in order to ensure that the main problem of access to the city is solved.

> (…) In the world, the most important problems of housing deficit and habitability deficit are fundamentally an urban deficit. (…) In this case, the techniques to solve such problem must as well be the most adequate. Dwellings with higher-levels, dwellings on dense plots, etc., are the ones, in theory, which must provide the answer for a city that is accessible to all. And I separate this from the somewhat idyllic vision of housing and ‘rurourbanity’, and housing in the most remote areas, more related to the land, more related to nature. Because, in reality, we are talking about a population that needs easy accessibility to urban services and not an expensive accessibility, not an accessibility that requires travelling long distances to connect with the services that the inhabitants need (…). But, undoubtedly,

> there are very important experiences at the international level of dense constructions with this technology. There are also very interesting experiences using wood and with important or average densities, at least. In a way that – and here we enter in a field I do not know – if those things can be solved somehow with a certain competitivity… because we need to solve a problem, we cannot somehow make this process unfeasible neither in time nor in cost. To me [earth architecture] looks very interesting, it can really be applied, it is really interesting that a group can collectively appropriate, but all this has to be put into perspective in the framework of answering housing public policies (…) (Raúl Vallés, interview 6, author's translation)

### 5.2.5 The institutional barrier: norms and restrictions on government loans

One of the main pillars of housing cooperativism in Uruguay is government support, as discussed on section 4.3.3. As Nahoum (2013a) brilliantly puts:

*"Without the participation of the state, how would it be possible in our countries for a family that earns minimum wage or a little more to pay for a house that costs the equivalent of 10 or 15 years of that family's income? How would that family have access to land, which is controlled by such a very small number of individuals, who wait for land values to rise before they sell? It cannot be done without the participation of the state."*

For housing cooperatives, the access to government loans is essential and the success of cooperativism depends on continuous state investment. In order to be eligible for such loans, housing cooperatives must follow a series of different government regulations, comprising not only guidelines around their social and economic characteristics, but also on the architectonical project they develop. According to the research findings, it is precisely the latter that can hinder the uptake of earth architecture in such collectives.

By reading the Subsidy and Product Regulation (Reglamento de Subsidio y de Producto), one can clearly grasp the number of guidelines houses financed by the MVOTMA must follow. Such guidelines aim to ensure that the product coming from those projects comprise with the quality standards imposed by the government. For instance, the regulation establishes minimum conditions of comfort, such as acoustic isolation, exposure to sun light, ventilation and illumination, electrical power and so on. For housing cooperatives, the National Housing Agency also imposes regulations on the number and allocation of dormitories, for example. Moreover, the National Housing Law itself has a chapter comprising minimum housing requirements that all houses must comply with.

On one hand, those requirements ensure the quality of houses built through government programs. On the other hand, if excessive, they can limit experimentation and innovation and increase bureaucracy.

> Many limitations are imposed [in government loans]: of square meters, quantity of dormitories, dispositions of the collective space… That is, many are the limitations imposed [by government loans]. Quantity of units, there can't be done more than 50 nor less than 10… I mean, there is a set of limitations to grant the loans. (Isabel Zerboni, interview 8, author's translation)

Evidently, the use of non-traditional materials in government financed constructions comes with a series of additional requirements on top of those already demanded. In 2011, MVOTMA implemented a new regulation to include innovative technologies on the construction of houses through the use of non-traditional components or constructive systems (MVOTMA, 2011). In short, to use non-traditional technologies the presentation of the Document of Technical Suitability (DAT) is required – process presented and explained in section 4.4.2. According to many interviewees, the requirement to present such document can be an obstacle for the adoption of earth architecture, especially given that such technology does not possess a DAT currently.

> Non-traditional constructive systems require a technical study made by the Faculty of Architecture together with the Ministry of Housing, which certifies the use of a non-traditional technology. On earth there is currently no constructive system presented. (...) Surely, if there was, there would be other experiences that would have been developed. (…) (Gustavo Machado, interview 12, author's translation)

Therefore, earth architecture is not a recognized and approved technique/material in the framework of projects who can compete for public financing: to access government loans, the constructive system must be recognized and approved, which prohibits housing cooperatives to implement earth architecture currently. One cooperativist interviewed, currently in the process of construction, affirms that earth architecture was not considered as a possibility given its lack of approval by the government:

> To the extent that you propose to build a cooperative through the Ministry, you know that there are certain constructive systems (...) approved and then nothing else. That is, there is no alternative approved by the ministry for adobe, nor for wood. (…) So, well, it wasn't on the table in large part because of that (Isabel Zerboni, interview 8, author's translation)

However, the process for generating a DAT can be complex and time-consuming, involving a number of different experts and evaluations. It is unlikely that such process would be carried out by a housing cooperative – especially given the many other complexities cooperativists are already facing in their fight for decent housing. Indeed, the majority of DATs currently valid comes from formal enterprises (MVOTMA, 2020a). Choosing to build with alternative materials in the framework of government programs can then be a very long and bureaucratic process, as corroborated by some interviewees.

> (…) It (the process for obtaining a DAT) does not necessarily have to be done by a cooperative, it can be done by a particular and the cooperative can be a 'permitted' figure, let's say – in the sense that the emissary is the one who has the DAT, authorizing it to build with the system. This is very complex because there are variants to the constructive systems. A construction system with earth also has its variants. Rammed earth, adobe, and this and that... And for each one a DAT should be instrumented, because they have different characteristics, they allow to do different things (…) (Raúl Vallés, interview 6, author's translation)

It is also important to highlight that the Ministry, through the acceptance of alternative technologies, aims to improve access to decent housing and facilitate technological innovation in the construction of social housing (Cancela & Ricceto, 2014). The goal is to have materials that can provide results faster and require less workforce, therefore optimizing the time and cost of construction (Cancela & Ricceto, 2014). Earth architecture (as any other

constructive system) might not fulfill those requirements in all projects and circumstances, especially being a labour-intensive technique and with limitations to construct in winter times.

Moreover, it is particularly important to highlight the urgent need cooperativists have on accessing decent housing. The process of forming a cooperative, obtaining government funds and constructing their own houses can take several years and imply on long, bureaucratic processes demanding the presentation of several documents – as clearly discussed on the previous chapter. In the light of the urgency and several procedures faced by those collectives, it is understandable the resistance and insecurities that might arise on the adoption of alternative technologies – with efficacy unknown to the general public and which require even more processes to follow. A collective, facing such urgency, would unlikely opt for following a process that would complicate their access to government funding – and, by consequence, to the access of their long-dreamed houses.

> There are several elements to be considered. One of them is the dependence on public policy and how much acceptance those technologies have in the government bodies or in the technical public policy team working in the Ministries for them to approve this type of materials to finance the loans. Therefore, usually, if you alter too much an alternative projects, you have serious risks of hindering your effective access – slowing down, at least – your effective access to housing, which, at the moment, is the great determinant above all (Gerardo Sarachu, interview 5, author's translation)

On one hand, it is also true that designing a DAT and a procedure for the adoption of alternative constructive systems indicate an openness to innovation on the government side. Indeed, the former National Director of Housing, on an interview to Revista Dinámica (2016), stated: "In terms of construction in alternative systems, the ideal is not to depend on only one supplier and to think of systems that combine components with non-traditional materials - a bit what cooperativism has done from the beginning - with manufacturing on site, in workshops, or with other types of elements, 'hybrid systems'" – which clearly shows a receptivity to innovation on construction.

On the other hand, even if a DAT for earth architecture was approved, the way government funds are passed to housing cooperatives might constitute an obstacle. Intuitively, experimenting with new or alternative technologies demand time for experimentation as well as malleability – conditions even more relevant given the lack of experiences with earth in mutual-aid housing cooperatives. As expected, building with earth architecture might require certain flexibility: for instance, wintertime poses great challenges to earth construction, given that earth walls can take longer times to dry. The time of the year also influence the construction processes given climatic conditions such as the cold, rain and humidity. Therefore, it can be a slower construction when compared to other conventional modes – which can go, in certain construction stages, against the logic in which the state financing is delivered to cooperatives. Several interviewees agree that, for the development of earth architecture, there could be a special and specific line of financing from government or a flexibilization of certain regulations to allow for experimentation.

Silvana Delfino, one of the founders of Guyunusa cooperative, when asked what could facilitate the process for adopting earth architecture in other housing cooperatives, states:

> I believe there must be policy. I mean, provide the opportunity so that alternative constructions can be financed from the ministry. (…) There must be opportunity for all the alternative. (…) (Silvana Delfino, interview 14, author's translation)

In turn, Gerardo Sarachu recognizes that the way government funds are handed can pose a limitation (process described on section 4.3.3) – but are not the sole responsible for the lack of experimentation in mutual aid-housing cooperatives: technical assistance institutes also play a decisive role – topic explored in detail on the next section.

> Here, the form of financing cooperatives requires that you go ahead according to the progress of the work done. So, the faster you advance, the faster you get the other part and so on. This is a limitation from the point of view of experimentation with new materials because it does not allow for such times and, in general, people go with what they know - not only the people in terms of their self-management, the collective that is developing this cooperative - but also the technicians that work with them, the technical assistance institutes (Gerardo Sarachu, interview 5, author's translation)

### 5.2.6 The convenience barrier: Technical Assistance Institutes and the participatory design

Technical assistance is one of the keys to the success of housing cooperatives in Uruguay. Guaranteed by law, IATs provide a fundamental support to cooperativists, not only on the design of architectural projects, but also on capacitation of the collective on self-management skills and community integration – as explained thoroughly in section 4.3.2.

There is, however, a fundamental aspect on such assistance that should be respected above all: the final say must always come from cooperativists and all processes should be participatory – especially since one of the pillars of mutual-aid housing cooperatives consists of self-management by their members. Such decision-power should also be respected when it comes to the architectural project – even if cooperativists might not possess the technical know-how of architects and engineers, the collective is responsible for deciding which architectural project will suit them best while being assisted by an IAT and as long as it is in compliance with government regulations.

It is precisely on the participatory design – or the lack thereof – that IATs can influence the adoption of constructive systems. Several different interviewees pointed that some IATs propose "ready-to-go" projects, which they are very habituated with, in order to avoid complications on the government loan approval or, for instance, because they are not familiarized with other non-traditional techniques.

> The possibilities, the pros, the cons, of developing certain projects with certain materials - it is good that the cooperatives know that they have alternatives, know what those alternatives are, what advantages and disadvantages they may have. But they must have the information. Who has to provide such information? It is the technical assistance institutes. (…) So, here there are many technical assistance institutes that work in different ways. There are those that work in that way, providing as much information as possible and then working with the group, guiding the decisions if they are understood to be better. And there are the technical institutes that already come up with a solution under the arm, and say "this is what I do, this is what I can do, and with this I assure you that we will reach a happy ending" (…) (Raúl Vallés, interview 6, author's translation)

Such “happy ending” can certainly influence cooperativists decisions, given the many regulations imposed by government loans, the urgency those collectives have on access decent housing and a certain “lack of experience” that some collectives might have at the beginning. That is, those collectives, mostly composed by Uruguayan working class, are required through the formation of housing cooperatives of engaging in a variety of different tasks - related to financing, management, organization, construction work and so on - which they are not necessarily familiarized or experienced with, which in turn, can difficult the process of self-management.

Therefore, it is essential that such change of mentality is accompanied with a strong empowerment and capacitation work, so that cooperativists can be the ones leading the process. While IATs are required by law to promote such training, FUCVAM is also essential on empowering cooperativists to appropriate their housing project, especially when some IATs might have lost the political commitment and the not-for-profit mark they had in the beginning of the cooperative movement in Uruguay, as indicated by two interviewees.

Moreover, it was also mentioned that IATs can be conservatives in the implementation of new elements or technologies to housing projects and might not be interested in incorporating the use of earth architecture.

> “(…) On the other side directly associated is [the fact] that, since the cooperatives require that a technical assistance institute work together with them on the project, it would imply that the technical assistance institutes are willing to go on the pathway of earth. But, well, for them it is much easier to apply a quantity of things they already do and already have all the calculations done, have all the plans, right? To think on new proposals would imply a greater investment from them against the money available (…)”, Fernando Zerboni, interview 4, author’s translation

It was also clear from several interviews that for earth architecture to be adopted on housing cooperatives IATs must be willing to support and develop such projects.

> “(…) I think many institutes are going to operate as a conservative element for that change. Some others, which are younger institutes, may be a strategic ally on this matter of changing even our own minds, the cooperativists’. But if the institutes are not also convinced of this, it will be very difficult for the cooperative movement to build at some point with other materials. (…)”, Isabel Zerboni, interview 8, author’s translation

Surely, the advice and expertise of IATs are also influenced by what government regulations demand – one cannot propose to build in an alternative system if such is not approved under the framework of government loans. An IAT would also be with its hands tied if a constructive system is distrusted by the collective.

However, participative design processes comprise much more than the choice of building materials: cooperatives members - besides taking years to access their houses and much invested effort on building them - will have to repay the government loan in the following 25 years after construction is done and, most of all, live all their lives in such buildings. It is, therefore, of utmost important that cooperativists are the ones deciding (and understanding) why and how their housing project is designed since it will not only influence their construction work, but also the habitability of the cooperative’s private and common spaces – a very important point raised in interview 6.

Finally, the resistances observed in some IATs can, therefore, be a great hinderance for earth construction techniques – but not only: for any innovation to permeate housing cooperatives, it will be necessary to rethink the role of all main urban actors and systematically assess how could each of them facilitate such process, bearing in mind that the conjunction of barriers here presented are mutually-reinforcing and that all strategies must be holistically applied.

# Chapter 6 – The permeability of innovation in mutual-aid housing cooperatives and the transition to sustainable building materials

## 6.1 The role of urban actors on promoting innovation in mutual-aid housing cooperatives: an overview and discussion based on the findings

As it is clear from the discussion above, for earth architecture to be an option for mutual-aid housing cooperatives, a set of different factors would have to be in place according to the findings of this research: cultural acceptance, awareness raising, professional training, university research, government and technical assistance support. However, even if the focus of this study was on the implementation of earth architecture techniques, other technology novelties might face similar barriers when it comes to housing cooperativism in Uruguay. Therefore, for innovation to permeate such collectives it is necessary to understand how urban actors could facilitate the experimentation and innovation, not only in housing cooperatives, but also in government financed programs.

Regarding the cultural, awareness and training barriers, universities and educational institutes could play an essential role in capacitating more professionals on alternative technologies through courses and workshops. Moreover, systemizing the existing experiences and publicizing good examples of earth architecture could set a change in perceptions and decrease prejudices. For earth architecture to permeate government financed programs, it must expand beyond certain stereotypes and include sectors which do not necessarily have a preconceived idea of sustainability – for that, a strategy can be generating debate and discussion on the public arena, educating on the environmental importance of earth, but also reinforcing its other benefits.

Universities would also be essential in the development of the Document of Technical Aptitude (DAT). Exploring the properties of certain techniques and adapting regulations on earth architecture developed on other countries could be an important line of investigation and research. Additionally, investigation on how to make earth construction more attractive and effective in urban centers comes with utmost importance, especially given the high urbanization rate of Uruguay. For instance, inspiration could come from other international experiences aiming to bring earth techniques in the construction of buildings at the center of great metropolis while still aiming for the sustainability of such architecture, as it is the case of the project Cycle Terre located in Paris, mentioned in chapter 1.

However, it is also important to highlight that earth architecture might not be aligned with the trend of mass production, industrialization and densification. It is important to highlight that earth is also a limited resource and the industrialization of the technique, even if allowing for its use in huge metropolis, might incur in similar unsustainable practices.

Moreover, on the framework of climate change and the Sustainable Development Goals, research is much necessary and earth architecture is indeed an alternative for sustainable buildings, which can attract different lines of research as well as government support. Two interviewees have raised the links between the use of earth and the search for sustainable practices, suggesting that there could be more opening for earth architecture from the environmental point of view. Indeed, important research has been developed in that sense: VerSus, an European research project, investigates the links between vernacular heritage and its contribution to sustainable development (Correia, Dipasquale & Mecca, 2014).

The sustainability dimension can certainly attract government investment. However, the regulations around government loans might need adaptation or it might be necessary to develop a different financing line, as appointed by some interviewees. Given that earth architecture is an artisanal technique and there are limitations on constructing during certain seasons, flexibility would be surely necessary. Again, those barriers could be diminished or overcome with proper investigation and research on how to make the construction process more efficient for government-based programs.

Increased government support could also lead Technical Assistance Institutes to study the implementation of such construction and propose it as an alternative for cooperatives. On the other hand, government should develop ways to ensure that participatory design is being carried out by all IATs – not only to encourage knowledge on different constructive systems, but, most importantly, to guarantee self-management and participation from cooperativists. A similar procedure is already applied when cooperatives choose to build with non-traditional systems: as described in section 4.4.2, they must submit a document attesting that they were presented to different constructive systems and deliberately opted for a particular one. Such requirement, however, could be extended to all housing cooperatives and not only to the ones which choose to build with non-traditional materials (a requirement that might even induce cooperativists to opt for conventional materials for practical reasons).

FUCVAM can also play an essential role on promoting innovation in cooperatives. Even if the Federation is not directly involved in the formulation of the housing project, it provides essential advice for cooperativists and it actively capacitates its members on self-management and cooperativism values while providing valuable advice for all the different process a cooperative must endure. Different interviewees stated that there might be a resistance on FUCVAM to the implementation of new construction technologies in housing cooperatives. Given its political and social influence, the support – or lack thereof – to innovative technologies might determine the permeability of such on collectives. FUCVAM, through its technical department, could also play an important role on investigating innovations and the possible benefits alternative materials could bring for housing cooperatives. Furthermore, given its social role and its militant imprint of fighting on a diversity of social fronts, and especially in light of the climate emergency, the Federation

could promote sustainability practices in its housing complexes, engaging with the environmental issue in a more active way.

> (…) There is some resistance in the Federation itself to the incorporation of new technologies. The technical assistance department of FUCVAM has not been developed with this logic of experimenting with new ways, but rather of doing better what we already know. The approach has been more pragmatic than seeking innovation and development. In this sense, it seems to me that there is a weakness in the social movement in general – and in FUCVAM, in particular – to place with greater dynamism in the agenda all this environmental dimension. Although FUCVAM has played a relevant role in defending the public, including the right to land, the right to the city, same emphasis has not been given on environmental advocacy. And it has the conditions to do so (…) (Gerardo Serachu, interview 5, author's translation)

FUCVAM, however, will only promote technologies and systems that can benefit cooperatives and will most likely reject initiatives that have the potential to undermine and slow the access to government loans and, ultimately, to decent housing. Therefore, the advantages and benefits of earth architecture must be clear as well as government support to the collectives which choose to apply innovation. One more time, the work of dissemination and research also comes as essential in this process.

Furthermore, one interviewee raised a very interesting point around the dynamics between families inside the same cooperative and among different housing cooperatives: there is a strong knowledge and experience exchange inside the cooperative movement, with dissemination of experiences and best practices between families, cooperatives and FUCVAM. Such dynamics show the potential that the cooperative movement has on becoming a sort of "reservoir" of expertise and best-practices with different constructive systems. In addition, two interviews highlight the innovative potential housing cooperatives have to experiment with new technologies. Indeed, some housing complexes have water roofs, which requires a permanent maintenance that cooperatives manage very well given the internal organization of the collective, keeping it in the agenda of the cooperative.

## 6.2 Systemic transformation and the transition to sustainable building materials in the Uruguayan context

The results and discussions of this research highlight the rigidity permeating socio-technical regimes and their strong stability through path-dependence and lock-in mechanisms. In the case of Uruguay, for instance, government regulations and user practices as well as cultural values are determinant on the choice of building materials, hardly opening space for innovations to emerge.

It also exposes the mutual influence between how a set of rules guides the activities and actions of social groups which, in turn, implement and apply rules in concrete actions in local practices, reproducing the elements of socio-technical systems (Geels, 2011).

To break with this pattern, windows of opportunity in the regime must indeed come to place in order to provide space for innovation to emerge, reconfiguring existing systems. As it was thoroughly developed in chapter 2, a system transition will entail policy, markets, consumer practices, infrastructure, cultural meaning and scientific knowledge – all of which became evident in the findings of this research when investigating a transition to sustainable building materials in Uruguay. Indeed, for earth architecture to be adopted a series of pre-conditions would have to be given with alterations in all different spheres mentioned above. See figure 6.

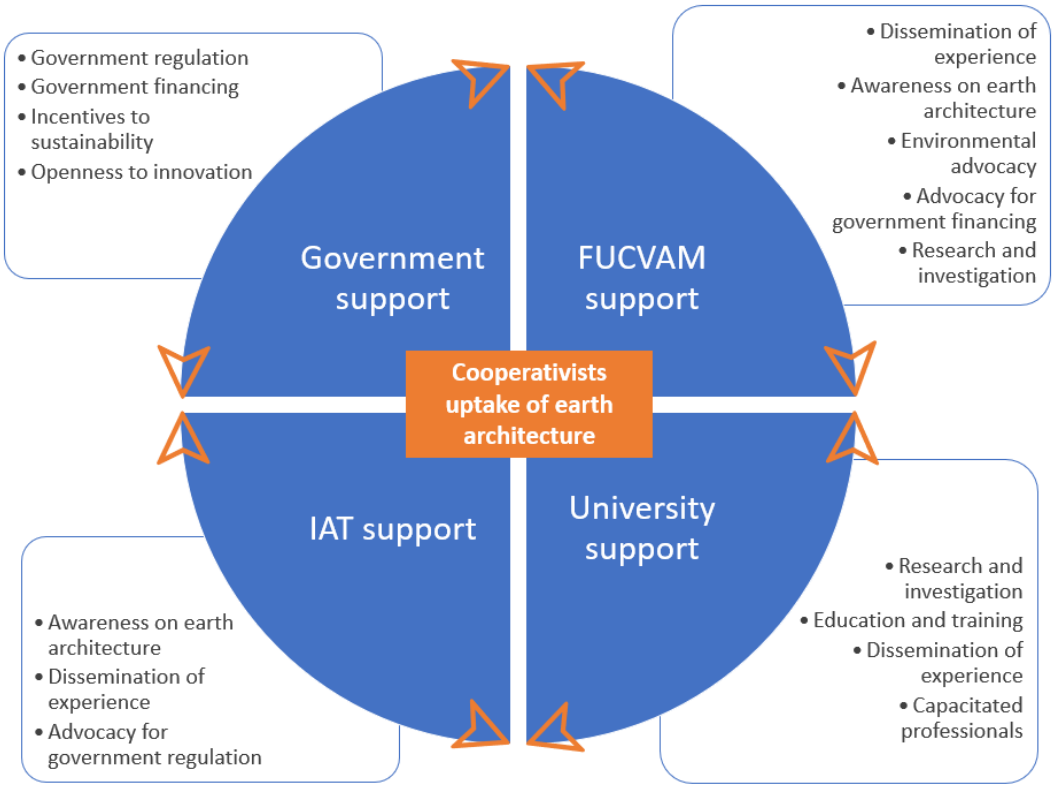


*Figure 6: Urban actors support and the interlinkages of their actions. Source: author.*

As illustrated, the uptake of earth architecture by housing cooperatives will heavily depend on the support of each main actor involved in housing cooperativism – all of them mutually influencing each other. There are different fronts in which the main urban actors can act and have an impact. The implications and consequences of their actions and support, on the other hand, will also directly influence the acceptance of earth architecture by other actors, and their following support. For instance, government support can come through the design of regulations and special lines of financing. Those, on the other hand, will influence the support of FUCVAM, IAT, University and cooperativists.

As mentioned before, technologies play an essential role in the fulfillment of societal functions, which makes it worth to distinguish the production, distribution and use of technologies as subfunctions (Geels, 2004). In turn, for the fulfillment of those subfunctions several corresponding elements are necessary, called resources (Geels, 2004). In the case of earth architecture in Uruguay, several resources are either missing or playing against the fulfilment of the three different subfunctions:

1. Regarding the 'production' subfunction, the basic resources are scientific knowledge, education, labour/human resources, technological/design knowledge, capital (money), tool/machines, natural resources/parts (Geels, 2004). For earth architecture in Uruguay, scientific knowledge and education are currently weak, which detrimentally influence the technological/design knowledge and capacitated labour/human resources;
2. Regarding the 'distribution' subfunction, the main basic resource (which also belongs to the other two subfunctions) is regulation which produces "trust", comprising quality norms, property rights, laws, etc. (Geels, 2004). In Uruguay, as exposed in the previous sections, there is an absence of quality norms and laws specific to earth architecture – which do not only influence the distribution sphere, but also the production and use of earth architecture as the research findings have clearly corroborated;
3. Regarding the use of technologies, the necessary basic resources comprise cultural meaning, facilities for repair/maintenance and complementary artefacts (Geels, 2004). In this case, the great prejudices surrounding earth dwellings and the cultural meaning attributed to this technology inhibit the use of earth architecture.

As it is clear from the above, for earth architecture to fulfill the societal function of housing, the well-establishment of such resources are necessary. Moreover, the analysis presented above is in accordance with the findings from the interviews – which shows an alignment between the theoretical framework and the research results. Consequently, the strategies described in the previous sections are also valid for tackling those specific resources.

However, when it comes to the potential of housing cooperatives, as social innovations, to produce architectural innovation through the use of sustainable technologies – as suggested by Seyfang and Smith (2007) – the results are ambiguous. The tight regulatory framework in which Uruguayan housing cooperatives are inserted – together with all other barriers mentioned in chapter 5 – can certainly limit spontaneous innovation. However, previous articulation between government, university, construction companies and FUCVAM have allowed cooperativists to be able to choose among certain non-traditional constructive elements (which possess DATs) in their housing complexes – a positive indication, even though the aim was not related to sustainability. Moreover, as mentioned before, interviews have also pointed that housing cooperatives can play an important role on trying out innovations – such as the case of water roofs in some cooperatives.

Indeed, the potential for such collectives to pool resources and invest in sustainable technology – also mentioned in Seyfang and Smith (2007) – shouldn't be underestimated. Those resources might not necessarily be financial, but linked, instead, to the empowerment and strength those collectives acquire in the process of forming their cooperatives. In fact, even with limitations, it was still possible for one mutual-aid housing cooperative to build with earth architecture thanks to the determination of its members and the support of capacitated professionals: the Guyunusa cooperative. Such collective has not only built with earth, but has also adopted several sustainable practices, namely solar collectors, ecological sanitation and other measures linked to energy efficient. Even very financially limited and facing great

barriers posed by institutions, all that it took was a very determined collective, empowered in its strength and strongmindedness, motivated to live alternatively and ready to fight for its right to *choose*.

## 6.3 When theory meets reality: The Guyunusa Cooperative

According to this research, Guyunusa, founded in 1994, was the only mutual-aid housing cooperative in Uruguay which has built the entirety of its project with earth. Therefore, it's of great interest for this study to understand their experience and investigate to what extent the barriers aforementioned described were faced by this collective. Five interviewees who participated on this research were involved in the construction process of Guyunusa: two cooperativists, an independent architect and two professionals from the IAT which assisted the collective, an architect and social worker. In order to have a complete view, secondary-data was also used in the making of this specific section[13].

*Figure 7: Guyunusa cooperative. Pictures courtesy of Silvana Delfino.*

### 6.3.1 The Formation and the profile

The collective was mainly formed by women, heads of household, who were the majority in the cooperative. Out of the 10 families who composed the cooperative at the end, 8 had women as heads of households.

According to Rodríguez & Arué (2014), the initial formation of the cooperative dates back to the end of the 1990s and the initial members were mostly known to each other from their

[13] A final course dissertation, as part of one course on Housing Cooperatives given in the University of the Republic, investigated the use of bioconstruction in mutual-aid housing cooperatives. The study, "Arquitectura con Tierra: Bioconstrucción en Cooperativas de Vivinda por Ayuda Mútua", performed interviews with some of Guyunusa' cooperativists and with the architects involved in the design of the project – all transcribed in the study. In this section, all data coming from those secondary interviews will be referenced accordingly. All other data non-referenced comes from the findings of my research.

previous housing cooperative, Malvín Norte, of which some were members and neighbors (Rodríguez & Arué, 2014).

The small size of the cooperative was a deliberate choice – Guyunusa wanted to remain small in order to have a more personal and familiar environment. A small cooperative with 10 families, mainly formed by women: that is the profile of Guyunusa.

Interestingly, the name "Guyunusa" came as tribute to an indigenous woman. In Uruguay's colonial past, most indigenous people were exterminated. From those that survived, around four Indians were taken to Europe to be exposed as an attraction. Among the four, there were 3 chiefs (*caciques*) and a pregnant woman – called Guyunusa. This indigenous woman was representative of Uruguay and the women who formed the cooperative chose this name as a tribute.

The model of mutual-aid housing cooperative was the chosen one since it was very well regarded by the collective as an inclusive tool for the access to decent housing.

### 6.3.2 The choice of the building material and its advantages: Why earth?

Since the beginning when the collective was formed, it was decided that the construction would be done with a quality and cheap constructive system, given that building supplies in Uruguay can be very expensive. From there, the search began: the collective transited through different alternative constructive systems, such as wood (which was too expensive) and stone (which had poor thermal properties) until finally getting in touch with earth architecture in a visit to *Comunidad del Sur* – one of the most important pioneers in bioconstruction in Uruguay, as discussed in section 5.1.

> (…) And, well, we fell in love with these buildings. We were very surprised by how nice, how thermic... They had no humidity! We were in the middle of winter and they were in a plot with nothing around to shield them... And, well, it was warm inside, we found it very cozy. And, well, from then on, we embraced this technique (…) (Silvana Delfino, interview 14, author's translation)

Such experience reinforces how important it is the dissemination of examples of houses built with earth so that people can experience themselves the properties and advantages of such construction. This goes in line, not only with the literature studied, but also with the findings from the research's interviews.

> We had this idea, we did know what *rancho* houses were, which they call here poor, very poor housing. But the important thing was to be able to see and get to know the project of *Comunidad del Sur*, which was not at all ugly. On the contrary, it was beautiful, it was very nice, it was very cozy. (...) It showed us that it was possible to build decent housings with earth. Not linked to poverty, as it was thought here. (…) And I think that's fundamental, because when you come with all this historical background around the *rancho* housing, that the *rancho* is for the poor, you have this horrible idea. However, when you come and find a beautiful project and the houses, decent, with the proper amenities, that takes all the rest away. (…) (Silvana Delfino, interview 14, author's translation)

Moreover, the collective clearly presented a high environmental awareness and the will to live sustainably: besides building with earth, the cooperative also makes use of a biomass

stove, double windows, solar panels for water heating (solar collectors) and an ecological sanitation system (Rodríguez & Arué, 2014). Such characteristic of the collective also corroborates the links between high-environmental awareness groups and the choice for earth architecture, pointed out by several different interviewees.

> (…) So, it was always a collective of very modest people but very involved with the environmental issue. (Diana Spatakis, interview 3, author's translation)

*Figure 8: Solar collectors in Guyunusa Cooperative. Source: Arquitectura con Tierra: Bioconstrucción en Cooperativas de Vivienda por Ayuda Mutua (p. 41) by V. Del Pino & V. Estramil, 2014.*

*Figure 9: Biomass stove in Guyunusa Cooperative. Source: Arquitectura con Tierra: Bioconstrucción en Cooperativas de Vivienda por Ayuda Mutua (p. 41) by V. Del Pino & V. Estramil, 2014.*

Among the main advantages of living in an earth dwelling, the members pointed out the excellent thermal capacities of the material, the humidity regulation, the reduced economic costs in construction and constructive techniques easy to be learned.

> (…) I'm in love with the thermal aspect of earth construction. That's fundamental for me. Then the second is the economic part. And then we could list the third one as being easy to build, let's say. (…) (Enrique Rodriguez, interview 10, author's translation

> (…) For example, ambient humidity. Here, the ambient humidity often wets the floors in conventional houses. We never know when there is a lot of humidity unless we see it, because our floors are always dry. In other words, the house maintains the insolation from humidity as well. (Silvana Delfino, interview 14, author's translation)

One more time, those observations go aligned with the literature as well as with the perceptions obtained from interviews.

### 6.3.3 Challenges and barriers

Since the formation, the collective had to face innumerous barriers. The first obstacles came when trying to obtain the legal status, find some plot to buy and apply for government funding. It was particularly difficult to design a project with earth as a constructive system: using a material and technique which were not certified as valid before the Ministry greatly difficulted the access to a government loan. Besides, at the time, the cooperative movement as a whole faced longer processes: the procedures involving housing cooperatives are much more straightforward nowadays, as opposed to those times. However, the fact of choosing earth as building material did pose more difficulties to such processes. As one cooperativist testifies:

> (...) It was a very long process, also, because earth was not qualified as a material, as a good technique to build, that is, as a constructive method. It was not. It wasn't legal to build with that, the ministry wouldn't give you money. (...) In other words, we had to start breaking down various barriers. One was to make a project and have it approved by the Ministry. So, the process was quite long, right? (Silvana Delfino, interview 14, author's translation)

The cultural barriers were also a factor playing against the collective, especially given the government programs which eradicated earth dwellings under a rather hygienist view. The group, however, remained strong on their conviction of building with earth despite the prejudices around earth architecture.

Moreover, as expected, the search for a technical group which would support such project was also difficult, as Silvana tells:

> Actually, the most difficult was to find an Institute. We have come a long way looking for technicians. When we said, "we are going to build with earth", they'd say "What?! No, no. No way, because we don't even know what to do with that. No, no. (Silvana Delfino, interview 14, author's translation).

Silvana also highlighted how difficult it was to find capacitated personnel to work with earth architecture and the high costs it implied hiring workforce which did have some training on earth architecture.

After some time, the collective did find an institute that was willing to fully board on the project: COVIMA. For the institute, however, taking on such project was a great professional challenge and it demanded an important commitment on learning such alternative technique. In order to provide for training, the IAT and the collective have decided to hire the help of a professional specialized on earth architecture: Rosario Etchebarne. When asked if working with such construction technique implied on a professional challenge for the IAT, Diana Spatakis remembers:

> Totally! We had to start studying it from scratch, we didn't have previous approximations. We did know it, we were aware about colleagues who worked with that and that's why we've hired the colleague Rosario Etchebarne, who gave us her support on capacitating the technicians who worked on this and all the group as well. We have done a contract with her for the entire project process and we have greatly learned with her – to which we are very thankful. It gave us the opportunity to be able to approach something so special and interesting that, in reality, we knew it from afar. (…) And she also

> gave us the support to approach personnel with training level. (Diana Spatakis, interview 3, author's translation)

Such professional challenge was also confirmed by Ana Ezeiza, architect from COVIMA also working on the project (Ezeiza, 2014). She reckoned the lack of experience with such constructive system on the IAT, which has led them to hire a technical advisor specialized in earth architecture (Ezeiza, 2014).

Indeed, the strong support and commitment of COVIMA were essential for the success of the project – highlighting the importance a technical assistance institute has on the uptake of earth architecture.

Again, those findings clearly align with the points raised by the interviewees on section 5.2, around the possible difficulties to find IATs which would support and work with earth architecture as well as the lack of training and capacitated professionals on the market and the essential role IATs play.

In the project, Rosario Etchebarne was responsible for the design of the constructive system, the constructive details, assisting with the production of adobes and the construction itself of the earth dwellings (Etchebarne, 2014; Ezeiza, 2014). The other two architects who worked in the project were Ana Ezeiza, responsible for the architectural drawing of the houses, and Diana Spatakis, responsible for the structural calculations – both coming from the IAT COVIMA (Etchebarne, 2014; Ezeiza, 2014).

After finding an IAT, the government loan had to be somehow assured. Since the constructive technology used was not certified before the Ministry, the collective couldn't access funding through the financing line dedicated to housing cooperatives. Instead, the cooperative had to apply for funding through an alternative government financing program, called SIAV[14], which was the only which could eventually accommodate the profile of Guyunusa. This, however, implied in a smaller amount of funding for the square meters they had proposed to build.

Even so, the collective had to fight to be able to access this alternative credit line. First, for the choice of the material; and second, because such credit line was not open for housing cooperatives. Therefore, an important fight was done by Guyunusa to be considered an exception.

> It was the only thing that could be legally arranged for us to enter. (...) Because it was earth, it was not allowed. So, we had to open that gap which took a lot from us, because they also didn't accept that it was a cooperative. This line of credit was not for organized people, which we had to fight against. (…) It was an interesting challenge, because we also opened ways to show that this loan, this line of credit had to have a cooperative form. And, well, that was clearly exposed, right? (Silvana Delfino, interview 14, author's translation)

Therefore, as Guyunusa illustrates, the access for government funding can certainly be considered one of the main barriers in the adoption of earth architecture in the framework of projects financed by the State. It is worth highlighting that it would be unlikely to find a group with urgency on accessing decent housing that would be willing to engage on such fight

[14] This alternative credit line is nowadays dissolved (La Red 21, 2008).

– especially given the several other procedures cooperatives must endure. Therefore, government support comes as an essential pre-condition for the uptake of earth architecture among mutual-aid housing cooperatives – as the findings of this and previous sections indicate.

> To overcome the obstacles that the Ministry puts is very cumbersome. We have never for one moment thought of leaving all this behind when we were on the way. But not all the people would have… We've began and had around 10, 12 years on this. And I believe it is demonstrated that alternative techniques are precious if the people who uses them are convinced of such. So, I think that it has to be allowed, it has to be given legal openness (…) (Silvana Delfino, interview 14, author's translation)

Indeed, the group was very determined to build with earth and the interest on such construction was remarkable: the collective engaged in learning almost all different techniques on earth architecture, before deciding with which Guyunusa would be built.

During construction time per se, the collective has also faced significant unforeseen events. The most important ones were related to the wintertime, given the rains. During the cold season, earth walls took longer to dry, and it was of utmost important to protect the walls with nylon covers so that they would not get wet.

> So, we were in the middle of the wall and it rained for example in the winter, in which it rains very often, and this totally blocked us. We had to cover all the walls so that they wouldn't break down, because, as it's made of earth, the water carries it away. So, we had to cover all the walls and that was also a rather complicated setback. (Enrique Rodríguez, interview 10, author's translation)

Even so, the collective was taken by surprise and had walls which were completely destroyed given the rain – occasioning complications in the time of construction and the budget of the collective (Rodríguez & Arué, 2014; Días, 2014).

The economic aspects also imposed several limitations. The government loan (smaller than expected) also had to be used to pay for part of the plot, which was bought privately by the cooperative – therefore, leaving the group with very limited economic capacities. Such limitation made that the houses had to be finished individually by each family over the period of one year after the construction work had finished. It also imposed limitations on the construction processes and contributed on the lack of resources to prepare for the difficult climatic events.

Given the lack of capacitated professionals in the market and the expensive workforce of those who were capacitated, the cooperative had to hire some foremen who were not experienced with earth architecture techiniques, which eventually occasioned some mistakes during the construction. Moreover, to save in economic costs, the collective had to dedicate considerable time to the building process – sometimes spending whole weekends at the construction site in order to advance.

The particularities of the technique applied also implied that the construction time was slower. And, during winter, this was even more evident.

> The part, for example, of drying the adobe in summer, for instance, in 4,5 days it was dried. In winter, for example, when we had to do it and let it dry to be able to use it, much more time was needed, let's say. So that was a delay. (Enrique Rodríguez, interview 10, author's translation)

> Yes, the cooperatives have a rather strict schedule. In the case of Guyunusa, with earth construction, we had to convince the Housing Ministry that "look, we don't have a construction strike, we don't have this, but we have ten days in which we have 80% humidity and rains day in, day out" and that this was really a difficulty. In winter the work advances very little, very little. (Diana Spatakis, interview 3, author's translation

An interesting point raised by some interviewees is that the lack of other similar experiences and projects with earth architecture did not allow for a knowledge exchange or accumulated expertise – which might have helped to prevent some mistakes. Guyunusa until today remains as the only mutual-aid housing cooperative which has built the entirety of its project with earth.

> In this case, in those pilot experiences, what happen was this – which with all the pilots sort of happen: there is inexperience, lack of knowledge. (Gustavo Machado, interview 12, author's translation)

> The thing is that there was little experience in earth construction. Perhaps there was experience, but of individual houses, not like a cooperative with many houses together, right? (Enrique Rodriguez, interview 10, author's translation)

Finally, Guyunusa also faced some resistances in FUCVAM.

> Well, in reality, when we started the project, among other things, we were few people. (…) But, moreover, another thing that happened was that we were mostly women – there were men as well, but the members, the ones generating the idea and the ones working, were women. (…) And, at this moment, FUCVAM was having many problems. And when Guyunusa comes and we go talk to FUCVAM, they said "Ten? Few people, few arms. Women in a construction site? And with earth?" It was absolutely out of the picture! (…) And we couldn't talk to FUCVAM from another place because we didn't have foundations at the time. So, well, with FUCVAM we had a poor relationship, let's say. We got close, but it was very necessary for ourselves to be dedicated to this [our project], not to activism at this moment, because this [our project] already required a lot of time from each of ourselves (…) (Silvana Delfino, interview 14, author's translation)

### 6.3.4 The legacy

The cooperative has also intensively engaged in the dissemination of its experience as well as in the dissemination of earth construction techniques. For instance, around 2005, during one congress supported by the Faculty of Architecture and Rosario Etchebarne, Guyunusa was the place where the practical training on earth architecture was done, which counted with the participation of foreign professionals and external people interested in earth construction. Besides, the collective was always welcoming of people who were interested to come to the construction site and meet the project. Since the beginning, it was clear for the cooperative the importance of sharing its experience (Rodríguez & Arué, 2014).

Once the construction finished, some newspapers also spread to civil society the experience of Guyunusa on building with sustainable materials (Acosta, 2010; La Nación, 2010). Still, even with the great efforts on disseminating experience, there was no other group as the cooperative of Guyunusa which decided to opt for such construction.

The collective also counted with a strong support from its local community: some people, once they'd learned about the project, would come to help in the construction. There was also a local school that would bring its students during some mornings to work on the techniques of earth construction, particularly on the making of the adobes – therefore, providing an important support for the group (Rodríguez & Arué, 2014).

> Many people helped! Many! The solidarity of the Uruguayans is unique. People who came on Saturdays as if it was a paid job – they would come and help. (Silvana Delfino, interview 14, author's translation)

Despite the eventual problems and particularities linked to the maintenance of such buildings, the collective remained strong and supported each other on the conservation of the houses. Both cooperativists interviewed affirmed that they were very happy and satisfied with living on earth dwellings.

> If I start to remember about everything that we have lived, as we did it with you, it was also very... it helped us to empower ourselves, to stand from another place, to have a vision of issues that, although we knew it from books, to live the gender issue as we lived it, the matter of seeing how this project impacted on other people, the knowledge and the claiming of knowledge of everything... So, I have the impression that although it was a laborious path, if you ask me today - I am about to turn 62 years old - if you ask me today if I would do it again, I'd say yes. (…) (Silvana Delfino, interview 14, author's translation)

## Conclusion

After reading this thesis, you might have the impression that earth architecture would be nearly impossible to be applied in mutual-aid housing cooperatives in Uruguay – indeed, that is a risk when exploring so deeply the barriers for this construction mode. However, the purpose of this study was to serve as a resource for change – since it is precisely *change* our societies mostly need at this moment. Armed with the information here presented, urban actors can incur on such transition: from old practices to new ones, from prejudice to awareness, from institutional barriers to facilitation, from stigma to knowledge.

Therefore, the barriers and perceptions were not exposed with the purpose of showing the impossibilities of earth architecture – instead, they came to provide for tools on *how to make such architecture a possibility for mutual-aid housing cooperatives in Uruguay*. That does not come without saying that such type of architecture is not here proposed as a panacea applicable to all mutual-aid housing cooperatives nor with the intention to completely substitute other constructive systems. However, it is a *potential* solution for sustainable housing techniques to be applied in favorable settings, which must be recognized.

In the face of climate emergency and dauting societal inequalities, urban actors must strive for holistic solutions: it is well passed the time of prioritizing particular settings and strategies in the name of economic development or trying to separate the different spheres of sustainable development.

Indeed, the barriers and perceptions thoroughly described in this research clearly shows that, for innovation to permeate mutual-aid housing cooperatives, urban actors will have to work consistently and holistically in different fronts.

For cooperatives to become green niches, they must be given the space – and not be coerced to choose certain constructive systems because of tight institutional frameworks. They must not be led to think that innovation will imply in a delay on their access to decent housing. Ultimately, they must be provided will *all* information and be empowered enough to make the best decision.

For cooperatives to become green niches, technical assistance institutes must fulfil both their social and architectonic role, bringing information, awareness and breaking with limiting stereotypes and stigma. They must allow for participation in all processes. They too must learn on the importance of sustainable architecture and the innumerous benefits it can provide – not only for the collectives – but for society in general.

For cooperatives to become green niches, government must, not only give the space for sustainable innovation to emerge but incentivize sustainability practices in its programs. In the framework of the 2020 Agenda, politicians and the government technical body must too support and search for solutions that will holistically respond to society's most dauting challenges. They too have an important role on breaking with stigmas and prejudices while informing the general population.

For cooperatives to become green niches, FUCVAM must be ready to engage in the environmental fight, knowing that there is no social justice without environmental justice and that the values of solidarity and community go hand in hand with sustainable practices. Through its power in advocating for better life conditions and the right to the city and through its dream of creating a just society, FUCVAM has an essential role in raising awareness and investigating the benefits that emerge in sustainable collective practices.

For cooperatives to become green niches, university must break down with knowledge gaps and consistently invest on research and dissemination. It must provide for the purest source of knowledge that can guide the development of policies and inform society on issues it ignores. University and educational institutions must take upon its fundamental role in breaking misconceptions and prejudices through education – not only for those privileged enough to be in classrooms, but also for those who do not have the same chance – educating, therefore, beyond the walls of institutions. In face of climate change and increasingly unequal societies, "the educator has the duty of not being neutral", as Paulo Freire states.

It is important to further mention that the findings of this research are not limited to the context of earth architecture in mutual-aid housing cooperatives even if this is the main topic of my research. The results here presented can also refer to other types of sustainable innovation trying to permeate the framework of government housing programs that might face similar barriers. Equally important was the insights gathered on the limitations permeating the mutual-aid housing cooperative model, particularly the ones involving participatory design. For the collectives to fill their role of creating an alternative urban reality, they must be empowered in cooperative values and hold the responsibility for all decisions.

Finally, it is important to stress one more time the influence and importance of mutual-aid housing cooperatives in the construction of more just and equal societies and in the fight for the right to decent housing and the right to the city. The research aimed to take a step further on investigating how such collectives can take part in a transition to sustainability, while bearing in mind the transformative potential grassroot initiatives have in our society, with the hopes that those results can be taken further and transformed into resources in the pursue for resilient and sustainable communities.

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