Urban Densification of Informal Settlements in Lima, Peru - Study Case of Vallecito Alto in Lima, Peru

Auteur : Meus, Michel
Promoteur(s) : Teller, Jacques
Faculté : Faculté des Sciences appliquées
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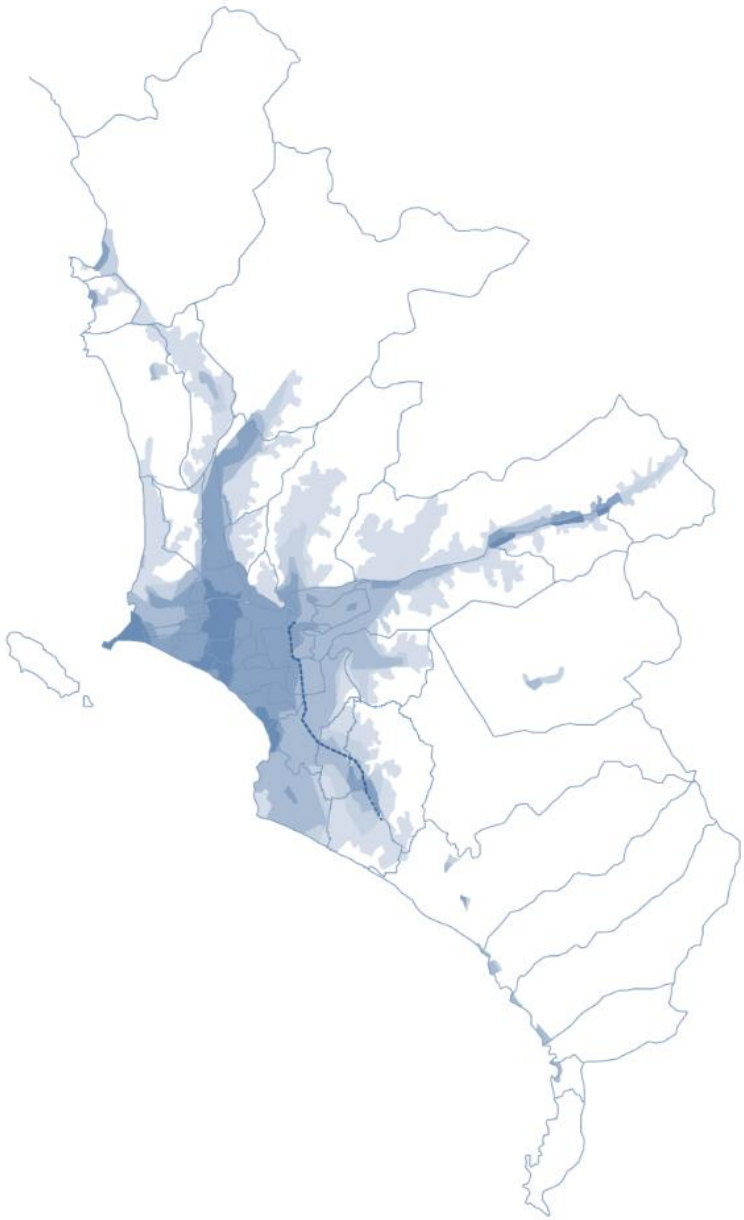

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Author: MEUS Michel

Promoter: Jacques Teller

ABSTRACT

According to the international literature, numerous studies have been made on the urban process of expansion, several studies on the densification processes in formal settlements and very few ones focused on the densification in informal settlements. Indeed, it seems that the urban process of densification taking place in informal settlements has never been clearly understood and seems to be difficult to analyse.

Hence, through different approaches, the following work focuses on the urban densification processes, taking place in informal settlements in Global South. More precisely, it highlights the urbanistic problems and relations between urban densification and its associated factors (population growth, policies…) in the informal settlements of Lima in Peru.

Divided into different approaches including some fieldwork, this work will present the theoretical concepts related to the subject of urban densification. It will focus as well on analysis of existing data and, finally it will bring complementary information from personal data collected onsite. It will highlight the urban densification trends in the last decades in informal settlements like Vallecito Alto and at different levels, from the metropolitan level to the settlement level, therefore showing that the urban tissue tends to be denser in the metropolitan region of Lima. It will also reveal that, when looking at different scales, the urban densification trends tend to vary from one place to another, especially for peripheral districts like Villa Maria del Triunfo where urban densification is taking place but is dominated by urban sprawl, mostly characterised by land invasions.

Even if this research generally enables a better understanding of the densification process in informal settlements, and that some densification trends could be stressed for the analysed study case, it also brings other questions about the way in which densification takes place in other parts of the world.

CHRONOLOGY OF THE PROJECT

17 February 2020	Arrival in Lima
18 February 2020	Arrival at PUCP and meeting with members of the CIAC First data collection about Lima
24 February 2020	Meeting with Marta members of the CIAC to discuss the study case area, persons to contact, deadlines.
01 March – 03 March 2020	Participation in the International Seminar/Workshop Limapolis 2020
13 March 2020	First meeting with locals in the studied neighbourhood of Vallecito Alto
16 March 2020	Beginning of COVID-19 emergency quarantine
3 & 4 June 2020	Interviews
15 August 2020	Return to Belgium
7 September 2020	Presentation of the project
6 January 2021	Submission of the thesis

ABBREVIATIONS

Full name	Abbreviation
Hectares	ha
Informal Settlements	IS
José Carlos Mariategui	JCM
Lima Metropolitana (Lima-Callao)	LM
National Geographic Institute	IGN
National Institute of Statistics and Informatics (Peru)	INEI
New Urban Peripheries	NUPs
Pontifical Catholic University of Peru	PUCP
Research Centre of Architecture and the City	CIAC
United Nations Human Settlements Programme	UN-Habitat
Vallecito Alto	VA
Villa Maria del Triunfo	VMT

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This work is the achievement of several years of study. It has been an incredible learning opportunity, a chance of unforgettable human encounters and an experience full of inspiring discoveries. All of these pushed me, despite the worldwide sanitary crisis, to learn more about the others and myself. This thesis would not have been possible without the help of many people.

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Finally, I dedicate this work to the inhabitants of Vallecito Alto, as well as all the other citizens of informal settlements, hoping to contribute to a profitable and sustainable development of the amazing city of Lima.

Michel Meus

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INTRODUCTION

In 2020, UN-Habitat (2020) reported more than 2.59 billion people in the world living in urban areas such as megacities, which represents almost a third of the world's population. This population is estimated to increase to 3.47 billion in 2035. For several years now, this number has been growing constantly, with various consequences for urban environments like cities. Confronted with this growing population, cities are dealing with various urban phenomenons with significant environmental, social, economic and other consequences.

While some parts of these growing urban areas are facing phenomenons such as urban sprawl, others are undergoing in parallel a progressive urban densification, mostly to meet the demographic growth and the demand for housing. This rapid growth, especially the one of megacities, leads to uncontrollable and unplanned urban development, frequently resulting in the development of the so-called 'informal' neighbourhoods.

Figure 1: Informal settlements in Lima

These megacities are developing throughout the world in different ways, depending on the city, the culture and the region. Given the novelty of this trend, the management and urban development of these megacities becomes a fundamental challenge for future generations, especially when we look at the sustainable aspect of these neighbourhoods. Various studies have demonstrated the advantages of densifying the

urban tissue rather than spreading it out, especially for cities with several million inhabitants. However, the existing literature shows a certain lack of information on the subject of urban densification in informal neighbourhoods.

Consequently, this work is oriented towards the study of the urban development of these informal neighbourhoods, particularly with regard to the aspect of urban densification. In parallel with an urban design project, it is structured around several approaches including fieldwork and the analysis of existing data, at different scales. The data collected on-site, in one of Lima's informal neighbourhoods, aims to provide the additional information needed to understand the process of urban densification, thus enabling better management for the future urban development of our cities.

I. STATE OF THE ART

This first chapter will discuss the concepts and definitions of urban densification and informal settlements found in the existing international literature. These phenomenons are taking place more and more all over the world, especially in megacities from the Global South like Lima, therefore creating new issues and challenges for today's and future's globalizing world. Thus, explanations about the existing literature (scientific articles, reports, studies) on processes of urban densification and urban development of informality will be necessary to discuss these concepts, their causes and consequences in order to understand the context of this work and come up with some additional research questions.

1.1. Concepts & definitions

1.1.1. Urban densification

1.1.1.1. Definitions of urban densification

As well as later seen for the term of informality, the notion of densification can differ from the field in which it is used. As this work will mainly focus on the urbanistic and architectural viewpoint, we will consider only some of these definitions. To support this statement, Turok quotes in Yadav (2019): "*Densification is a complex, multi-layered notion open to ambiguity and misinterpretation*", which says a lot about the term densification (Yadav, 2019). There are many definitions and interpretations regarding the concept of densification. Various definitions and interpretations regarding the concept of densification exist. Some of these definitions are mentioned by different authors in Yadav, for example:

- "*Densification denotes a spatial process whereby more buildings and people are injected into an urban area*" (Jim C. Y. et al., 2018).
- "*Urban densification refers to the approach of compact city planning, which has been progressively argued since the 1990s and has been considered widely as a global applied planning concept*" (Amer et al., 2017).

- "*Transition from low density to high density areas*" (Mustafa, Heppenstall, et al., 2018).

The other terms used to describe the urban densification are identified as "*infill development*", "*urban compaction*" and "*consolidation*" (Yadav, 2019). In the case of this research, we will use the definition set by Mustafa, Heppenstall, et al. (2018) in Yadav's work: "*a transition from low density to high density areas*". In this case, we will mainly refer to urban densification or "*building densification*", because several types of densification can take place (population densification for example, which is most of the time closely correlated to the urban densification). As it clearly appears, there is an unavoidable notion of space in these definitions, which will inevitably lead to spatial analysis.

In this work, we will therefore refer to densification as a transition from low density of housing to high density of housing, within a same area. Which means buildings are built higher. Thus, we will focus also on the relation between the evolution of the population and the intensification process, especially in informal settlements.

1.1.1.2. Effects of urban densification

Several effects of urban densification are already known, as well as for urban sprawl (Yadav, 2019). However, it is important to highlight the fact that, like for the causes of this densification, the effects may vary from one case to another. Among the known positive effects of urban densification, there is generally a reduced dependency on mobility, better air quality etc. However, several negative effects take place too. Even if urban densification seems to be the first and most obvious solution to the problems generated by urban sprawl, there are also negative effects of this phenomenon of urban densification. Of course, these positive and negative effects have to be criticized like the positive aspects, and analysed in their individual context. An exhaustive list of these effects, elaborated by Yadav, can be found in Annex 1.

1.1.1.3. *Drivers and breaks to urban densification*

In this section, we will base our analysis on Yadav's work on the different drivers and breaks that lead to urban densification (vertically speaking). Urban densification is a very complex phenomenon, taking place in both planned and unplanned areas, and which depends on a number of parameters. We will briefly discuss these different factors and later see in which sense they can be implemented in this work, especially in the case of Lima's informal settlements.

As shown in Table 1, there is a wide and complex range of parameters that can enhance or slow down densification. These drivers and breaks can apply for both formal and informal settlements, which will be explained later. Some assumptions can already be made regarding the factors that lead to urban densification, for example the rapid urbanisation, the extreme population growth, real estate market forces etc.

Drivers of densification	Breaks to densification
• Economic purposes/development or market forces • Real estate market forces • Growing industrial areas and technology parks	• Political intentions/influence or lack of political willingness
• Demographical trends/shifts • Extreme population growth	• Cost implications in terms of land/fields
• Transport policies/ transitoriented developments/technological innovations in transport	• Public opposition a. Inbuilt culture and locals' preference for low density and freestanding houses on big chunks of land b. Residents' association of density with crowding and less privacy. c. Psychological motive (unwillingness of residents to socialise with diverse people) d. Fear of deterioration of environment
• Topographical conditions or geographical restrictions –little scope for expansion	
• Rapid urbanisation • Urban and smart growth • New Urbanism	
• Location advantages	
• State or city development policies	
• Inner city areas revitalisation	• Affordable private vehicles to cover long distances makes densification difficult
• Socio-cultural context and climatic factors	• Complications related to Brownfield developments - Fragmented ownership
• High land prices	• Lack of coordination/relationship between government departments and municipalities
• Change in consumer housing preferences	

Table 1: Drivers and breaks to urban densification (source: Yadav 2019)

1.1.2. Population density

The population density can be analysed through different dimensions and scales. Indeed, it can be analysed from the scale of the dwelling, from the building and of the settlement. These definitions, taken from (Usavagovitwong, et al., 2013, p. 6), will depend on the scale of the analysis:

- ***"In-home density**: Residents per square metre of home floor space. This is calculated approximately by the average number of people in a household divided by the average size of the dwelling unit.*

- ***Building density**: Residents per square metre of built-up area, or "building footprint". This is calculated by the total settlement population divided by the total settlement size, excluding open (or non built-up) spaces.*

- ***Settlement density**: People per square metre of ground area in the whole settlement, estimated as the total settlement population divided by the settlement plot area (including built-up and non built-up space)."*

Depending on the available data, the population density analysis will be conducted only for the settlement density. Some hypotheses will be made for the analysis of the In-home and building density. Indeed, no reliable data was found for the smaller scales of this analysis.

1.1.3. Urban expansion and sprawl

1.1.3.1. Definitions urban expansion and urban sprawl

A way of understanding urban densification is to understand the opposite phenomenon which is urban expansion. Therefore, this section will focus on the phenomenon of urban expansion, and more specifically the process of urban sprawl. Understanding this process, which is now occurring in Lima as well as other megacities, is mandatory to put in context the opposite process of densification explained hereabove.

According to Inostroza, Baur, & Csaplovics (2013), some differentiation has to be made between the concepts of urban expansion and urban sprawl. Even if the exact definition of both concepts is being discussed between experts, they are still used ambiguously and are used with the same connotation in urban literature.

While the term of "*expansion*" is a more neutral concept which outlines the growth of cities in size and surface into its surrounding land areas, free of qualitative implications, the concept of urban sprawl is a more specific concept, mostly used with a pejorative connotation. Inostroza et al.(2013) came up with some definitions of the concept;

> *"Urban sprawl has been defined as growth by the creation of new low-density suburbs with detached or semi-detached housing and large commercial strips (Schneider and Woodcock, 2008; Schwarz, 2010). It has been described as the physical pattern of low-density expansion of large urban areas, under market conditions, mainly into the surrounding agricultural areas. Sprawl is the leading edge of urban growth and implies little planning control of land subdivision and urban development. It is patchy, scattered and strung out, with a tendency for discontinuity, and it leap-frogs over areas leaving agricultural or open space enclaves behind. Sprawling cities are the opposite of compact cities, with empty spaces that indicate the inefficiencies in development and highlighting the consequences of uncontrolled expansion (EEA, 2006)."* (Inostroza, Baur, & Csaplovics, 2013, p. 88)

Peri-urbanisation is generally described as a differentiated spatial arrangement which results from the development of closeby new urbanized areas, most of the time fragmented and heterogeneous. These new separated urbanized areas are most of the time in the contiguous zones of the city (Hidalgo & Borsdorf, 2009, in Inostroza, 2017).

The result of that peri-urbanisation is typically the problem discussed in this work, which is the problem of urban expansion and more specifically urban sprawl. Notice that even if the subject urban expansion, also known as urban sprawl, is an important part of this work, we will mainly focus on the urban densification, which is the process after an urbanized area has been saturated. Therefore, the approach of vertical densification will be more discussed in this work.

1.1.3.2. Problems of urban sprawl

Urban sprawl is mostly known to be the cause of different issues, from the socio-economic ones to the environmental ones. Most of these issues can be found in the case of Lima, as well as for most of the other megacities victims of urban sprawl. Among these problems are air and water pollution, loss or disruption of environmentally sensitive areas (i.e. Lomas), bigger dependence on motor vehicles, mostly uncontrolled planning, high costs in public infrastructures, socio-economic segregation, health and security problems etc. The issues related to urban sprawl are numerous and are proof of a real sustainability deficit for newly developing cities all over the world.

In terms of urban dynamics, two types of structures can be identified for the growth of the urban tissue. The first one usually takes place in a radial direction from the city centre or follows linear axis such as roads, rivers etc. This first process takes place along the limits of already urbanized places. Within this spatial behaviour, two patterns can be distinguished; infill and axial development. The axial development follows axes, urban infrastructures etc and most of the time consists of continuous urbanisation. Unlike the axial development, the infill is being defined as *"vacant parcels or remaining open spaces, in already urbanized areas which might or might not include patches located at a certain distance from the existing urban tissue*" (Angel et al., 2005, in Inostroza et al., 2013).

1.1.4. Informal settlements and informality

Various definitions of informality or informal settlements can be found in international literature. Since the degree and form of informality depend on the location and time, it is very difficult to establish a unique definition. Even the names attributed differ from one place to another. Informal settlements take the name of *barridas* in Peru (see Figure 2), *favelas* in Brazil, *bidonville* in French-speaking Africa and so on, depending on the city/country (Fekade, 2000).

However, some notions are correlated and recurring. Here are some of the definitions that can be found:

1. "*Areas where groups of housing units have been constructed on land that the occupants have no legal claim to, or occupy illegally; 2. Unplanned settlements and areas where housing is not in compliance with current planning and building regulations (unauthorized housing)*." (United Nations, 1997)

2. "*Informal settlements become a melting pot for socially exposed people, living in neighbourhoods with insufficient infrastructures, such as water and sanitation."* (Engleson, 2010)

3. *"Informal settlements refer to areas that are not formally planned but nevertheless are occupied illegally by the dwellers*." (Mangaung Metropolitan Municipality, 2014)

4. "*Type of non-conventional low-cost housing.Mostly it is constructed with non-conventional building material that is obtained in an informal way, i.e. beyond the formal channels*" (Urban Foundation, 1991, in Aggarwal, 2017)

5. "*Generally an obvious street pattern is lacking, and space for community services (schools, green areas, etc.) is absent. Basic resources and services such as drinking water, sewerage and electricity are lacking at first*." (Aggarwal, 2017)

6. “*The informal settlements are generally characterized with a large number of residents and less-developed physical housings (i.e., densely populated poor-quality accommodations*).” (Fekade, 2000)

Figure 2: Informal settlement of Vallecito Alto

Despite these numerous definitions, UN-Habitat established a more general meaning. A settlement can be defined as informal if one of these features is absent:

1) Easy access to drinking water
2) Adequate access to sanitation and other infrastructures (enough toilets etc.)
3) Security for the right to property (documentation to prove secured tenure or protection from expulsion)
4) Durability of housing (poor-quality materials, structure, geographical or environmentally vulnerable location etc)
5) No overcrowding (No more than 2 people per room)

(United Nations Human Settlements Programme (UN-Habitat), 2003)

We can therefore make the distinction between the different meanings found in the literature. Some refer to the **legal** viewpoint while others refer more to the **physical** viewpoint of household and the availability of public infrastructures (see Figure 3).

In general, the **legal** definitions suggest that the accommodation have been acquired by illegal means, which is the case in the studied area of Vallecito Alto. Some lots have

been acquired through land traffic between land speculators and corrupted members of the municipality. While other lots are obtained through land invasion, which is a common method in informal settlements (Inhabitant 1, 2020).

The **physical** definitions, on another hand, focus more on the quality of the building materials, quality of space, inhabitants density, geographical or environmentally vulnerable location and generally speaking on poor living conditions. For example, many informal areas are built on the remaining spaces like hillsides, where the ground is unstable and where it is quite difficult to access (Clichevsky & Fekade, in Inostroza, 2017).

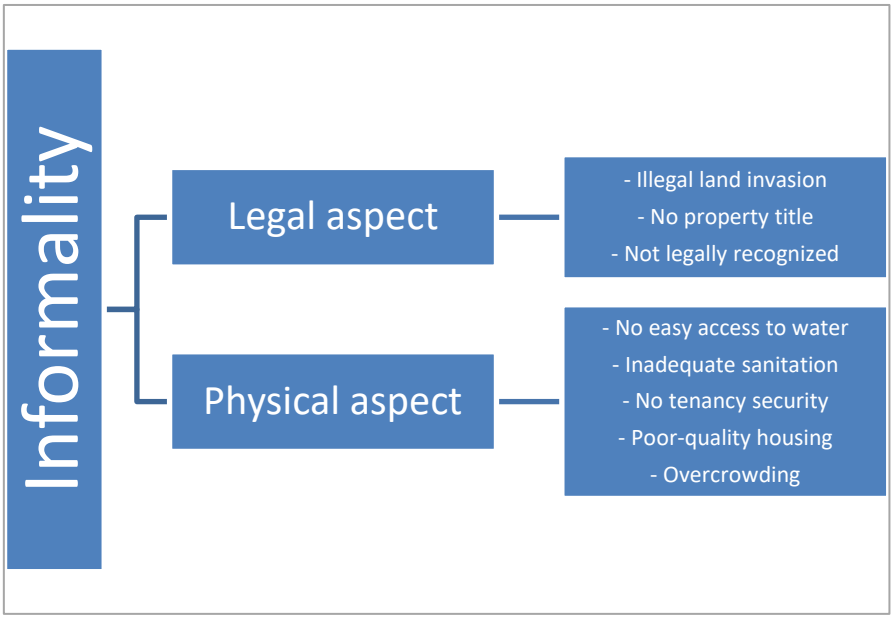

Figure 3: Definitions of informality (Adapted from Fekade 2000, UN-Habitat 2003)

As we can see, informal settlements are not equally recognized in the same way in all regions. It is a definition varying between every region around the globe (Fekade, 2000). These informal settlements seem to appear most of the time in centric cities, especially in those where the economic activities are far from each other (ex. Lima, which is one of the only megacities in South America) (Aggarwal, 2017). One of the reasons for this absence of proper consistent definition is mainly the consequence of the permanent change of this type of settlement. Indeed, the development processes of these settlements generally come in the form of a lack of public infrastructures and services in the area where the settlement is being developed at its first development phase, later followed by infrastructure enhancements to meet population growth (Hogeun, Peilei, Ranjeet, Zutao, & Jiquan, 2019).

1.1.5. Growth of informal settlements

1.1.5.1. Stages of informal settlements growth

Informal settlements types vary between countries, cities, topography, economy and many other factors. The difficulty of studying these settlements and finding a single definition resides in the constant metamorphosis of these areas through time. However, some stages in the formation of these settlements have been identified and generalized for the majority of the settlements.

Unlike formal settlement, the processes of urbanisation of informal take place sometimes simultaneously. Therefore for formal settlements, there is usually a sequential system of urbanisation, plotting of land and edification. Informal settlements develop following a simultaneous system where urbanisation, plotting of land and edification take different forms and happen at the same time within the same area (Giraldez, Calderón, & Peña, 2010). Figure 5 illustrates the different stages and processes of the growth of informal settlements.

- ***Infancy***: first stage where vacant lands are occupied by the first dwellers. These vacant lands are often found in unsafe areas such as river banks, along roads, on hillsides etc.

  Infancy is, therefore, the cause of uncontrolled urban expansion, which is the main problem the city of Lima and many other megacities are facing.

- ***Consolidation***: stage between infancy and saturation. Generally defined by expansion, subdivision, construction of new buildings and sometimes tenancy (Sliuzas, 2008, in Aggarwal, 2017).

The consolidation level generally depends on the following factors (see Figure 4):

- The economic status and the size of the family
- The importance of the street
- The proximity and types of urban infrastructures
- The position from green areas
- The relation with commercial areas

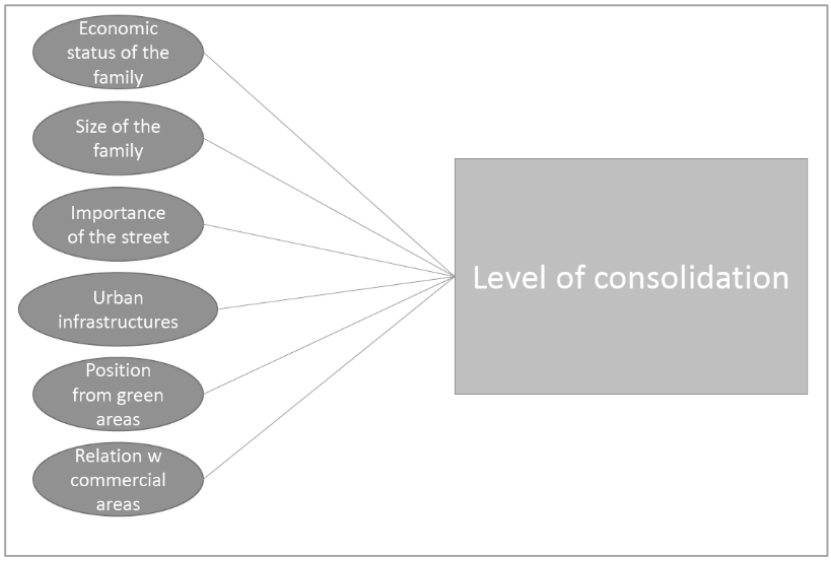

Figure 4: Factors of influence of the consolidation level of informal settlements (Source: Aggarwal 2017)

- ***Saturation**:* the last stage of the development of the settlement since there is no more free ground space. New buildings are filling up the remaining areas. Since the area is saturated, it can sometimes lead to vertical densification, also known as intensification. The saturation point is often characterized by a high population density (Sori in Aggarwal, 2017).

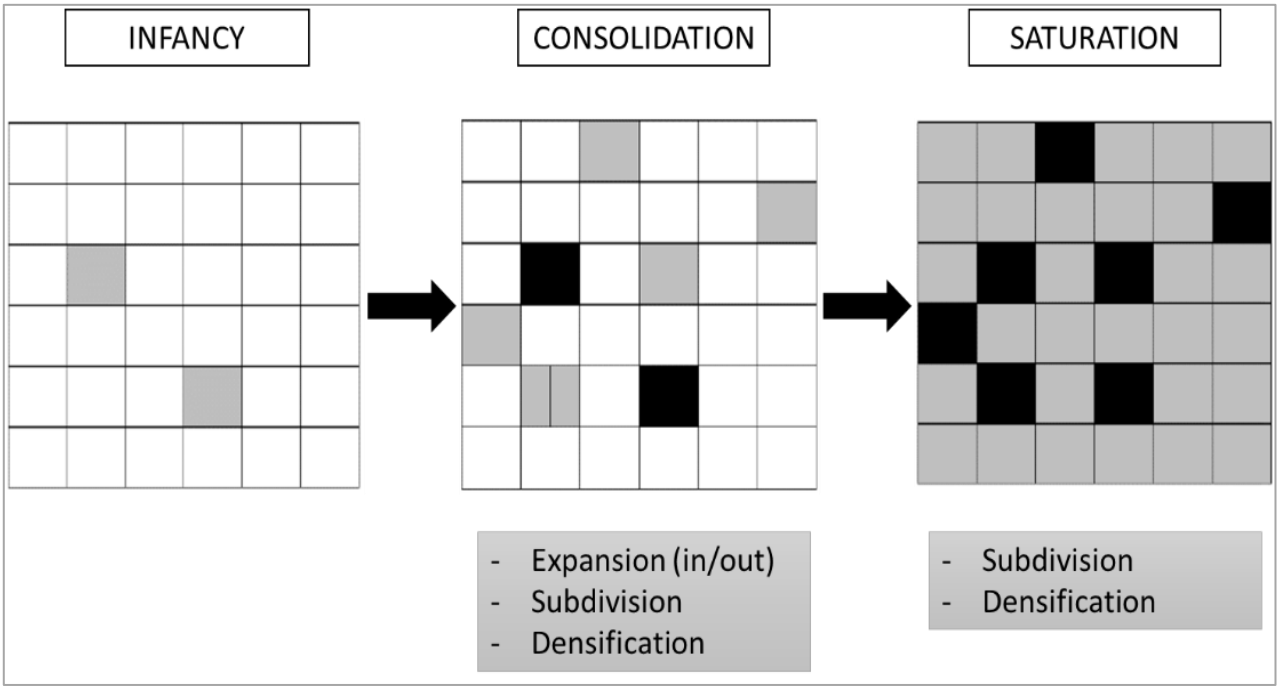

Figure 5: Stages & processes of informal settlements growth (Adapted from Giraldez, Calderón, & Peña, 2010)

1.1.5.2. *Processes of informal settlements growth*

Likewise some stages of the development of the IS can be identified, the coincidental means of that development/growth can also be identified. Between the different means of growth, three of them are distinctive and illustrated in Figure 6.

- ***Expansion***: the main feature of this process is the augmentation of the size of the IS. It can take place toward the centre of the settlement, independently from it but most of the time takes place outward.

- ***Densification***: the process of densification leads to the infilling of vacant spaces within a defined area. It is typically characterized by an increased roof coverage area. The terms of *population density* and *residential density* are commonly used to describe this process. In this work, we will also use these terms but we will use the term *urban density* instead of *residential density*.

- ***Intensification***: process where vertical increment takes place in the defined area, often when it is already filled. It can take place simultaneously with densification i.e. the increase in floor area ratio (Aggarwal, 2017).

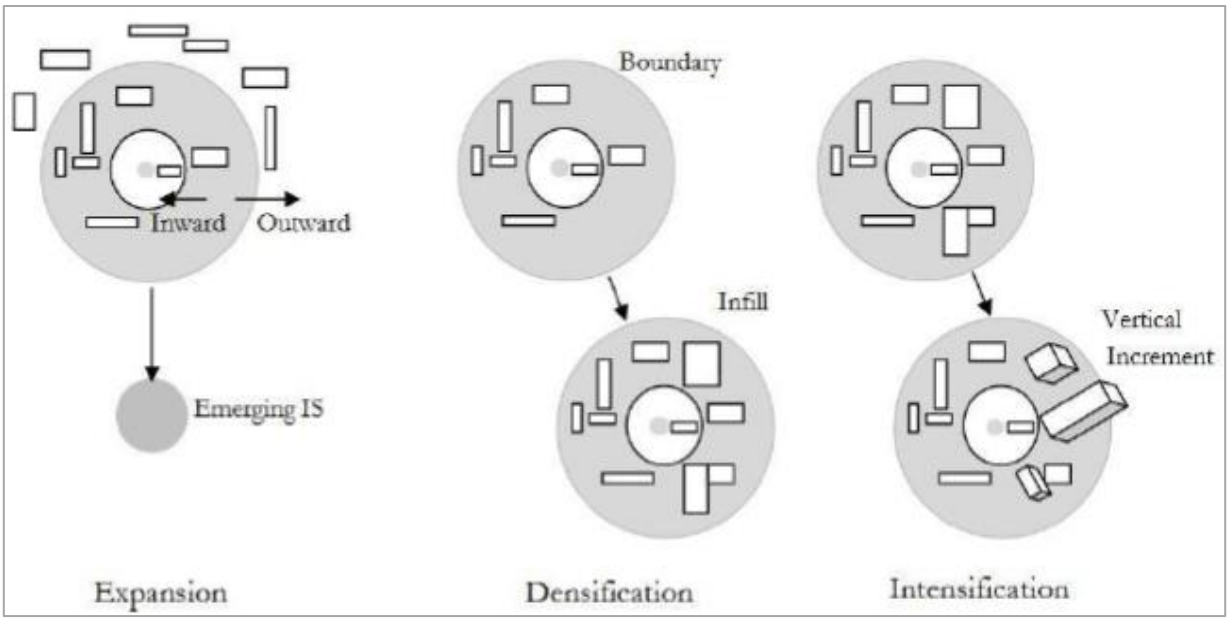

Figure 6: Concepts of INSE expansion, densification and intensification (Source: Aggarwal, 2017)

These stages and means of informal settlements development are, most of the time, unplanned and uncontrolled. Which is the reason for the general lack of public infrastructures in these settlements.

What will be analysed in this work are the means of intensification and especially the mean of intensification since most of the analysed area is already urbanised with no more vacant space. The impossibility of building in other places therefore leads to a vertical development of the building. It is important to note that some of these stages and means can happen simultaneously in the same neighbourhood. Indeed, the intensification can take place at the same time as a physical consolidation, which is the case in the studied area. As we can see, the terms used to describe the means and stages can be similar and lead to confusion. This is why when talking about urban densification, we will be talking about the means of intensification in the stage of saturation explained here above. For the reason that the analysed area of the study case of Vallecito Alto is already saturated and is going through a process of intensification, or densification in this work.

1.1.5.3. Process of internal densification at the housing level

In addition to the process of urban expansion, the process of internal densification is characteristic of informal settlements. Most of the time, the growth at the scale of the dwelling takes place in two stages: the horizontal growth where the original house grows to occupy the whole lot, and the vertical growth where the dwelling increases in the number of floors, building extensions, from 1 to 6 floors (Giraldez, Calderón, & Peña, 2010, p. 104). In this work, we will be talking about the urban densification, and more specifically about the vertical incrementation known as *intensification*. Where intensification is understood as a process of vertical incrementation within a defined area.

1.1.6. Other concepts

1.1.6.1. Megacities

Megacities are usually defined as large metropolitan areas or conurbations with a total population of over 10 million inhabitants (UN DESA, 2018). Other sources use the criteria of a minimum of 5 million inhabitants with a population density of 2000 people per km². In this work, we will use the most common definition of a metropolitan area of more than 10 million inhabitants, used by the UN. Note that some synonyms like megalopolis or megapolis are also used to describe the same concept. According to UN DESA (2018), Lima is counted as one of the 33 megacities in the world in 2018, as well as other cities in Global South.

1.2. Conclusion of the state of the art

In conclusion, this whole section dedicated to the concepts of urban densification, urban sprawl, informally and the general ways informal settlements grow gives an overview of what exists in the literature. It also shows a clear lack of constant methodology, common definitions and ways to measure, quantify and analyse the growth of these informal settlements, especially when it is about the densification process. Thus, it leads us to some further questions about the densification itself, which is still a bit unknown. By looking at the dwelling level, what influences the vertical densification? How is it related to the urbanisation dynamics of much bigger levels like the metropolitan level? We could also ask, by knowning what has already been done on the subject, how can vertical densification be measured in informal settlements?

II. METHODOLOGY

This section focuses on the methodology and the multiple approaches applied for this research. A first explanation will be given on the overall methodology, followed by a justification of the choice of the studied area. After that, more detailed explanations on each approach, scale by scale, will be done. Finally, the the limits of this applied methodology will be exposed.

2.1. Overall Methodology

The literature review gave us a broader idea of the subject of urban densification and informal settlements. It also gave a better idea of the subject by setting the existing theoretical frame. It results that quantifying and qualifying densification in informal settlements is very difficult for various reasons such as the accessibility, the lack of coherent data etc. Very few works focus on the densification itself. Most of the literature focuses on the spatial expansion, which is more easily measurable through satellite and aerial views.

Therefore, to collect a maximum and reliable data on the subject of urban densification in informal settlements, the methodology of this research consists in a combination of different approaches. All these approaches bring their specific kind of information at different levels, which will be discussed to affirm or invalidate various hypotheses and understand the overall processes of densification in this kind of informal settlement.

The approaches will be applied at a decreasing scale from the metropolitan level of Lima Metropolitana, in order to understand the urban and demographical dynamics and understand the overall structure of this megacity. After understanding the urban processes and gathering the data at the scale of Lima, a similar approach will be done at smaller scales like the one of the Villa Maria del Triunfo district and finally the one of the Vallecito Alto settlement, located itself in the José Carlos Mariategui sector of VMT (see Figure 7). At each level of the analysis and data collection, different maps (i.e. topographical, functional etc) will be analysed, and data from the INEI censuses and literature will be retrieved.

From the metropolitan to the settlement level, we will mainly be interested in the most recent-in-time data. Indeed, the two last main official censuses realised at the national level were the national censuses from 2007 and 2017, made by the INEI. We will therefore aim the investigation and the data collection for that period since it will bring us the most recent and reliable data.

Finally, to add the complement of information about the densification, not found in maps, literature and censuses at the level of the settlement, we processed to some fieldwork. The fieldwork consisted in online surveys, interviews and visual comparison in the Vallecito Alto settlement. While the surveys and interviews added qualitative information to the already collected one (in the census, maps and literature), the visual comparison was purely looking at the housing typology, since a sample of 414 houses in the settlement was analysed. The whole methodological process of the research is illustrated in Figure 8.

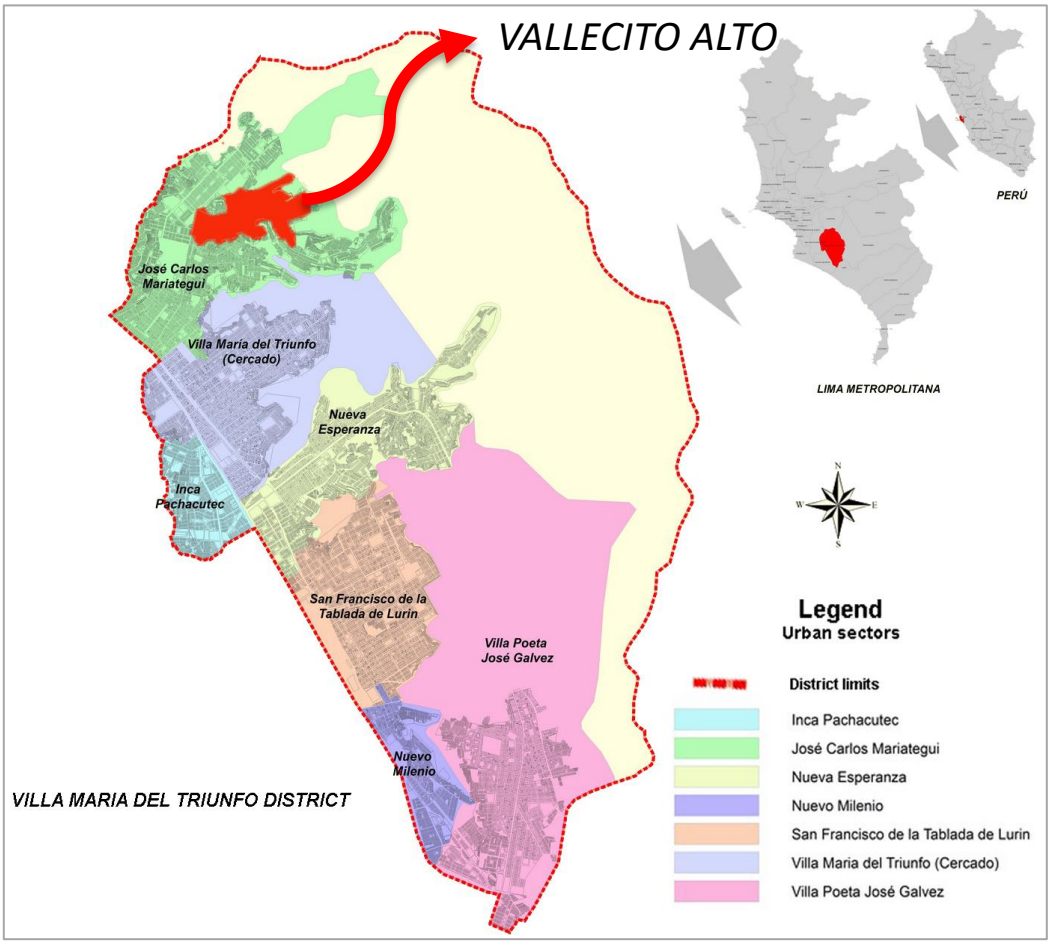

Figure 7: Map of the sectors of the Villa Maria del Triunfo district (Source: Municipalidad de Villa Maria del Triunfo)

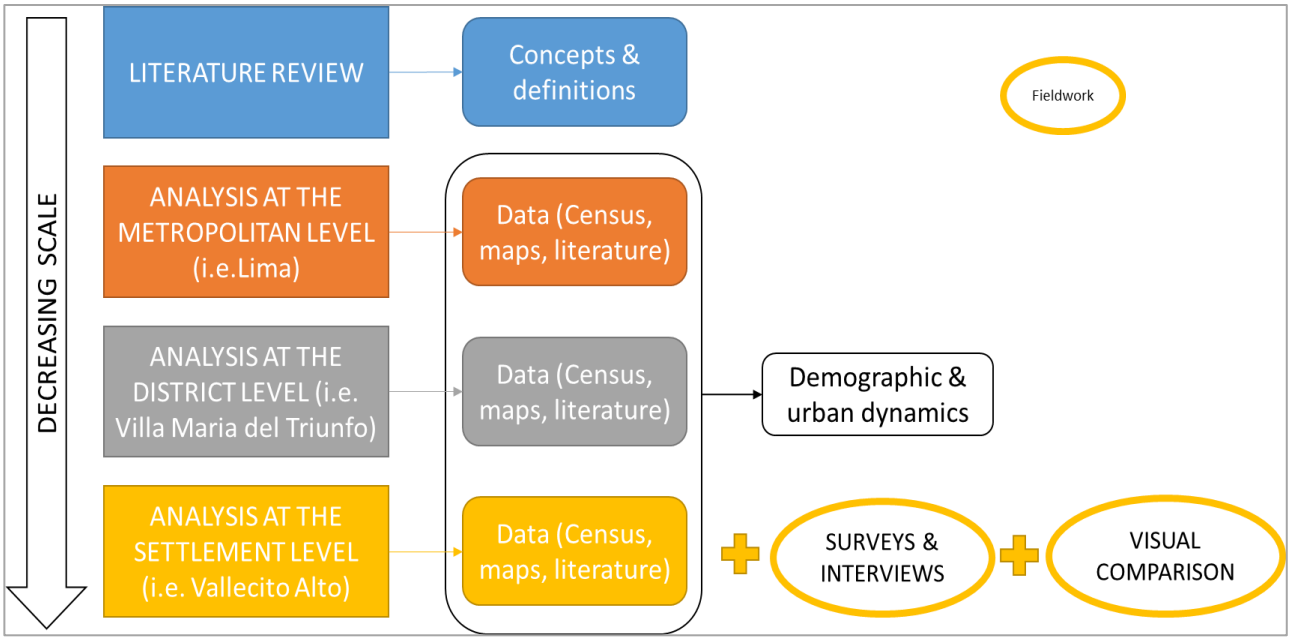

Figure 8: Overall methodology

2.2. Choice of the studied area

The study case is located in the urban area of Lima, in Villa Maria del Triunfo, one of the districts of Lima-Metropolitana (see Figure 7). Among all the districts, we chose the district of Villa Maria del Triunfo and more precisely the settlement of Vallecito Alto as a study case. Vallecito Alto was chosen as the study case for this research for specific reasons (contacts, urban development, characteristics of informal settlement etc). Other studied areas could have been chosen for reasons such as the biggest rate of growth of the population, the most densely built area, the district where some publics project have been built and the effect of these projects on the densification, the analysis of the transport system, the topography, the social factors and many others. Despite these reasons, the study case of Vallecito Alto was chosen for the following ones:

- It corresponds to the features of an informal settlement

The settlement of VA corresponds to the characteristics of an informal settlement (from the physical and legal viewpoint) since some areas of this settlement have difficult access to public services such as water, gas, electricity etc. Many buildings are built with poor quality materials, have poor architecturally developed spaces. On the legal viewpoint, the neighbourhood is exposed to land traffic and urban invasion (for example in the Lomas nature reserve). Leading therefore to informality since some lots/buildings are not legally recognized and registered.

Moreover, it is a representative neighbourhood similar to the ones that can be found in the majority of the periphery of Lima. Therefore, it can be considered as a representative sample of informal neighbourhoods that can be found in Lima. However, as said in the state of the art, informal settlements can be very difficult to analyse. Thus, note that the case of VA could only be extended to the city of Lima since the development of informal settlements in other countries could be driven by other factors such as other laws, cultures, architecture, climate, topography, economic reasons etc. Regarding the definition of informality, Peruvian people consider these neighbourhoods as “informal” because most of these habitations have not been built legally, therefore referring to the “legal” definitions of informality.

- Most of the neighbourhood is already consolidated and follows a densification process

As it will be seen later in the analysis at the scale of the district and the settlement, Vallecito Alto is a neighbourhood which has already been urbanised more than 40 years ago, especially in the lower part built in the 70s/80s. Even if the process of urban sprawl is still taking place in Vallecito Alto, most of the neighbourhood is already saturated and susceptible to intensification. The settlement is in the middle of an urban intensification process, which means that there is no more empty plot to build and the urban tissue is growing verticaly. Thus, Vallecito Alto provides an interesting case to study the process of urban densification.

- Scale of the study

This study was concentrated in the neighbourhood of VA because the district of Villa Maria Del Triunfo was too big to be analysed since the district of VMT has around 400 000 inhabitants for a surface area of 7057 ha. This area was too big to cover so the studied area had to be smaller to realise the fieldwork since not enough time and data were available.

Moreover, the study case of VA has different zones. The lower part built in the 80s and a more recent part from the 90' until nowadays. Therefore, it was interesting to focus on the lower part since it was already consolidated and more prone to urban densification.

- Corresponds to interesting data

After analysing the population growth at the scale of Lima, the district of VMT has a positive rate of growth of the population of 10% between 2007 and 2017 (Instituto Nacional de Estadistica e Informatica, 2017). While central districts such as La Victoria or Lince have a negative rate of growth of population, other peri-urban districts such as Lurin or Punta Hermosa have a positive rate of growth (higher than VMT). However, VMT still has a positive rate of growth. Therefore, it was interesting – in addition to the other reasons- to analyse the different factors related to the urban densification and increase in the rate of growth of the population of the district.

- More information and documents about the settlement at the CIAC

A choice had to be made between the district of San Juan de Lurigancho and VMT because these were the two districts for which the CIAC had contacts and data. Since a lot of work had already been done on other districts like SJL, the analysis of VMT was interesting to bring new samples and new investigations about the subject of densification of informal settlements.

- Contacts on site

In the context of this thesis, contacts onsite were necessary to get accompanied onsite, share data and explanations about the life in the neighbourhood. Besides, having contacts onsite helped to get some specific data faster. The main contacts were the members of the CIAC and the local parish priest, who lives and knows a lot about the neighbourhood itself.

2.3. Methodology scale by scale

2.3.1. Analysis at the metropolitan level – Lima

After setting the theoretical frame, the goal was to understand the functioning of the urban processes at the metropolitan level of Lima. This part of the work implied the analysis from different sources of information.

The first source of information for the metropolitan level was the literature that helped us to learn more about the history of Lima, its urban dynamics and contextualize the metropolitan area, understand its urban structure from other authors.

The second analised sources of information were the INEI data and other official data sources from the CIAC. The collected data at the level of Lima was synthesized in order to later relate it to the spatial analysis and the study case. Within this data analysis, demographic and urban processes were highlighted for the different districts of LM, including the district of Villa Maria del Triunfo which will later be analysed in the same way.

The other analysed source was a bit different from the previous ones since it consisted in a spatial analysis of maps of Lima Metropolitana. The analysis of these maps were

most of the time corresponding to the INEI data of the population and the urbanised area. This analysis was mainly focusing on the demographic growth, the urban densification and was made using: Google Earth, Google street map, topographic maps, maps of the CIAC, all of them at the level of the metropolitan area.

This first analysis at the level of Lima Metropolitana allowed us to establish several hypotheses, define some trends at the level of LM, which will later be discussed. Thanks to these hypotheses and after some discussions with the CIAC members and the promoter, the study case area was chosen for the previously listed reasons.

2.3.2. Analysis at the district level – Villa Maria del Triunfo

The second approach was made in the same way as the metropolitan level approach, by analysis of different existing sources of information such as literature, official data and maps. Fewer official data and information were found at the level of the district (even less at the level of the VA settlement). This is why, even if the approach was similar to the metropolitan level one, different types of maps and data were found and processed.

The analysis at the district level allowed us to understand the general trends of urbanisation of the district and allowed us to have a general overview of the kind of housing and settlements encountered in the area. This approach highlighted the differences that exists among the different districts of LM. Indeed some districts have different urban policies, different levels of consolidation and different levels of informality. The district not only differs by its characteristics but also by its available information. Unlike some more recently urbanised and consolidated districts like Miraflores, which have more accessible and complete sources of information regarding its urbanised area, the studied district of VMT has less accessible and reliable sources of information. Therefore the data collected for the level of the district was mainly from official sources like the Municipality of the Villa Maria del Triunfo district, which had the most accurate data that could be found on the area.

The spatial analysis consisted in analysis of the few available functional district maps. Unlike the LM approach, maps of the demographic and urban growth could not be found.

2.3.3. Analysis at the settlement level – Vallecito Alto

The approaches applied for the other scales were also applied for the smallest scale which is the settlement. Most of the posed hypotheses for the district were extended to the settlement of Vallecito Alto, since it is located in one of the sectors of the VMT district.

The found and analysed maps of the settlement were not up-to-date and had to be modified by onsite visits. The onsite visits gave the opportunity to bring new information and complete the maps, also for the student project of Atelier 5. By doing this overall horizontal map analysis, a few hypotheses were established. The hypotheses were related to the urban densification and expansion of the settlement.

To add complementary data and information (social, economic, configurational, land use) to the existing one, some fieldwork consisting in surveys, interviews and visual analysis was conducted. Therefore, the two first methods of the fieldwork consisted of interviews and surveys. The surveys and interviews of the inhabitants gave an additional and an internal vision and opinion about how the neighbourhood has developed through the years, urbanistically speaking. It also brought new interesting information like the way of living of the inhabitants, the access to basic services and the existence of public infrastructures in the settlement. Most of this information could not always be found in the literature. Thanks to these interviews and surveys, for example, some information such as the fact that a lot of corruption and land traffic takes place in the neighbourhood is a piece of information that cannot be counted since there is no official and legal document to prove it. Other additional information was collected like how the different public spaces are used (especially for the AT5 project, which was a student project where the objective was to design an urban residential project within the study case area). The other method of the fieldwork consisted in a visual comparison of personal pictures taken onsite with Google Street View pictures from 2013, therefore focusing on the typology aspect and bringing it to the settlement level.

The fieldwork allowed to relate the collected data at the level of the settlement with the analysis previously made at the other scales, therefore some answers to research questions were already partially answered as well as it brought some new ones.

Thanks to these interviews and surveys, some hypotheses could be validated and invalidated.

We can note that some changes in the methodology had to be done. Initially, more interviews were planned to collect as much information and data as possible from other actors (experts, members of the municipaly, inhabitants, local leaders etc). On the one hand for the dissertation with well-targeted questions related to it, and on the other hand for the workshop project with more targeted questions on the needs of the users to provide useful additional information for workshop project 5. The pandemic and compulsory quarantine shortly after arrival on-site changed the approaches initially planned for the research. Thus, only an approach via the internet was then possible. First communications were therefore carried out by exchanging emails and messages via the Whatsapp application.

- Online survey

In order to collect the quantitative and qualitative information needed for the research and the workshop project, an online survey ("Google Form") was shared with several contacts on-site, who in turn shared it with other inhabitants, and so on. The online survey was created because video calls with local leaders were not possible because of communication failures and because the survey was an easy way to collect the needed information among the VA inhabitants. Thus, the aim was to get as many people as possible to respond to the online questionnaire. Unfortunately, the response rate to the online questionnaire was relatively low as only 10 people responded, which was not enough to have a representative idea of the population. The questions of the surveys (see Annex 2) were asked to gather information at the scale of the urbanisation of the neighbourhood, especially regarding the vertical growth of the buildings.

- Interviews

In parallel with the online questionnaire, interviews were prepared to identify the needs and habits of service users. While the surveys focused more on a smaller scale of the house and the street, the interviews had the purpose to deepen the research of the survey but at the scale of the settlement. The aim was to carry out these interviews by

videoconference via "Whatsapp" as this was the main means of communication used by the inhabitants of the neighbourhood.

Finally, it was after the first interview conducted by videoconference, due to the lack of time and means available locally, that another approach was considered. Indeed, it was particularly difficult to communicate with the interviewees for several reasons (little network, communication failures, a lot of noise on the interviewees' side, etc.) and the response of the online survey was insufficient. It was therefore almost impossible to carry out an interview under these conditions. I, therefore took the personal decision to go on site, despite the government restrictions. To do so, and fortunately, I was able to be accompanied by a person with an exceptional travel permit. Thanks to this, we were able to go to the site and conduct various interviews (appointments with the people concerned, of various profiles, were arranged in advance).

The interviews, carefully prepared in advance to collect as much data as possible in the minimum delay, were spread over two days of site visits. Optimising the time available was crucial since it was normally forbidden to circulate and dangerous to set up meetings with the interviewees. Meeting times and locations were fixed in advance, with some flexibility in timing to optimise the time spent on site. Interviews were carried out with people with different profiles, i.e. men/women, young/old, local leaders and simple inhabitants. Semi-structured interviews were used. In fact, within the framework of this work, very specific data were necessary to better understand the habits and practices of the local population.

Basic questions, some more closed, some more opened, have been carefully prepared. The questions (see Annex 3) were developed in advance and arranged in chronological order and by theme. Because the questions were relatively open-ended, it was possible during the interview to prompt the interviewees with other questions, sometimes leading to unexpected information or even information of interest for the work carried out. Precisely, 12 interviews were carried out over 2 days, in different places in the studied district of Vallecito Alto (in the home of the inhabitant, in the district parish, in the street), which had a certain impact on the way to conduct the interviews (need to repeat questions due to noise, interruptions by other people, etc.). Each interview was carefully recorded with the agreement of the person with the main ideas

later transcribed (see Annex 4). Personal notes were taken during each interview to add additional personal information (reactions of the interviewee, etc.).

- Visual comparison

The visual analysis of the urban densification will focus mainly on the comparison of the Google Street View pictures taken by the Google Company in Vallecito Alto in May 2013 and the personal pictures taken in June 2020 during the visits of the studied neighbourhood. The comparison of these two periods was selected because they are the closest data, in terms of temporality, to the available demorgraphical and analytical data of the INEI census of 2007 and 2017. Also because, unlike other districts of Lima (e.i. Miraflores etc), the VMT has no proper record of the heights of the buildings, census of the inhabitants, family status etc. From this comparison, several profiles and typologies were defined in order to analyse the urban growth of the neighbourhood (mostly regarding the number of floors, the eventual extensions of the houses and the ground floor functions).

To do that analysis and take the needed pictures on-site, a first methodology was considered; to cover most of the neighbourhood, pictures were first taken from a slow-moving motorised vehicle (by two people, to cover both sides of the streets). After a few attempts, the results were not satisfying since most of the time, the quality of the pictures was very bad and it was not possible to directly locate the pictures on a map. Therefore, the same process was considered but simply by walking, therefore giving time to take, when needed, a step back to take proper pictures. The photographed buildings were localized on a map through the whole process.

Then the next process was to identify and quantify the different housing typologies of the neighbourhood. However, the whole neighbourhood could not be inventoried since some streets were not accessible for security reasons, because they were closed, because of the lack of time to collect the data due to the curfew…and also because the whole neighbourhood was not covered by Google Street View. Figure 9 shows in yellow the covered area of the visual analysis. Therefore, even if the results are representative of the neighbourhood, they are not exhaustive.

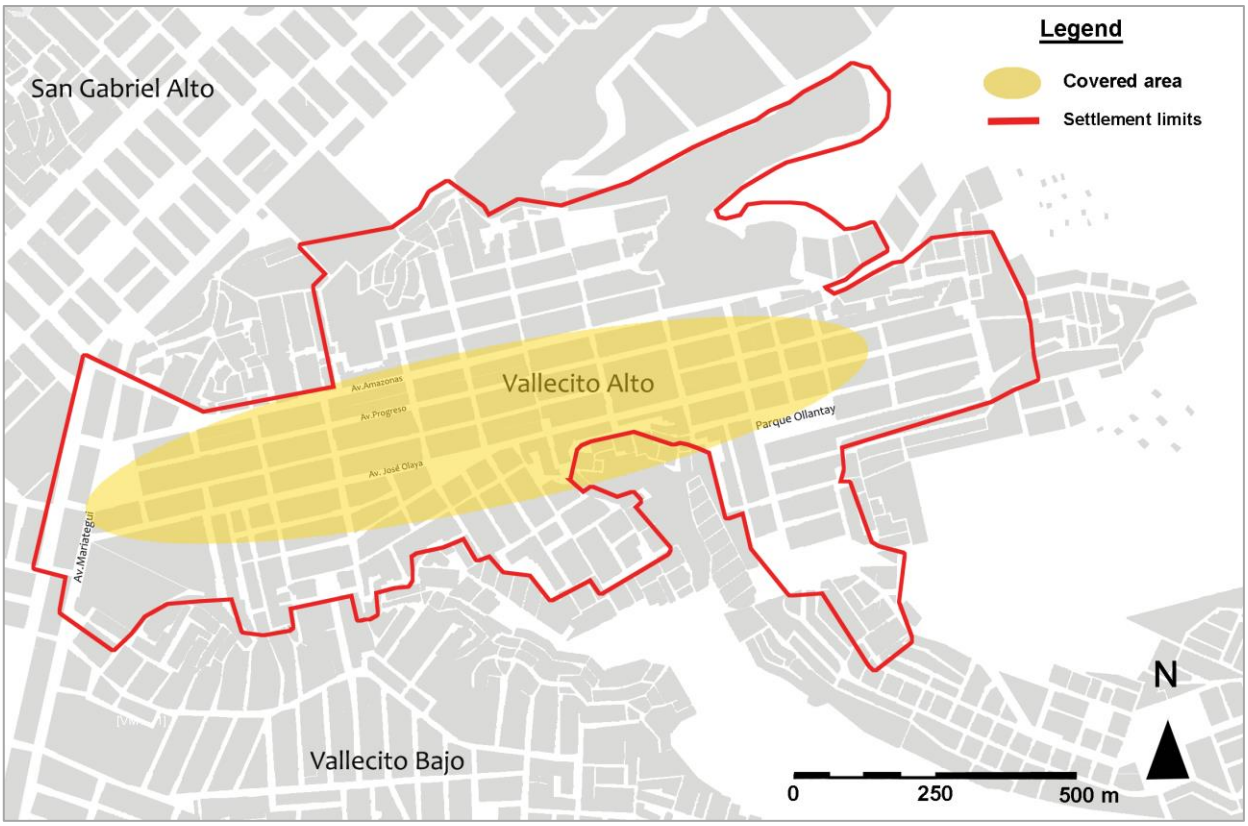

Figure 9: Area covered by the visual analysis (Adapted from Municipalidad Distrital de Villa Maria del Triunfo, 2011)9

2.4. Limits of the methodology and the study

For many parts of this work, hypotheses were posed. To have a more complete work, considering other factors, additional data should be necessary. Thus, the main hypotheses of this work are the following ones:

- ✓ The obtained results will be extended to the study case population since various and representative profiles were interviewed (inhabitants, external people, taxi drivers, youngsters, elders, leaders of the neighbourhoods…).

- ✓ Since the whole study case area was not accessible (physically, no roads, limits of the google street view pictures, safety reasons etc), some parts of the studied neighbourhood will be assimilated to the closest ones. The data gathered in the surveyed streets will be extrapolated to the unanalysed ones.

These hypotheses were posed because the research and data collection at the metropolitan level and at the settlement level were partially limited for the following reasons:

- The language

Despite a correct level of Spanish, the communication with people and the data collection was sometimes difficult to understand and to be familiarised to. Communication and data on the studied area were exclusively in Spanish, leading most of the time to a need for translation or explanation (on my own or with the help of locals). Moreover, the communication with the interviewed people was sometimes difficult for different reasons such as the vocabulary and the accent (the street language most of the time). However, it is important to note that the language was not a complete barrier to the understanding of this project.

- The lack of knowledge and understanding of the culture, urban politics, way of living and building in the study area.

From the arrival in Lima, a time of adaptation was needed, not only to get to know a new culture but mainly regarding the uses and urbanism policies of the country. Most of these notions had to be learned and understood quickly to understand the functioning of the urbanism in Lima. These policies differ from one district to another. It is therefore very difficult to generalize the conclusions made for the studied neighbourhood.

- The time

Time should have been sufficient to gather all necessary information especially for the level of details of this research. For more accurate information and conclusions, more time, more interviews would be necessary. However, in the situation of the pandemic, everything was frozen for several months. Therefore, many meetings, onsite visits had to be postponed or cancelled, slowing down the data collection.

- The limited availability of information

From the previous research in the international literature about informal settlements, it was already known and said that informality was very difficult to measure. This fact was confirmed by searching for information about the studied neighbourhood of Vallecito Alto. Indeed, the sought data of the number of floors, division of the land etc was nearly inexistent in official instances like the municipality of the district of VMT. The data was either inexistent or too old to be used for this work. As an example, many houses of the settlement are not even registered in the informatic systems of the municipality and the city. Even if most of the accessible and encountered data was processed, having a lack of reliable data was making this work even more difficult.

- The access to the area

The access to the area was a restraint to the data collection. Especially during the COVID-19 outbreak. The neighbourhood of the studied area is known to be unsafe and difficult to access. Therefore, it was most of the time necessary to be accompanied by locals or people who knew the place to make any onsite visits. Moreover, the traffic jam, road works throughout the city did not help either to get on site. The roads were most of the time in poor condition and the only possible way to access some parts of the study area was afoot or with the moto-taxis.

- The Covid-19 pandemic slowing down all the data collection, meetings and onsite visits but helped to get some contacts, learn the language, and move with locals who know the place.

In addition to these reasons, the Covid-19 outbreak did not help to collect data and carry out the previously planned meetings and visits. All the previous reasons became a bigger brake augmented by the Covid pandemic. The mandatory quarantine during the stay in Peru blocked the data collection as well as many planned visits. Therefore, a different methodology (online surveys, online interviews etc) was enunciated for the data collection because going onsite was impossible due to governmental and sanitary reasons. The possibility to go onsite during the quarantine was made possible thanks to Peruvian friends who, by chance was working for the municipality of VMT and had

authorisations to get there. Therefore, two visits onsite were made during the quarantine period to take pictures and realize interviews of various profiles of inhabitants, despite the listed restraints (especially quarantine).

III. PERU AND LIMA

To understand the urbanisation dynamics taking place in Lima and the settlement of Vallecito Alto, it is convenient to also understand the urban, political and geographical context taking place in Peru in general. This section is devoted to the geographical, historical, political and climate context of Lima and Peru in a general manner. First, a quick overview of country scale will be done, then a closer one from the same perspectives (geographical etc) at the metropolitan level of Lima. Finally, special attention will be given to the urban context of Lima, especially regarding demorgraphy and its urban development. Thus, this section will mainly be an analysis of the existing data and literature at the national and metropolitan level of Lima.

Figure 10: Coast of Lima (Source: https://www.virtualtrips.io/locations/lima)

3.1. Peru

3.1.1. Geographical and climate context

The Republic of Peru is a country located on the coast of the western part of **South America**. It is directly bordered by **Ecuador** and **Colombia** to the north, by **Brazil** to the east and by **Bolivia** and **Chile** to the south. On the western part, it is bordered by the **Pacific Ocean** (see Figure 11). The country is gifted with a wide diversity, in terms of topography, climate, cultures etc. As well as other South American countries, Peru is crossed by 3 distinct topographical and climatic regions known as *Costa* (the Pacific Ocean coast), *Sierra* (the highlands) and *Selva* (the tropical rainforest). Therefore, like illustrated in Figure 12, Peruvian climate will vary from arid and mild to a tropical climate, passing through temperate and cold climate in the famous highlands of the *Ande*s (LimaEasy, 2015). These 3 areas cover a total of 1,285,215.6 km², covering the whole country.

Figure 11: Map of South America

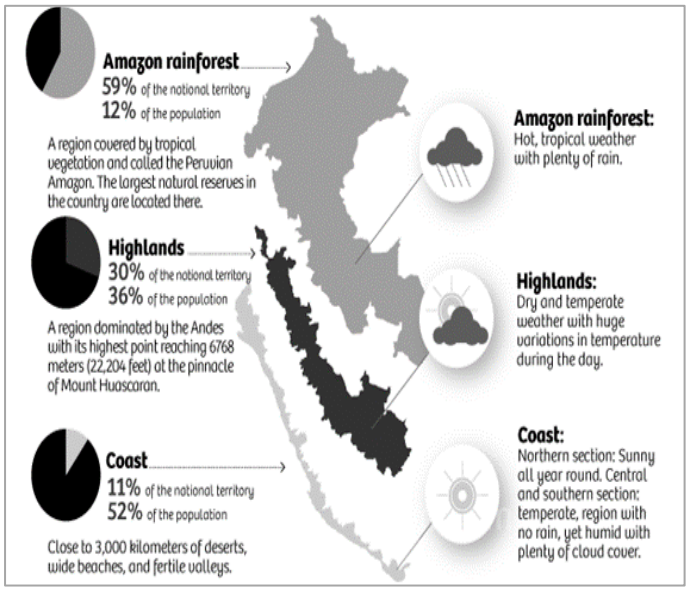

Figure 12: Climatic map of Peru

3.1.2. Historical and political context

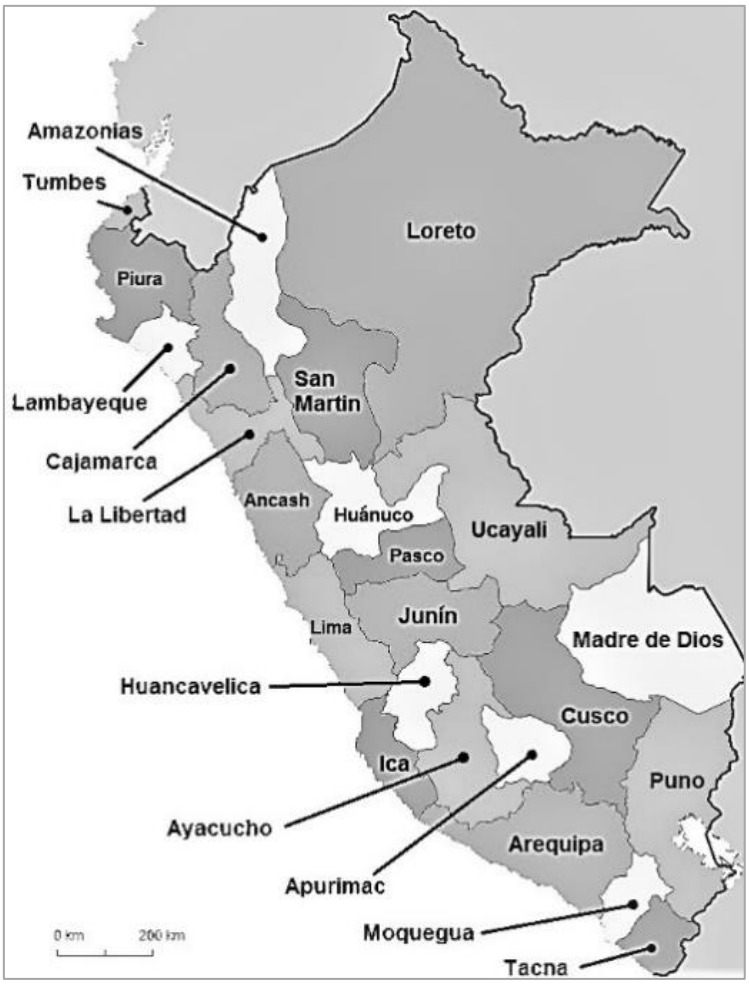

Figure 13: Administrative division of Peru (Source: palomaexpress)

Peru was first inhabited more than 20 000 years ago with several pre-Columbian civilizations like the Paracas, Nazca. Hundreds of years later, most of the country was ruled by the Inca civilization before being conquered by Spanish colonies in the 16th century. At the arrival of the first conquistadors, the Inca Empire stretched from North of Equador to East of Chili. The Inca Empire had the city of Cuzco for its capital. The city of Lima, known at that time as the “City of the Kings”, was founded in 1535 by the Spanish conquistador Francisco Pizarro. During the Spanish occupancy, Lima was considered as the capital city of Peru, which was part of the Spanish empire until its independence from Spain in 1821. Several years after its independence, modern Peruvian political history was subjected to several dictatorships, years of terrorism, bad civilian governments leading to continuous unstable political situation. Even today, Peru is still facing several political problems, mainly because of corruption. After its independence, the urban growth of Lima continued, but the major urban growth took

place in the last 70 years with massive migrations and an uncontrolled urban expansion of the city (Frommer's, 2020).

Today the entire country is considered as a developing country of Global South and is still in a continuous process of development. It is divided into 26 administrative departments (see Figure 13) which are themselves divided into smaller administrative areas called districts. Among these departments, the Metropolitan region of Lima has a particular status since it is the capital city where the economical and political powers of the country are centralized.

3.1.3. Demographical and urban dynamics in Peru

In a general way, and especially in the last 50 yesars, Peru faces a high concentration of urban areas and increasing population in the coastal region, especially in its capital, Lima. In contrast to other South American countries, Peru benefits from a unique coastal leading city were most of the country's population lives in. Unlike other megacities in GS, the concentration of population is quite big in the megacity of Lima compared to other smaller cities of the country. As stated by Moschella (2018), that might be the consequence of the scarcity of arable land in the country and the socio-political dominance of the city of Lima.

The population of Peru constantly increased since 1940 when the first national surveys were conducted. According to the INEI (2017), and as shown in Table 2, the population in Peru has mostly been higher in urban areas than in rural areas in the end of the 20th century. As depicted in the Figure 14, in the last 60/70 years, the urban population has increased as well as the rural population. However, we can notice a trend reversal in the last 10 years, which results in a decreasing rural population while the urban population keeps increasing at a rate of 1,6 %. Unlike the previous years, the last 10 years shows a decreasing population of 27.5% to 20.7% between 2007 and 2017 in rural areas. While the rural population decreased in the last 10 years, the urban population keeps increasing from 72.5% to 79.3% of the total Peruvian population (Instituto Nacional de Estadistica e Informatica, 2017). Following INEI data, Peru was counting 32 131 400 inhabitants in the country in 2019 and a predicted number of 39 million for 2050 (INEI, 2019).

	Population census			Mean rate of growth per year (%)		% of the total population	
Year	Total	Urban	Rural	Urban	Rural	Urban	Rural
1940	6207967	2197133	4010834			35,4	64,6
				3,7	1,2		
1961	9906746	4698178	5208568			47,4	52,6
				5,1	0,5		
1972	13538208	8058495	5479713			59,5	40,5
				3,6	0,8		
1981	17005210	11091923	5913287			65,2	34,8
				2,8	0,9		
1993	22048356	15458599	6589757			70,1	29,9
				2,1	1		
2007	27412157	19877353	7534804			72,5	27,5
				1,6	-2,1		
2017	29381884	23311893	6069991			79,3	20,7

Table 2: Evolution of the urban and rural population in Peru, from 1940 to 2017 (source: INEI 2017)

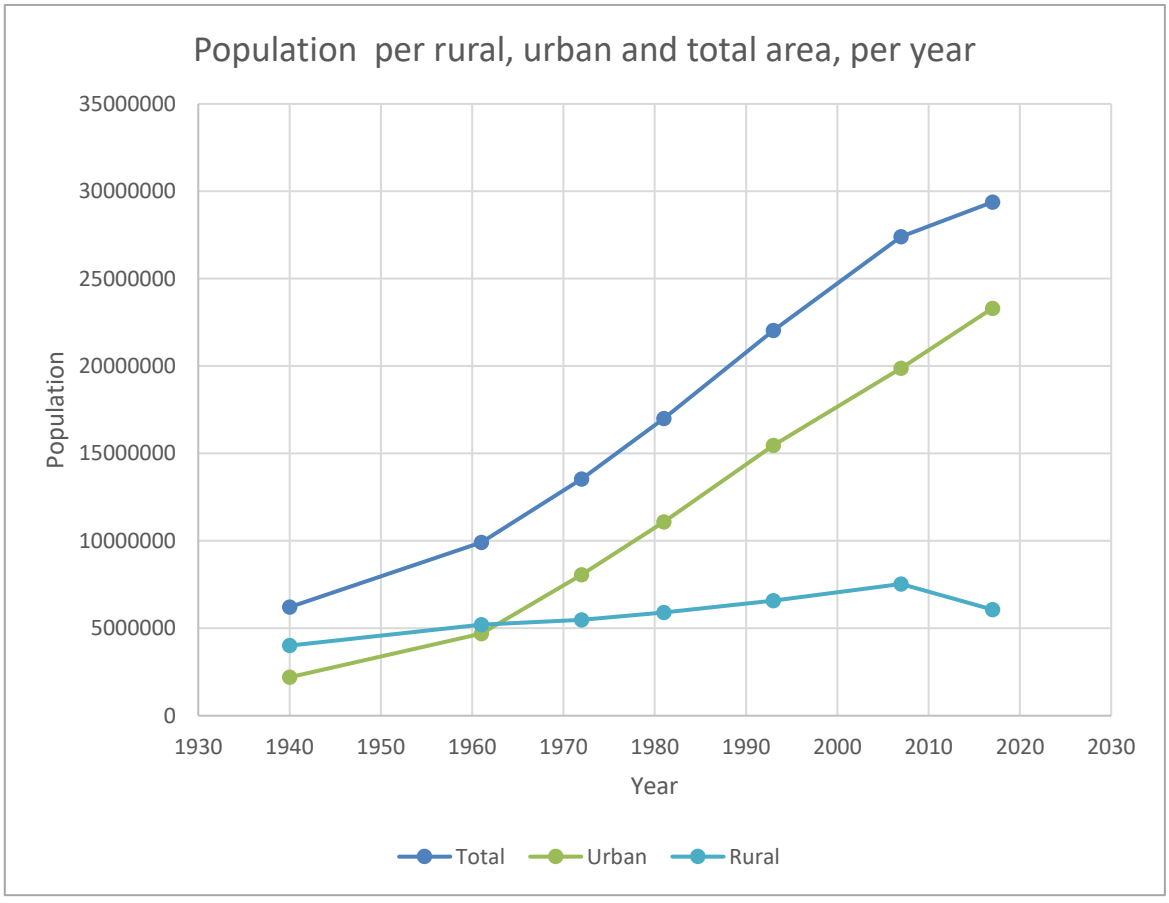

Figure 14: Evolution of urban & rural population in Peru per year (Data source: INEI 2017)

3.2. Lima

3.2.1. Geographical and political context

Located on the central western coast of the country, Lima has an average altitude of 150 m above sea level. It is located between the valleys of *Rimac*, *Lurin* and *Chillón* rivers. The entity of LM is a centre-peripheric continuous urban structure politically divided into 43 districts distributed in several urbanized areas – the Central area, the Province of Callao and the peripheral cones, the Northern one, the South and the East. (See Figure 17). Theses three peripheral sectors mainly developed through self-help processes (Fernández-Maldonado A. M., 2010). Lima from the Spanish occupancy, Lima is considered as the capital and largest city of Peru. Lima is also the capital of the departement of the same name. The entity of Lima Metropolitana includes the Province of Lima and the Province of Callao. For several years and still today, Lima has played the role of economic center of the country, mainly by its strategic location but also by its centrality as a meeting point of transit axes like the Panamerica going from North to South.

In terms of politics, Lima, as well as the rest of the country, underwent several political changes from unstable civil governments to times of terrorism. From the 60s, Lima faced massive population migrations, which can be considered as the cause and/or the consequence of the political and economic instability of the country. Nowadays, more than one-third of the population of Peru lives in Lima.

3.2.2. Mobility

As seen in Annex 5, the city of Lima is crossed by several main roads and highways. The most used mean of transport is the car (taxi or private car). Lima is considered as one of the highest motorized cities in Latin America. Therefore, it generates a high negative environmental impact and problems for urban mobility (CAF, 2016). In order to regulate the number of cars and slow down the number and size of traffic jams, only pairs or unpairs plate numbers can be driven on specific days. Some other environmental-friendly projects have been built and are still on their way. Among them, we can count the Metropolitano fast-line buses (see Figure 15). A fast-bus line crossing

the city and joining different districts avoiding traffics jams (Instituto Metropolitano PROTRANSPORTE de Lima, 2020). Other smaller buses called “combis” also give the

Figure 15: Metropolitano bus line (Source: Instituto Metropolitano PROTRANSPORTE de Lima)

possibility to move around the metropolitan area.

Another more recent and efficient project is the Lima Metro which is a system of urban electric trains passing through different districts. Therefore reducing the time of travel, providing a cheapest and safest way to travel, promoting a new and better socio-economic interaction between the different districts and reducing the carbon footprint. For now, only the line 1 of the Lima Metro system is active, providing a 35 km environmental friendly way to move around 315,000 citizens per day through 11 socially and economically different districts (CAF, 2016, Instituto Metropolitano Protransporte de Lima, 2020).

Finally, in more informal neighbourhoods, the moto-taxi is commonly used, since it is smaller and can deserve less accessible areas. However, it looks like a non-sustainable way of moving because it can only carry 2 to 3 people at a time (Personal observations).

3.2.3. Main problems of Lima

In the context of urbanism and demography, Lima is facing several problems, which are the direct consequences of this rapid and unplanned urban growth. Most of these problems are connected and have a direct incidence on each other.

The first one is the rapid population growth in itself, due to the growing birth rate and migrations from the inner lands as well as from other countries such as Venezuela. Peru and especially Lima, is facing a population growth. The main growth took place in the 60s with massive migration from the inner lands to Metropolitan Lima. The major population growth issue Lima is facing nowadays is the migration of more than 860,000 migrants from Venezuela.

The other main issue, closely related to the rapid population growth, is the rapid and uncontrolled urban sprawl, which mostly takes place in the form of informal settlements. As it will be explained later on, the urban expansion usually takes place in poor quality areas, in the form of land invasions (see Figure 16). This urban expansion results in undeveloped or even missing adequate urban infrastructures, increasing poverty, social inequalities, un-and underemployment. At the metropolitan scale, it induces difficulties to connect different parts of the city, in terms of public transport and basic services (water, electricity etc). In a general way, there is a clear lack of space for public accommodation and public infrastructures, mainly because of the topography which limits the urban expansion (location in a valley, bounded on the west by the Pacific Ocean, on the east by the Andes).

Figure 16: Land invasions in Vallecito Alto

The urban expansion, rapid population growth and lack of rain in the region have direct environmental consequences such as heavy air pollution due to heavy traffic without proper public transport system, destruction of local fauna and flora, social segregation etc. One of the main causes of this uncontrolled urban planning is also the lack of

coherence of urban policy. Indeed, Lima is divided into 43 separate districts, each with its own mayor and municipality, therefore making joined decisions very difficult.

3.3. Urban and demographical development of Lima

3.3.1. Urbanisation of Lima Metropolitana - Metropolitan dimension

During the growth of modern Metropolitan Lima, two parallel processes appeared. One considered as formal, led by the real estate market, and the other one more informal.

The modern urban development of the city of Lima really started in the 50s when the axes of the urban growth of the city were influenced and defined by a few important families, private urbanisation companies, leading the business of the city urbanisation in the Lima-Callao-Chorillos triangle. The process of con-urbanisation in the Lima-Callao-Chorillos triangle and the occupation of the residential districts were mainly embraced by formal real estate market. In addition to this development, some other less important state programs took place in various less-commercial value neighbourhoods. Therefore, the growth of the legal part of the city in the 50s was mainly the result of a formal real estate market where social groups and classes occupied land depending on their economic capacities, according to Calderon (2004) in Municipalidad distrital de Villa Maria Del Triunfo (2011).

On the other hand and at the same period, a general trend toward the urban expansion of illegal settlements occurred. These “illegal cities/neighbourhoods” mostly arose from illegal means such as land invasions, progressive occupations and sub-standard rentals, mainly by population with few resources. Within forms of illegal invasions, two different forms of illegal occupation could be identified;

- Informal settlements developed in a more **organized way**, in the form of lanes, fences and subdivided houses.
- Informal settlements where **overcrowding** and **overpopulation** prevailed.

Most of these invasions, informal settlement were located in the popular working-class districts (such as El Rímac, La Victoria and Callao etc), on hillsides (San Cosme etc),

riverbanks of the Rimac river and wastelands of the periphery of the Lima-Callao-Churillos triangle.

zBetween 1960 and 1980, Metropolitan Lima witnessed its main extension of informal settlements, which was socially considered as the dominance and ascendency of informality (De Soto in (Municipalidad distrital de Villa Maria Del Triunfo, 2011). These new extensions gave birth to the so-called “Conos” of Lima (see Figure 17 and Annex 6). This rapid growth of informality and urban sprawl was mainly the consequence of the new amnesty law passed in 1961 and the rapid population boom of the 60s, 70s and 80s. First, the amnesty law passed by the State in 1961 involved granting property titles to land invaders. This amnesty therefore triggered new and massive land

Figure 17: Map of Districts & Cones of the Metropolitan Region of Lima (Source: INEI 2017)

invasions, even though the same law expressly prohibited them. In 20 years, approximately from 1960 to 1980, the Lima population more than doubled, increasing from 1,845,910 to 4,608,010 inhabitants.

Finally, from the 90s until current days, the spread of Metropolitan Lima switched from the older and middle-income areas to the rapid densification of the central area known today as Miraflores, San Isidro etc. and the urban sprawl in the southern cone (mostly vacation houses).

For several years in the 50s, the Northern Cone (the districts of Coams, Los Olivos, Independencia etc) was considered as the most densely populated part of Lima, mainly made of informal settlements. During that period, the Northern cone constituted 36% of slum settlement, for 1.5 % in Southern cone (mainly VMT at that moment). It is with the invasion and the activation at the end of the 60s/beginning of 70s of urban centres of some settlements such as José Carlos Mariategui and El Cercado that the balance of slums percentage started to change. At the same time, the creation of new administrative districts such as Villa Maria del Triunfo in 1961, Independencia in 1964, San Juan de Miraflores in 1965 etc. supported the urban improvements of these neighbourhoods that we know nowadays. As a matter of fact, the percentage of Lima informal settlements' population went in the Northern cone from 34.3% in 1972 to 25% in 1993. Whereas in the Southern cone, the percentage of Lima informal settlements' population rose from 25.7% in 1972 to 31% in 1993. The rest of the slums population mainly increased in the Eastern Cone were an important development took place in the 80's in San Juan de Lurigancho (Municipalidad distrital de Villa Maria Del Triunfo, 2011). Nevertheless, the Southern cone (Lima Sur) kept until nowadays, its superiority as disposal for informal settlements and poverty, especially in the 21st century. This reversal in the Northern and Southern cone was mainly influenced by the establishment of Villa El Salvador (which was part of VMT) in 1971.

Unlike the development of informal settlements until the 90s where very large suburbs were formed, mostly supported at that time by the state, the growth of informal settlements nowadays has changed. Indeed, the growth of these new settlements is now characterised by the invasion and occupation of poor-quality, inhospitable lands on hillsides in the outskirts of urbanised areas (i.e. VMT, San Juan de Lurigancho etc.). Whereas bigger neighbourhoods, developed around urban centres on better-quality

lands, were formed before the 90s, the new settlements are less populated. Most of them count between 100 to 200 plots and are established through extensions on hillsides (see Figure 16). The State no longer supports the development of these settlements and so, invasions propagate quickly (Calderón, 2005, in Municipalidad distrital de Villa Maria Del Triunfo, 2011).

3.3.2. Urban expansion

The urban growth of the city considers all the actual occupied lands that were not part of the urban entity before. Figure 19 depicts the urban growth of LM from 1981 until 2017, also considering the density of population per district. This map clearly shows the proportions of urban expansion.

In terms of numbers, the total urbanised area of LM (including Callao) in 2007 was 66,325 ha while in 2017 it reached 88,223 ha (CIAC-PUCP, 2020). Without the Callao region, the urbanised area was 58,777.37 in 2007 and 79,138.43 in 2017. The values we will be using in this section are the values for LM without Callao. The positive rate of growth of urbanised area within these 10 years is 34.64, meaning the urbanised area of Lima nearly increased by one-third. This positive rate of growth means that LM underwent a urban expansion.

Among all the districts of the metropolitan region of Lima, the peripheral districts like Pucusana, Ancon, San Juan de Lurigancho, Villa Maria del Triunfo are the ones facing the biggest urban expansion with positive rates of growth going up to 364 between 2007 and 2017. Naturaly the inner districts like Brena, La Victoria do not have any increase of the urbanised area since these are districts which are surrounded by other already urbanised and consolidated areas. We can therefore see that the peripheral districts are still in a process of expansion while other, more central districts, do not expand anymore (CIAC-PUCP, 2020). Figure 18 shows the districts facing the biggest

positive rate of growth between 2007 and 2017. The other districts not represented on Figure 18 have a rate of growth of urbanised area equal to 0.

Therefore, most of the urban expansion of LM takes place in the peripheral districts which have a positive rate of growth of their urbanised area, which is logical because these are the districts where landspace can still be filled with buildings.

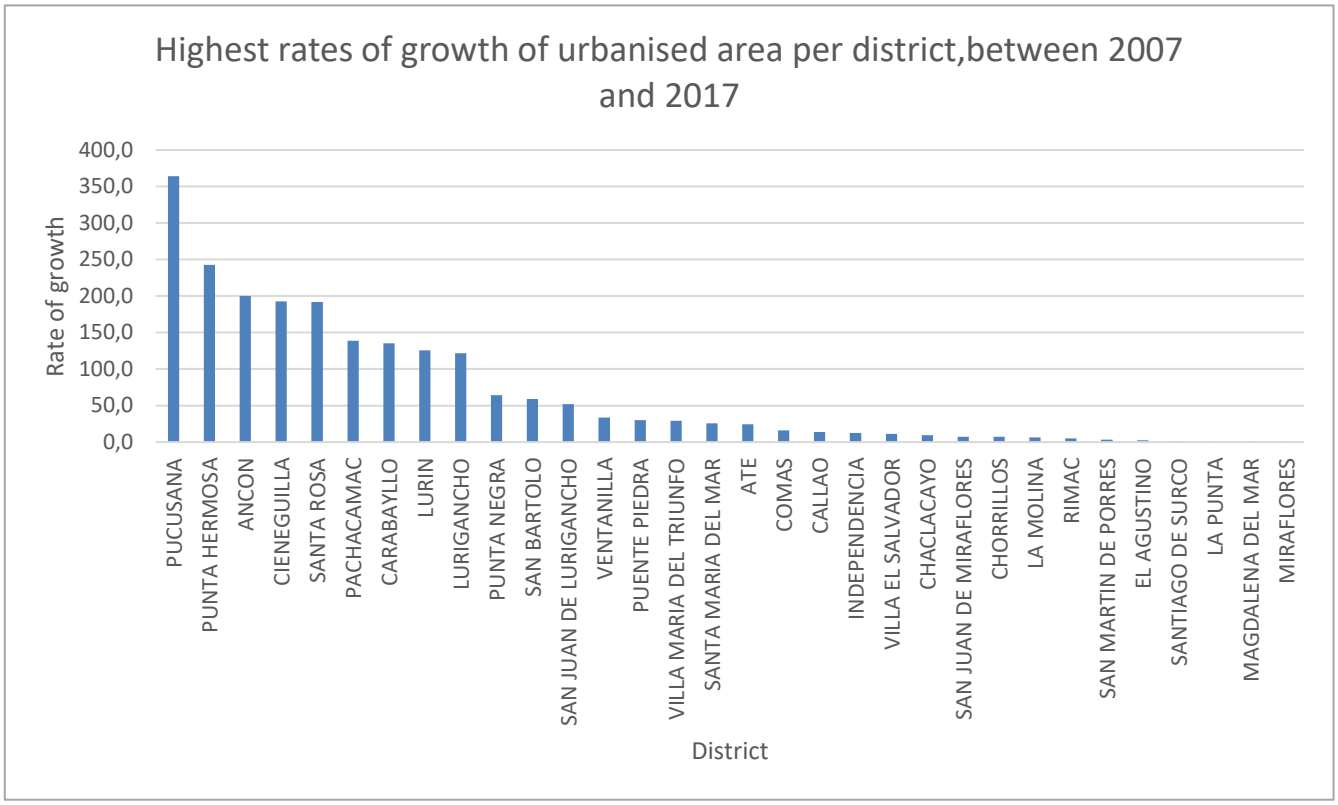

Figure 18: Highest rates of growth of urbanised area per district, between 2007 and 2017 (Data source: CIAC-PUCP)

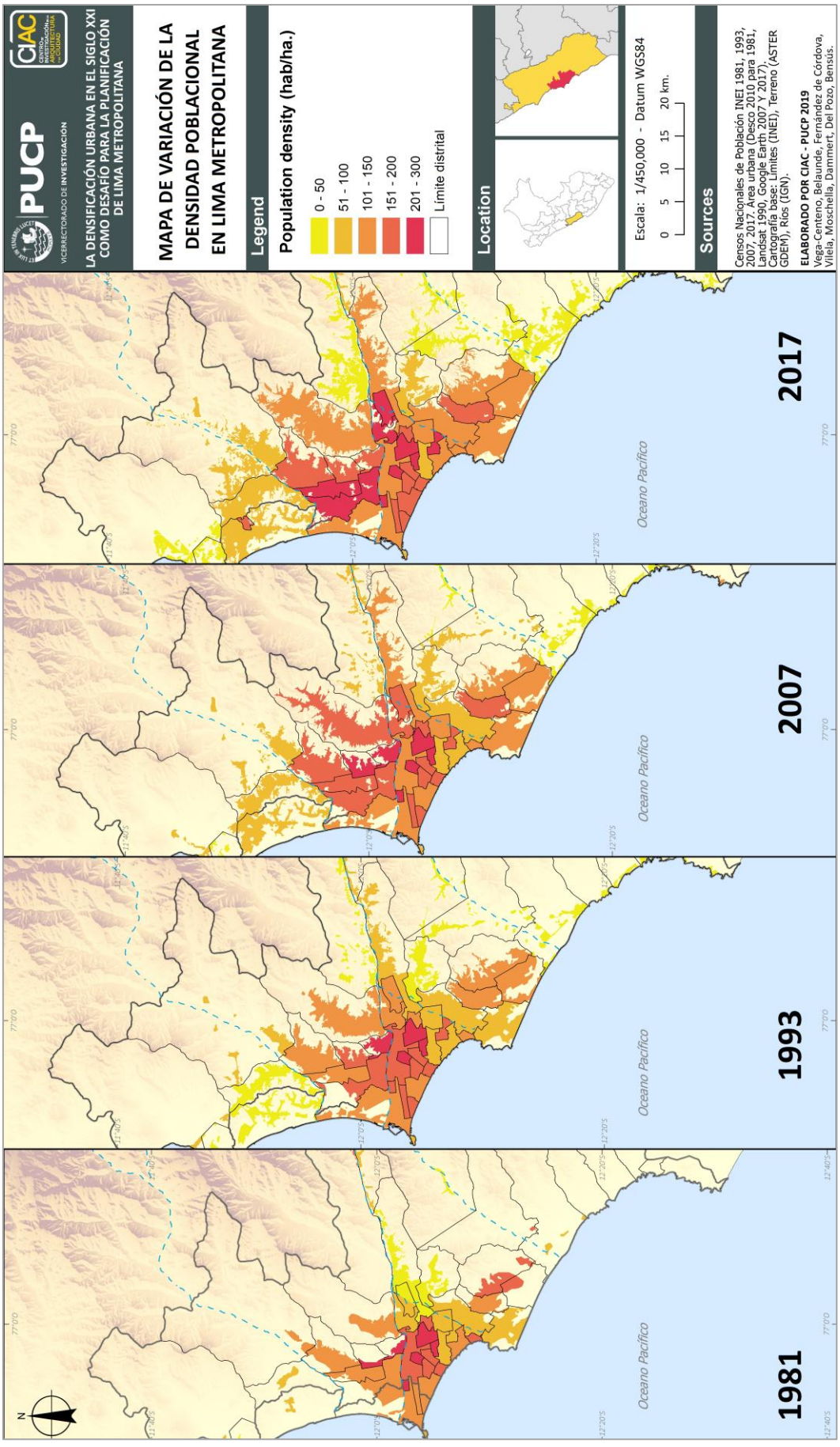

Figure 19: Map of the variation of the population density in Lima Metropolitana (Source: CIAC-PUCP)

3.3.3. Demography

Since its birth, the population of Lima has not stopped rising and continues rising (see Table 3. In 2019, the population of LM was estimated at 10,580,900 inhabitants, making it the 5th most populated city in South America and the 4th largest city in South America (INEI, 2019). Figure 20 shows the evolution of the population from 1981 until 2017 in the different sectors (cones) of Lima. As shown in that Figure 20, we can see that the population in the historic centre and the richest districts such as Miraflores, Barranco etc, forming the cone "Lima Centro", decreased (in absolute and relative terms), while on the other side, the population in the 3 other cones increased. These trends coincide with the population growth trends at the national level. Indeed, as there is a decrease in the rural population, there is a huge population shift from rural areas to urban areas like Lima. We will try to analyse later the causes and consequences of these evolutions.

Year	1981	1993	2007	2017
Number of inhabitants	4608010	6345856	7605742	8574974

Table 3: Evolution of the population of Lima Metropolitana, for the years 1981, 1993, 2007 and 2017 (source: INEI)

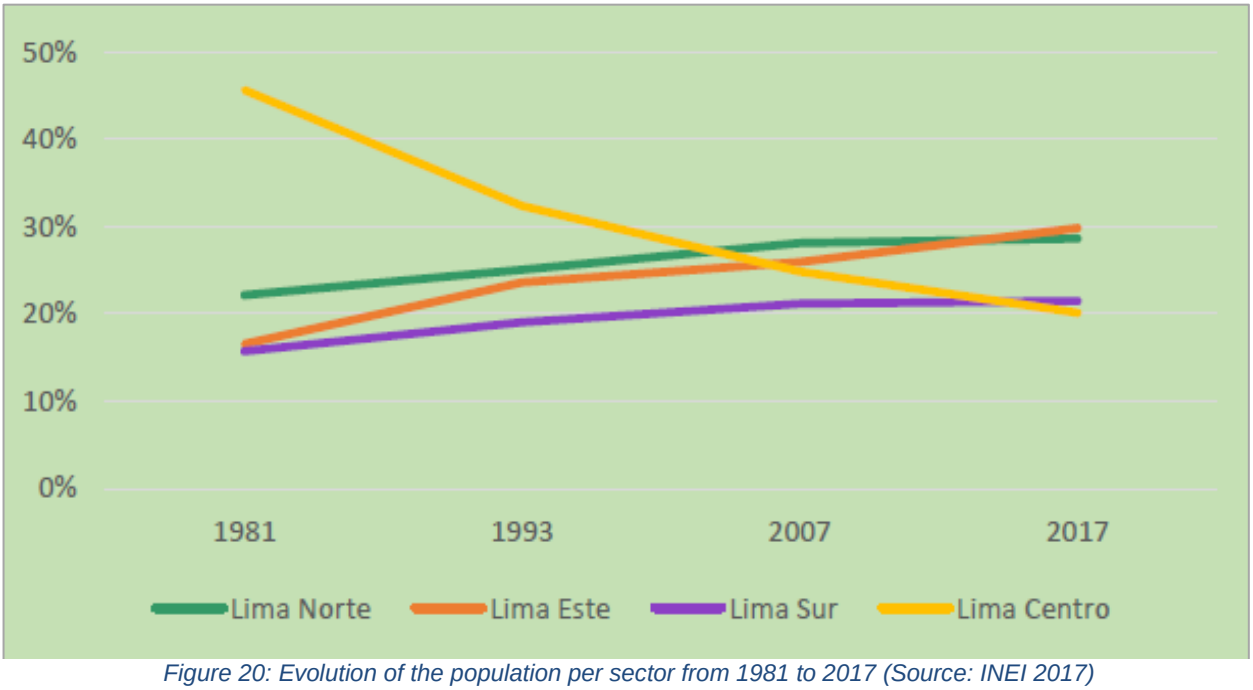

Figure 20: Evolution of the population per sector from 1981 to 2017 (Source: INEI 2017)

The urbanisation is still in an expansion process nowadays, especially with new types of migrations like the Venezuelans ones. Indeed, according to the UNHCR, due to political, social and economic crisis in Venezuela in 2015. Since 2015, massive migrations of Venezuelans took place in Peru, especially in the Northern part of Peru and in Lima. In 2019, the number of Venezuelans living in Peru is estimated at 860,000. These migrations also have a non-negligible impact on the urbanisation processes where the refugees settle, like the outskirts of the Metropolitan area of Lima, most of the time settling illegally (UN Refugee Agency-UNHCR, 2019). The migration of Venezuelans is part of the various migration waves and other reasons leading to the actual urban expansion of LM as listed in Table 4 by Instituto Metropolitano de Planificacion (2017).

Evolutions of the urbanisation processes and migrations in Peru according to factors (period: 1940-2007)		
Period	**Percentage of urban population**	**Factors of the urbanisation process**
40s	1940: 35%	• Agricultural crisis resulting from the Second World War
60s	1961: 47%	• The constitution of human settlements is established (Law 13517) • Growth of Lima Norte and Lima Sur
70s	1970: 60%	• Migration intensifies following the failure of the land reform
80s	1981: 65%	• Decrease in agricultural and manufacturing production: more trade and services • Improvement of the communication network • Terrorism and drug crime
90s	1993: 70%	• Massive formalisation of lands (Cofopri) • Displaced persons return • Last wave of migrations
2002-2007	2007: 76%	• Economic prosperity • Improved communications • Migration is decentralized: reduction of disparities (Lima is no longer the main focus of attraction)
2005-now	/	• Venezuelan migrations

Table 4: Evolution of the urbanisation processes and migrations in Peru according to factors, period: 1940-2007 (source: Instituto Metropolitano de Planificacion, 2017)

Among the 20 most populated districts (see Figure 21), the districts of San Juan de Lurigancho (898,443 inhabitants in 2007 and 1,038,495 in 2017) and San Martín de Porres (579561 in 2007 and 654083 in 2017) are the first place, with the VMT district not far behind with 378,470 inhabitants and 398,433 inhabitants in 2007 and 2017 respectively.

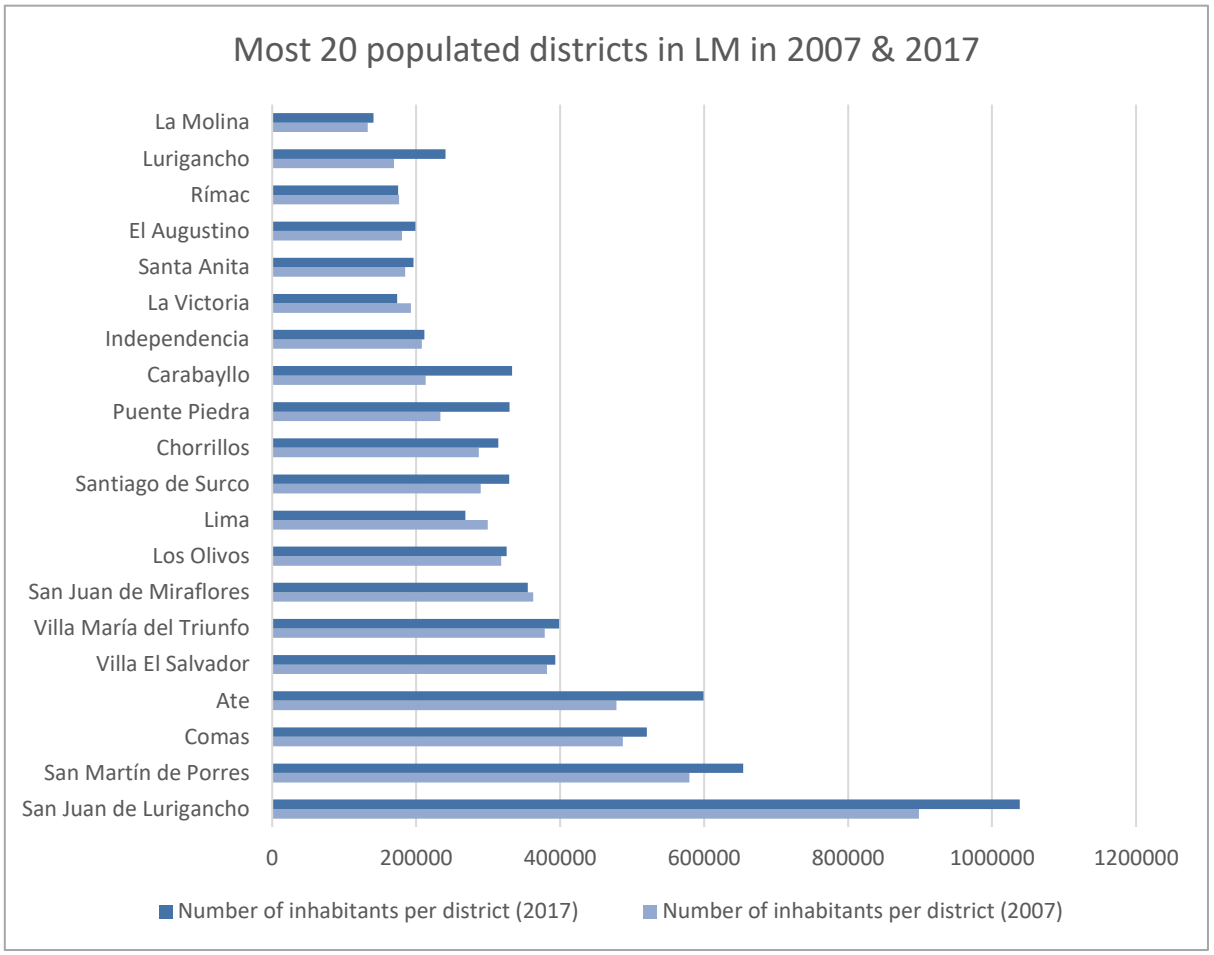

Figure 21: Most 20 populated districts in LM in 2007 & 2017 (Data source: INEI 2007, INEI 2017)

It is easy to see from the map of population growth rates between 2007 and 2017 (See Figure 22) that the districts located furthest to the centre have a lower or even negative population growth rate compared to some peripheral districts undergoing a demographic growth. In fact, there is a certain trend of depopulation in the central parts of the city, especially in the urbanised districts since a longer time such as the districts of Lima, La Victoria or San Luis with negative growth rates of -10, -10 and -5 respectively. The urban centre is losing its residential character in favour of companies and commercial areas. The cone Sur remains with the cone Este, one of the parts of the urban agglomeration most subject to urban development with a growing population and urbanisation.

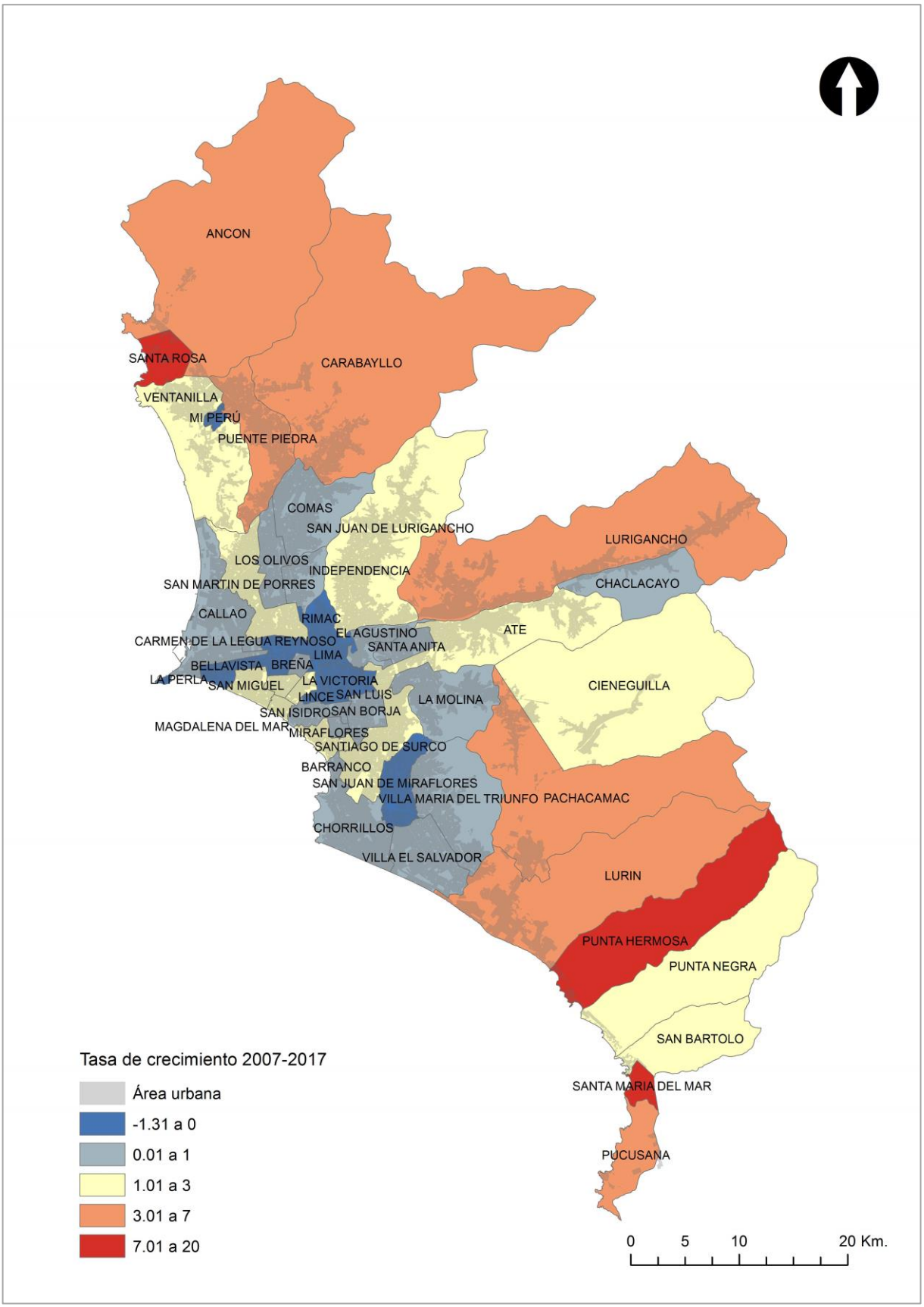

Figure 22: Rate of growth of the population in Lima Metropolitana between 2007 and 2017 (Source: CIAC-PUCP)

In terms of population density if we consider the fixed area for each district (see Figure 23), the situation has remained relatively constant in most districts of Lima. With an average population density of 29 inhabitants/ha in 2007, the average population density in Lima rose to 33 inhabitants/ha in 2017, which represents an average increase of 4 inhabitants per hectare. While some districts such as Lima or Victoria are experiencing a decrease in population density, it seems that most districts of Lima Metropolitana are facing an increasing population density, to a greater or lesser extent depending on the district (see Figure 23). The districts most affected by this increasing population densification are Magdalena del Mar, San Miguel and Pueblo Libre with an increase of 26.4, 24.5 and 20.9 inhabitants/hectares respectively, which represents up to 5 times the average increase on the scale of LM. Conversely, some districts are losing population density between 2007 and 2017, for example the districts of Lima and La Victoria with losses of 14.2 and 21.8 inhabitants/ha respectively. If we look more at the population trends in the different cones and the rate of growth of the population between 2007 and 2017 (see Figure 22), we can see that the peripheral districts located in the Southern, Eastern and Northern cones have the highest population rate of growth. The districts in these pheripheral cones have the highest rate of growth while the central cone with districts such as Lima Centro, Miraflores see a diminution of the population density. These trends correspond to the evolution of the population in different sectors (see Figure 20).

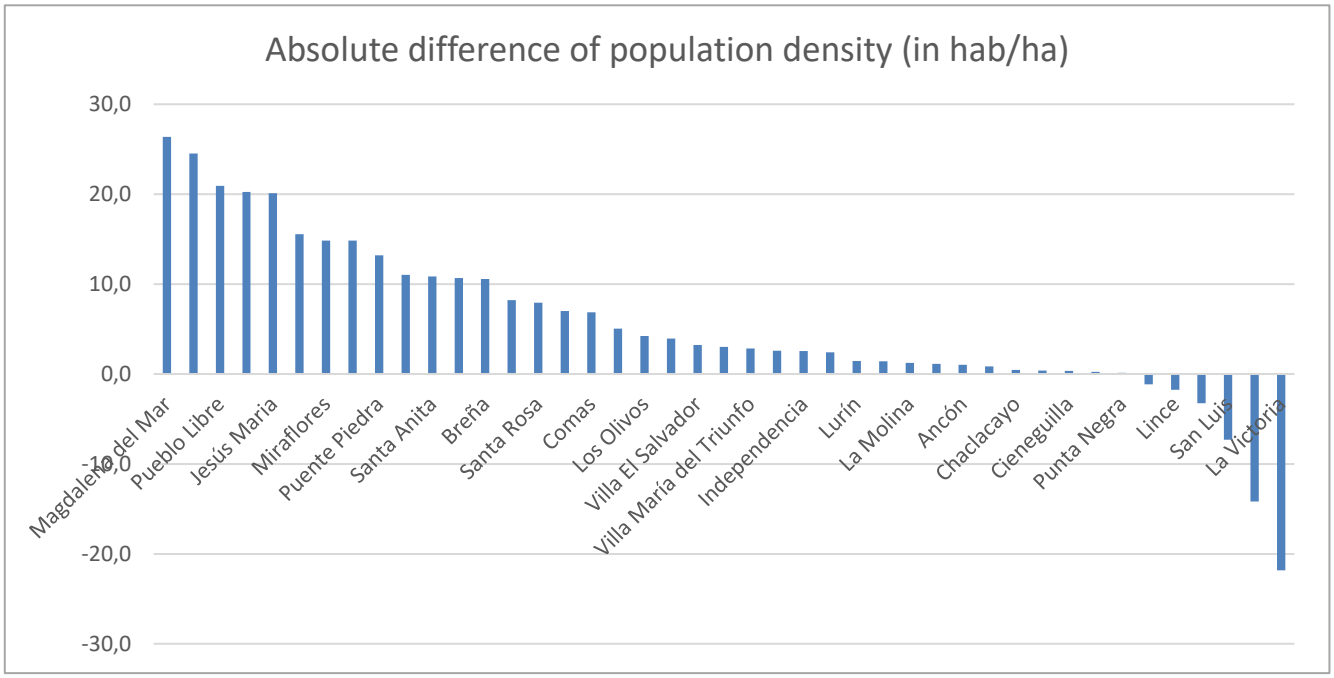

Figure 23: Absolute difference of population density in LM for a fixed area (Source: INEI 2007, INEI 2017)

In terms of population density if we now consider the evolution of the urbanised area for each district (see Figure 24), the situation is similar to the population density per fixed area except for peripheral districts such as Villa Maria del Triunfo and San Juan de Lurigancho. Districts like VMT and SJL faced a decrease of the population density of 26.4 inhabitants/ha and 40.2 inhabitants/ha respectively. Taking into consideration the evolution of the urbanised area between 2007 and 2017, the average population density (in inhabitants per urbanised hectare) in LM decreased from 129.4 inhabitants/ha in 2007 to 108.4 inhabitants/ha in 2017, which represents an average decrease of 21 inhabitants per urbanised ha. In parallel to some other peripheral districts, some more central districts like La Victoria and Rimac are also loosing in population density per urbanised area.

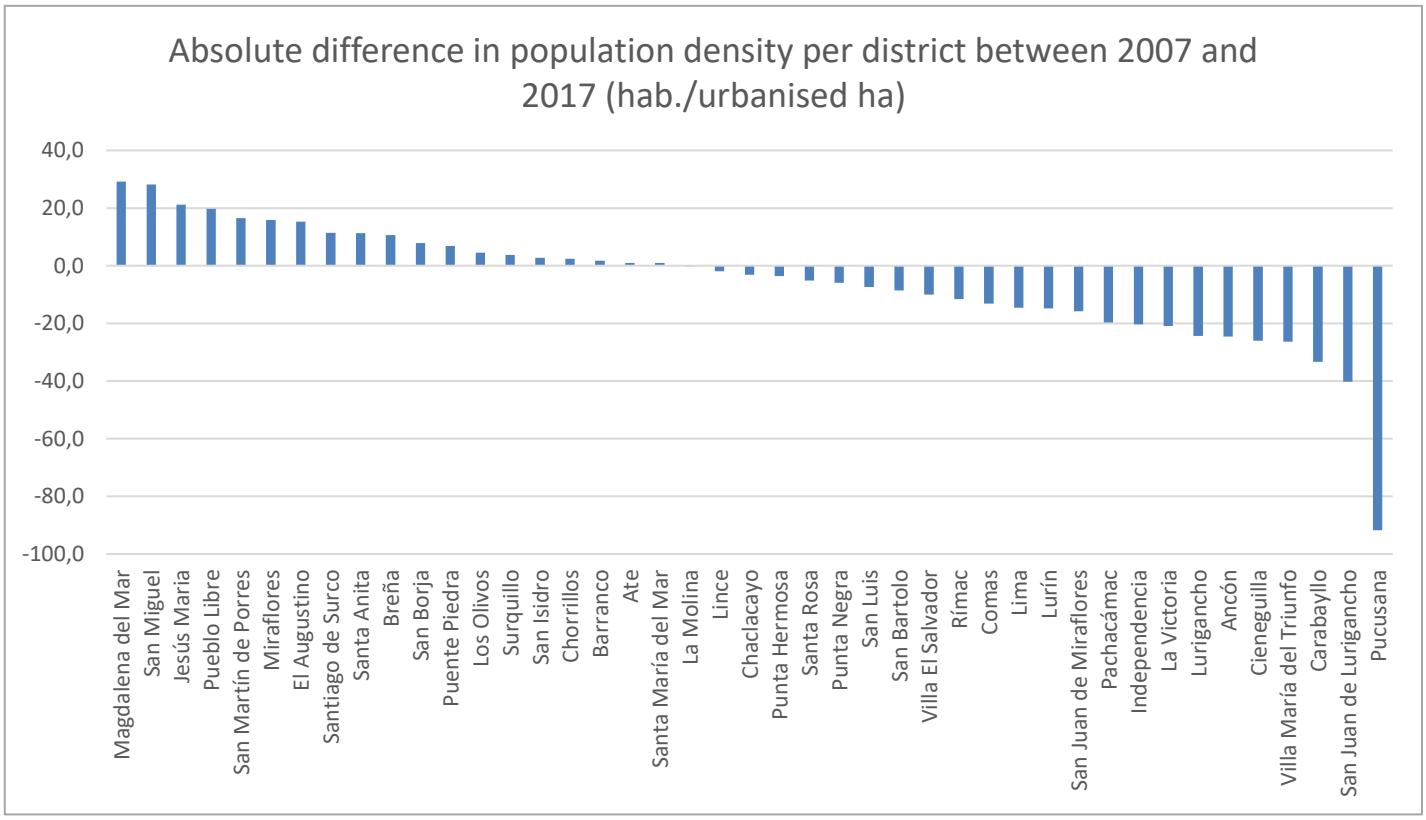

Figure 24: Absolute difference of population density in LM for per urbanised area, between 2007 and 2017 (Source: INEI 2007, INEI 2017, CIAC-PUCP 2020)

3.3.4. Households

The demographic analysis has given us an idea of the demographic dynamics at the metropolitan level. To link this analysis with the one of the built environment, it is necessary to approach the analysis of the different types of housing present in LM region within the same time lapse (see Figure 25 and Figure 26). According to the national census of 2017, out of a total of 2,607,336 private dwellings, the metropolitan region of Lima had more than 70.4% of single-family houses against 22.2% of dwellings in flats. While in 2007, for 1,854,950 registered private dwellings, the percentage of single-family houses was almost of 80% compared to 15% for flat dwellings (INEI 2017).The other types of private dwellings represent a cumulative percentage of less than 10%.

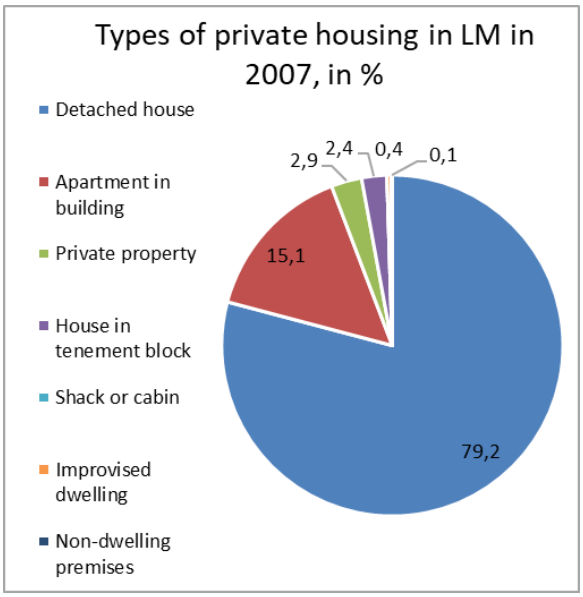

Figure 25: Types of private housing in LM in 2007 (source: INEI 2007)

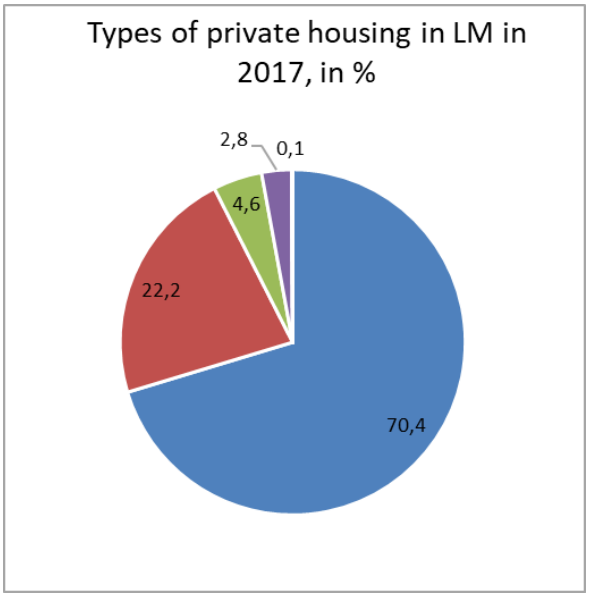

Figure 26: Types of private housing in LM in 2007 (source: INEI 2017)

As can be seen in graph of the evolution of the percentage of private housing types in LM per year (see Figure 27), there is an increasing trend in the number of apartments in buildings while the number of single-family houses is decreasing. This corresponds to the increase in average population density on the scale of LM. However, it is still important to focus on the districts where this densification, both urban and demographical, is taking place. To this end, we will analyse the case of VMT in order

to define whether this densification is also taking place in informal settlements such as in the VMT district.

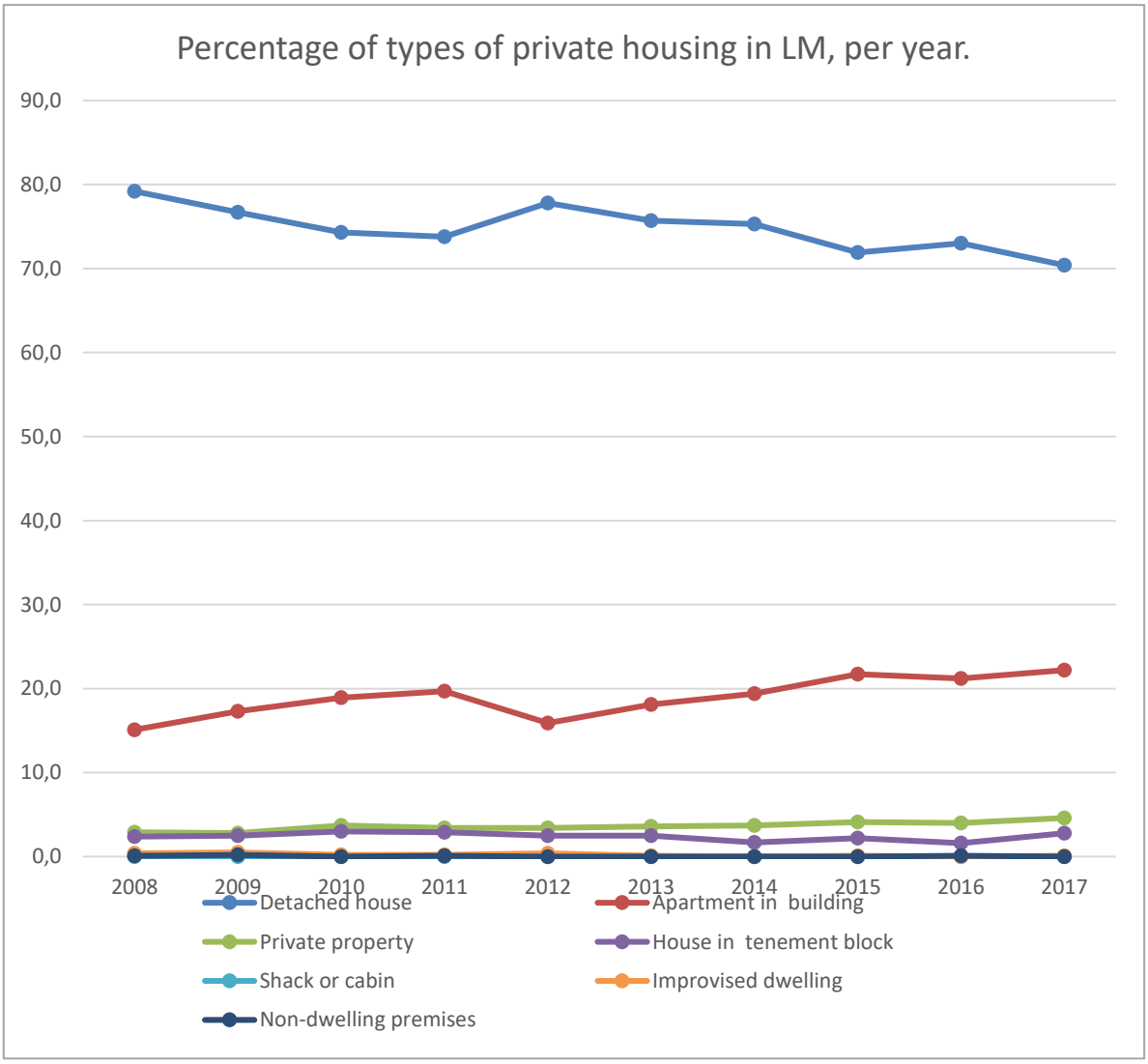

Figure 27: Evolution of the percentage of private housing types in LM, per year (INEI 2017)

If we look at the household density in Lima in 2017 (considering the urbanised area only), the mean household density in LM is 29.5 households per urbanised ha, with 7.3 apartments in building per urbanised area and 23.2 detached houses per urbanised ha. In 2007, the mean household density per urbanised area in LM was 27.9, with a density of 25 detached houses per urbanised area and 4.7 apartments per urbanised area (in ha). This clearly shows a growth of the household density, characterized by general growth of the apartment density and a low decreasing density of detached houses.

On Figure 28 we can see that the districts of Brena, Lince, Surquillo, have the highest housing density with more than 70 households per ha. When looking at the housing type, these 3 districts are one of the districts in LM in 2017 with the highest apartment density. They count respectively 42.4, 46.5 and 40.8 apartments in buildings per urbanised hectare. Most of the households in these districts are apartments in buildings, which explains that higher density which is mostly of more than 70 households per hectare. On the opposite, the districts of Lurin and Cieneguilla have a density of 7.9 households per urbanised hectare (CIAC-PUCP, 2020).

However, for the density of detached houses, some districts like Independencia have a density of 43.6 detached houses per urbanised hectare

In comparison, the district of VMT had in 2007 a density of 31.4 households per urbanised hectare. Among these 31.4 households per ha, the density of apartments in buildings reaches 0.45 apartments/ha and a number of detached houses/ha of 29.5 (Instituto Nacional de Estadistica e Informatica, 2017).

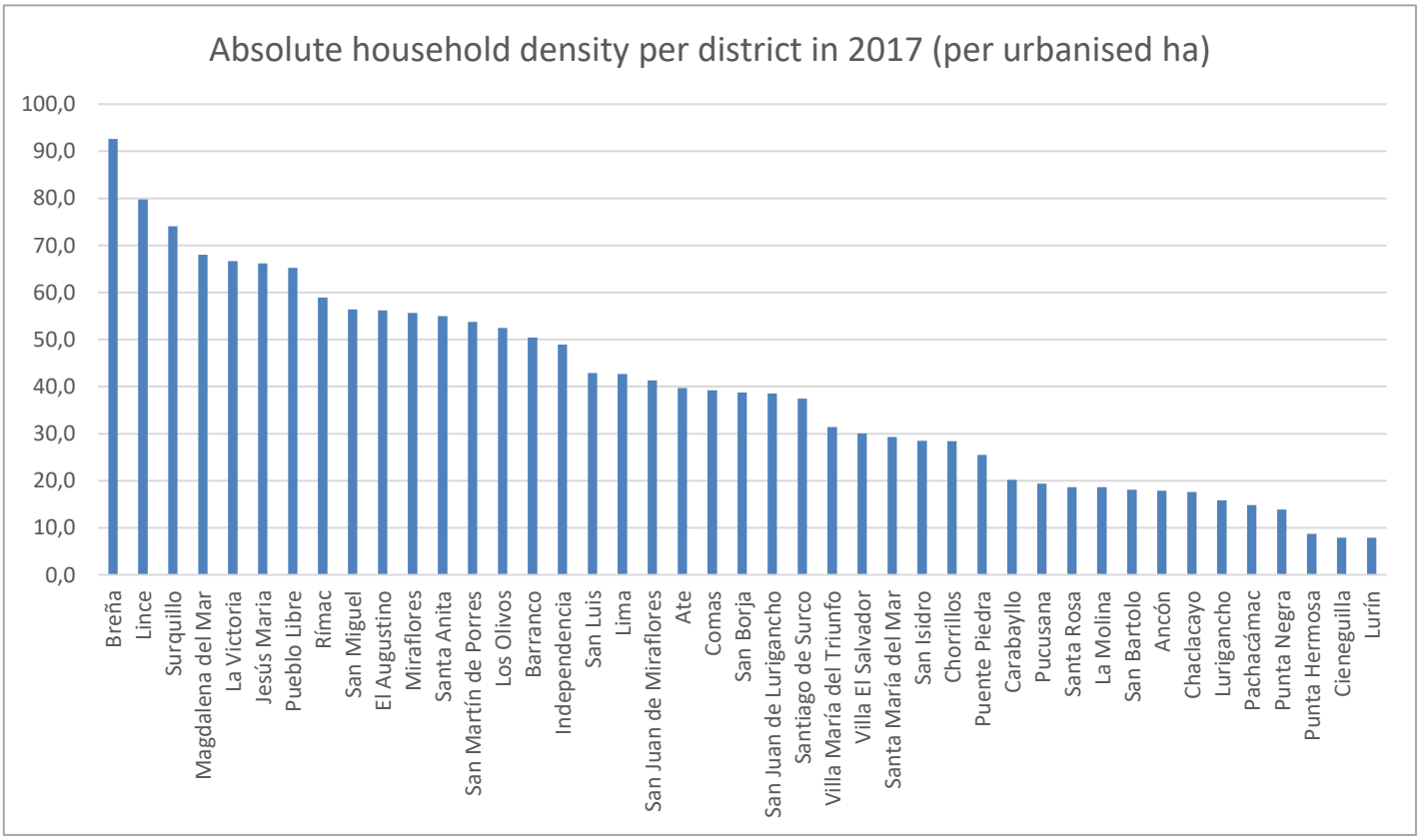

Figure 28: Density of household per district in 2017 (Data source: INEI 2017)

Considering the same lot size and an average built area per dwelling, a similar increase in population and number of households can be observed. While the positive rate of growth of the absolute number of households is 40.56 , the positive rate of growth of the LM population is 12.7, nearly 4 times smaller than the household rate of growth(INEI 2007, INEI 2017). The total demographic and household evolution in LM are shown in Figure 29 here above. Figure 29 shows that the population of LM increased from 7,605,742 inhabitants in 2007 to 8,574,974 inhabitants in 2017, while the number of households also increased from 1,854,950 households to 2,607,336 in 2017. Which makes a decreasing number of 4.1 inhabitants per household in 2007 and 3.28 inhabitants per household in 2017.

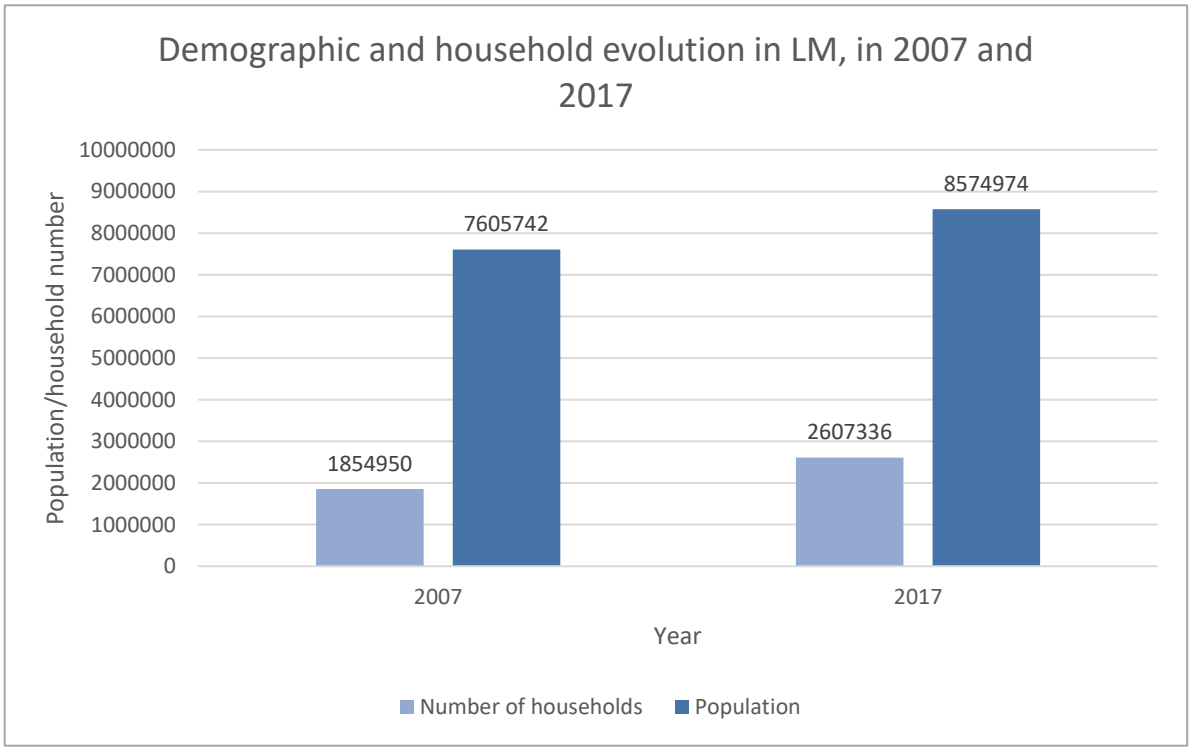

Figure 29: Demographic and household evolution in LM, in 2007 and 2017 (Data source: INEI 2007, INEI 2017)

IV. VALLECITO ALTO IN VILLA MARIA DEL TRIUNFO DISTRICT

After a literature review, data and map analysis at the scale of the metropolitan area of Lima, this section consists in a similar analysis but at a smaller scale, which is the scale of the Villa Maria del Triunfo district and more particularly at the level of the study case area of Vallecito Alto. Thus, this section will be devoted to a general approach of the district and the settlement of Vallecito Alto, then an analysis of the demographic and urban development of the district and the settlement will be conducted. This analysis will allow us to understand better urban development of the study case of Vallecito Alto, to later compare it to the analysis at the largest scale of Lima and with the results of the fieldwork.

4.1. Study case – Villa Maria del Triunfo and Vallecito Alto

4.1.1. General context of Villa Maria del Triunfo and Vallecito Alto

4.1.1.1. Topography

Villa Maria del Triunfo has a quite diverse topography. Indeed, it is located between the start of the Andes Mountains and the plateau covering most of Lima.

More closely, Vallecito Alto, which means “Upper Dale” is characterised by a lower, flatter part, but with a relatively gentle slope, and the hillsides on either side having a steeper slope. The oldest urbanised area lies where the slope is the most gentle, while the newest parts of the settlement take place on steep hillsides.

In terms of altitude, the lower and oldest part of the district rises to 205 m above sea level, while the highest part of the Vallecito Alto district rises to 400 m above sea level. This gives a difference of 195 m between the upper and lower parts of the district, which are about 2 km apart. It should be noted that the upstream boundary of the Vallecito Alto district is difficult to determine and is constantly changing since the upper part of the district is subject to land invasions and new constructions that are constantly being built higher and higher on the hillsides. The main reason for the name given to the district is that it is situated in a sort of small valley (hence its name), the whole district is situated on a slope with an average gradient of around 10%. This slope

nevertheless remains variable, since it is less in the lower and older part and can sometimes reach 30% in the higher parts, especially on the hillsides. The different altitudes of the district are shown on the satellite view from (Google, 2020) in Figure 30.

Figure 30: Vallecito Alto's elevation gain (Source: Google Earth 2020)

The district developed gradually around the main avenues, where traffic routes and housing estates were gradually consolidated, especially during the population explosion in the 1960s. Buildings were developed by filling in an orthogonal grid on the flattest part of the district. While the new urban invasions were articulated parallel to the contour lines (see Figure 31).

The topography is undeniably a factor which has influenced, and continues to influence, the development of the district. Indeed, two distinct parts of the district can currently be distinguished, namely:

- The upper part of the district, where there is a steep slope averaging 30%, where very-low-density buildings are built parallel to the contour lines.
- The lower part, which is older, follows an orthogonal layout and is built on a gently sloping site. This part of the district, which is denser, is the one we are interested in this work.

Figure 31: Map of the old and new urbanised areas of Vallecito Alto (Source: Google Earth 2020)

4.1.1.2. Climate

Even if Lima is located on the coast and has a pretty constant arid climate, the district of VMT is mostly located on the bottom part of the first hills/mountains, therefore being exposed to rapid changes of weather (it is a unique ecosytem). The air becomes more humid and allows the development of specific and unique fauna and flora of the Lomas (see Figure 32) during the coastal winter of Lima.The city of Lima has developed a program to attract visitors and promote the conservation of this unique nature reserve. The main reasons for the preservation of this ecosystem are that it is a unique ecosystem which regulates the local climate and prevents land erosion. Moreover, it has an aestetic, educative and recreative value, which attract every year more tourists and promotes the local economy (Municipalidad de Lima, 2020).

Figure 32: Lomas de Villa Maria del Triunfo (Source: Programa de Gobierno Regional de Lima Metropolitana)

4.1.1.3. Mobility

The pedestrian mode of transport prevails over the other means of transport of the neighbourhood, mainly because public transport is not well developed and because the majority of the local population does not own a private vehicle. Indeed, buses do not deserve many places, simply because only one private bus line, with a low frequency, connects the neighbourhood with the rest of the district. This makes it very difficult for the inhabitants to reach other parts of the city.

The only existing public transport is the combi bus line (see Figure 33) that runs along Primavera Avenue, enters the main avenue of VA, Av José Olaya, heads to El Paraisio neighbourhood and takes the same way in the other direction. It passes through VA and connects it with the city centre within 45 minutes. The recently built electric train line passes through the district and makes it possible to join the city more easily. However, the closest train stop from VA is approximately 40 min walk from the highest point of the neighbourhood.

There are also many moto-taxis, usually owned by individuals or small private companies, which stop a bit everywhere in the neighbourhood. But mainly in some strategic places like close to street markets, main crossroads, biggest avenues (i.e. José Olaya). The moto-taxi (see Figure 34) is the most used means of transport after

walking, simply because it can reach other areas of the neighbourhood that buses cannot reach (usually because the road is not maintained or not designed for buses).

Figure 33: Combis in Lima (https://www.stagesperou.com/comment-se-deplacer-au-perou/)

Figure 34: Moto-taxis (Source: https://www.stagesperou.com/comment-se-deplacer-au-perou/)

The main avenues (see Figure 35) and its perpendicular streets, mostly built in the 70s/80s, are tarred roads, often in a questionable state. Indeed, there is a clear lack of maintenance and repair by the municipality since most of these roads have not been rebuilt nor maintained since their construction in the 80s. Some of the streets are even being repaired by the inhabitants themselves, mostly with the available resources.

The roads in the oldest part are organised according to a squared grid pattern, while the newer parts follow a more organic one, usually following topographic lines or delimited by rough terrain. These streets, passageways are simply small winding dirt roads, often accessible only on foot or by motorbike taxi.

The sidewalks, on the other hand, are not continuous (often at the owners' expense), and most of the time poorly maintained, making pedestrian traffic difficult and impossible for persons with reduced mobility.

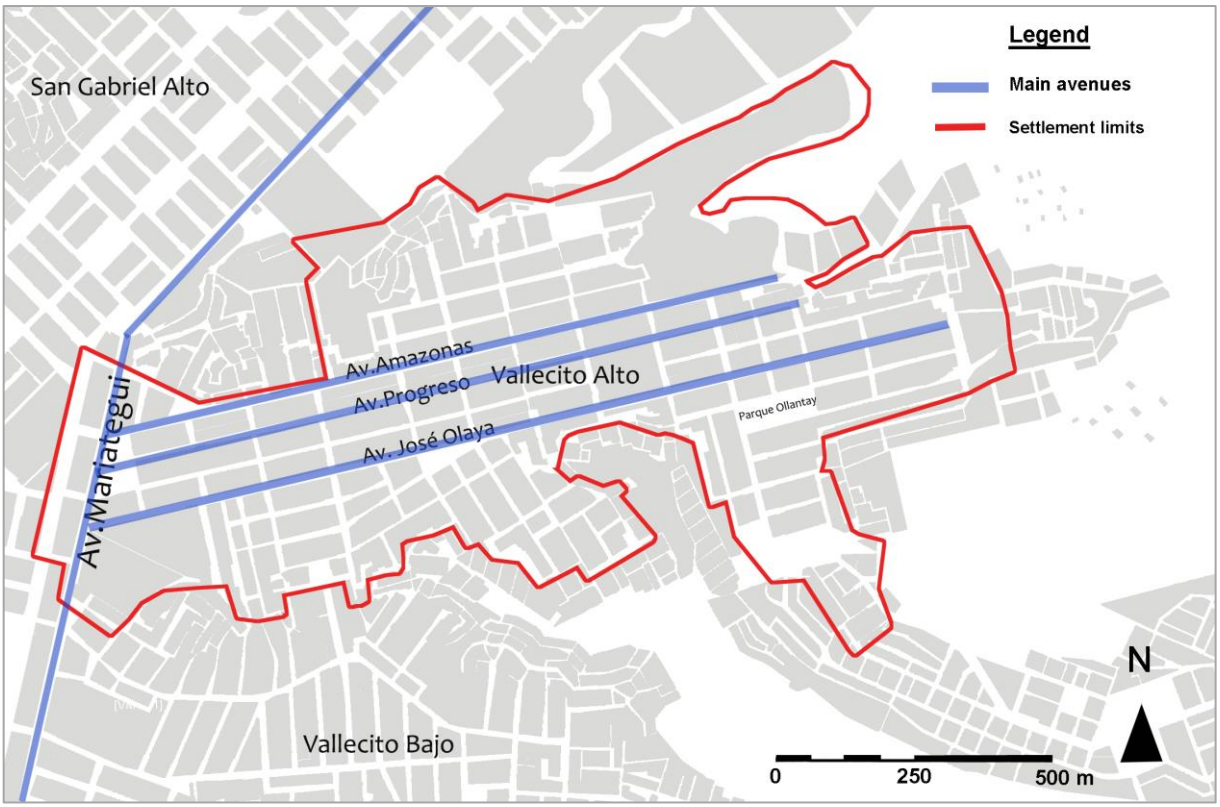

Figure 35: Main avenues of Vallecito Alto

4.1.1.4. Public infrastructure and services

There is very little functional diversity and public services in VMT (see Annex 7). Indeed, in 2017, almost 88% of the district's land is dedicated to housing. While 12% is dedicated to commercial functions and other kinds of public infrastructures (see Figure 36). This shows a lack of commercial, industrial and economic functions within the district. As a result, the district is gradually transformed into a residential area where the inhabitants develop all their activities out of the district (Emergente, 2017). As VA is part of the VMT district, there is a similar functional distribution in the settlement. Figure 38 shows the functional distribution of Vallecito Alto. This section will contextualise the main public infrastructures and services encountered in VMT.

In 2017, over 94% (101592 units) of the private households in VMT were detached houses, for only 3% (3285 units) of apartments in buildings. With few other household types like private properties and improvised dwellings, private households represented 108212 housing units, which represents 4.15% of the total LM households' number. In

comparison, the most populated and urbanized district of San Juan de Lurigancho represents over 12% of the total LM household number (INEI, 2019).

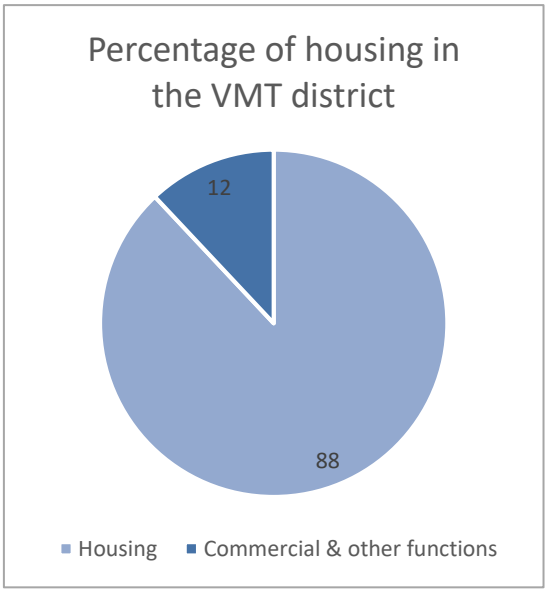

Figure 36: Percentage of housing in VMT (Source: Municipalidad Distrital de Villa Maria del Triunfo)

In terms of markets in the VMT district, there are a total of 73 supply markets occupying a total area of 65,000 m². Between these 73 supply markets, 29 are considered informal/illegal and account for 7% of the total surface area for supply markets. The JCM area is the most complete in the VMT district in terms of supply markets, as it represents alone almost half of the total surface area for local shops (26,000 m² of formal markets and 1,600 m² of informal, illegal shops (Emergente, 2017, p. 40).

There is a total of 742 schools in VMT, 68% of which are private. The only public schools are houses converted into classrooms and often insufficient in number for the demand of the different neighbourhoods. This results in a gap in the educational needs of children and adolescents in the district.

As with schools, there is a lack of health facilities, especially during periods of health crisis such as COVID-19. Only 21 hospitals/clinics/health posts are present in the district, including only one health post for the VA district.

In terms of sports facilities and establishments, a total of 25 sports facilities are present in the district, including a sports complex/stadium that was used for the Pan-American Games (currently very little used) and more than 20 vacant lots used as football pitches (Emergente, 2017, p. 41).

Generally speaking, the few shops in Vallecito Alto are mainly located on the ground floor of the houses, organised in a linear pattern on either side of the main avenues and with more open spaces reserved for the occasion.

The missing services most often mentioned by VA users are mainly public schools, larger and more complete hospitals than those currently existing and police stations for public safety.

Now about green and public spaces, Vallecito Alto does not have many green areas due to the lack of water and drainage. The few green areas and/or trees that exist in the area are at the door of the lot, which maintenance is up to the inhabitants.

Like the other areas of the district, the José Carlos Mariategui area benefits from several public spaces, often of poor quality, gentrified, and far too few in number. A distinction is made between several types of public spaces, namely public spaces with green spaces and public spaces without green spaces. The area of JCM where the Vallecito Alto district is located includes a total of 95 public spaces, covering less than 5% of the urbanised area. Among the 417 public spaces present at VMT, only 27% are green spaces, excluding the Lomas natural reserve (Observatorio Urbano, 2007).

Public spaces without green spaces are mostly mineralised spaces with little or no urban furniture and often little used by users. Among these non-green spaces are often wastelands which are mostly used as football pitches or for other public events in the district (see Figure 37). The only more orderly, planned parks are mineral areas which are usually difficult to access and do not meet the needs of the residents. The distribution of the public spaces in VMT is shown on the map in Annex 8.

On the other hand, there are several public spaces with green areas. Amongst these "green" spaces is the "Lomas" protected area, a natural reserve with a biodiversity that is almost unique on the South American continent. This area, considered by the Peruvian government as a nature reserve, is monitored and free of public access. Unfortunately, this protected area is subject to urban invasions and land trafficking organised by local leaders and some members of the municipality, thus destroying the local fauna and flora. There are also other green spaces, more organized and planned. Often the result of a few interventions by the municipality and the inhabitants to

maintain these green spaces, they remain however not enough used because they are not sufficiently maintained, do not offer shade in very sunny areas etc.

Figure 37: Football pitch in Vallecito Alto (Vallecito Alto 2020)

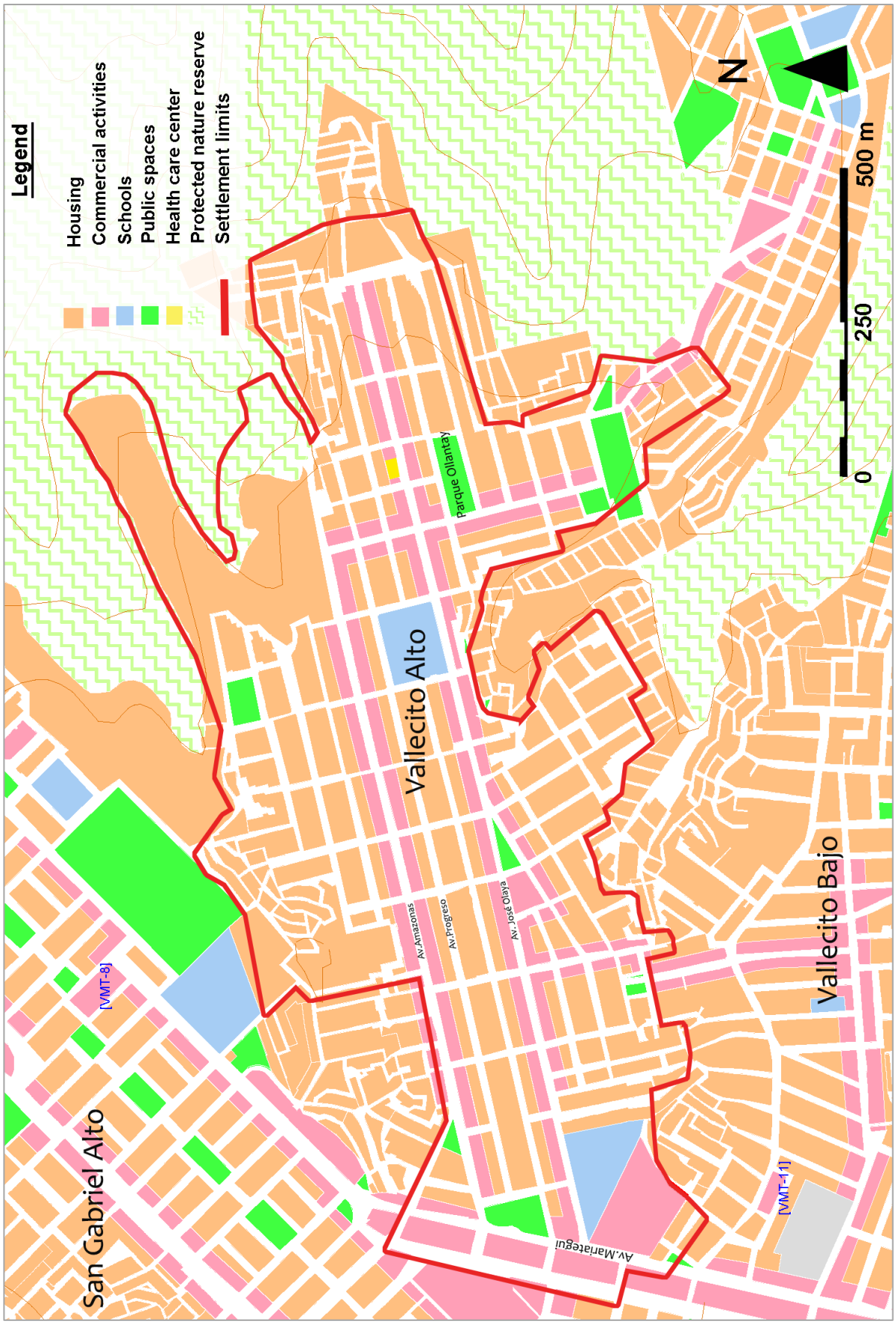

Figure 38: Functional distribution in Vallecito Alto (Adapted from Municipalidad districtal de Villa Maria del Triunfo, 2011)

4.2. Urban and demographical development of Villa Maria del Triunfo and Vallecito Alto

4.2.1. Urbanisation processes & stages of Villa Maria del Triunfo – District dimension

The administrative district of Villa Maria del Triunfo was created in 1961 in an already urbanized, but not consolidated area covering approximately 12,000 ha. Few years after its official creation, VMT district was quickly divided into several smaller administrative districts like San Juan de Miraflores in 1965 and Villa El Salvador in 1983, therefore reducing its original area of 12,000 ha to approximately 7,057 ha and making it become a continental district. At that time, it was relatively common and favourable for the authorities to create new districts over already informally built-up areas.

Urbanisticaly speaking, VMT was originally a small town of slums which occupied the Southern cone of Lima (Villa Maria del Triunfo and El Cercado in 1949). However, the major urbanisation period still happened during the 60s with the continuous invasion and occupation of the settlements of JCM in 1961, Pamplona in 1964 and many others along the present-day-called “Avenida Pachacùtec” (see Figure 39), VMT, Nueva Esperanza and Inca Pachacútec more to the South (Municipalidad distrital de Villa Maria Del Triunfo, 2011). Despite the continuous urbanisation of Villa Maria del Triunfo, three preeminent stages can be identified for the urbanisation process of Villa Maria del Triunfo, from its creation until today:

- Initial occupation (1949-1960)

Even if the VMT district was officially created in 1961, 11 human settlements (including the early ones of Tablada de Lurin, Villa Poeta José Gálvez Barrenechea and José Gálvez) already existed in the area. These human settlements were the result of several land invasions which primarily started around 1949 and expanded a lot from 1960.

The first settlers were small families, living in miserable living conditions in Surquillo, who decided to head South in 1949 in quest of wastelands for housing. They settled in Quebrada Honda and, afterwards, other families also moved from Surquillo and

Santiago de Surco to Quebrada Honda, Nueva Esperanza where they finally settled, by means of land invasions. Later, some other families joined them and some others settled in adjacent areas. Among these new invaded informal settlements, one of them called “El Triunfo” was legalized in 1956 (Municipalidad distrital de Villa Maria Del Triunfo, 2011).

In terms of urban dynamics, the structure of VMT corresponded to the gradual occupancy of peripheral unoccupied areas on the outskirts of Lima. These urban nuclei, created under the government of the President Odria (1948-1956), constituted the original source of six of the actual sectors of Cercado de Villa María del Triunfo, José Carlos Mariátegui, Nueva Esperanza, Tablada de Lurín, José Gálvez Barrenechea and Inca Pachacútec, all located along the arterial avenue of Pachacutec (see Figure 39). These gradually formed nuclei, were not permanently occupied by the inhabitants. Indeed, the poor road-quality, lack of social facilities, lack of jobs resulted in a partial occupancy of the neighbourhoods through time. The inhabitants continued to live in more central areas with more job opportunities and only came on weekends to progress on the housing constructions, which ineluctably slowed down the urbanisation process (Rodriguez, 1982, in Municipalidad distrital de Villa Maria Del Triunfo, 2011).

- Consolidation phase (1961-1993)

This urbanisation phase of VMT took approximately 30 years to be fully consolidated. The previously occupied nuclei began to expand in other parts of low slopes and desert areas. The expansion and progressive consolidation of these areas were mainly due to the rapid population growth between the 60s and the 80s when the “Cones” of Lima appeared. The Southern cone initially embodied only VMT before the creation of San Juan de Miraflores and Villa El Salvador in the 80s. The Southern cone, represented by Villa Maria del Triunfo was during several years the receptacle of poverty and slum dwellers. As a matter of fact, in 1993, among 267,278 inhabitants of VMT, 80% of them lived in slums. The rest were not considered as slum dwellers since a part of the housing had been consolidated and legalized. At the scale of Metropolitan Lima, the urbanisation of VMT, through land invasions and slums, played a very important role in the formation of the Southern cone and informal settlements in Lima. Indeed, it was

considered for a while, especially before the creation of new administrative districts, as the biggest and most populated slums area of Lima.

Unlike other districts of Lima, the growth of VMT was characterized by development through slums, with no private urbanisation, state programs, housing cooperatives. In brief, no legal and supervised planning was done. The area of VMT could mainly be considered as a programme of sized plots (of 200m²) and a self-managed urban community slightly promoted by the president Velasco (1968-1975) (DESCO, 2009).

- The "enlargement" and densification stage (1994-now)

The most recent stage of the VMT urbanisation process can be considered as the most complex one since two processes are happening at the same time.

The first one, and by far the most problematic one, is the urban sprawl through the process of **urban extensions**. The appearance of extensions is characterized by the formation of new neighbouroods in the continuity of the existing consolidated settlements. These new neighbourhoods usually take place in the areas of greatest slope in the vicinity of the old neighbourhoods, usually territorially fragmented, therefore presenting great troubles for the equipping of basic services and urban infrastructures. The occupation of these new settlements by their inhabitants also represents some dangers for themselves, especially regarding buildings stability because structures and foundations are not designed to resist to time and natural events (i.e. Some seismic activity).

They tend to settle within shorter periods, most of the time with the consent of already established inhabitants of the old neighbourhoods and often driven by local leaders and land traffickers. In most cases, the new precarious occupants of the lands are relatives of local settlers, who settle in scattered manner of small groups (some with only 10 lots of a few m²). Unfortunately, the newly acquired land is illegal and managed by local leaders and corrupted members of the district municipality.

In terms of trends for VMT, over 68,593 new settlers in these extensions, settled in VMT between 1992 and 2005. This population represents around 20% of the total VMT population. Regarding these informal extensions, VMT is the district facing the biggest extension in Southern cone, with 16,730 lots between 1992 and 2005, nearly half of the number of lots illegally occupied in the whole Southern cone during the same period

(DESCO, 2009). Despite some interventions of the authorities to stop these upper hills invasions, the phenomenon continues today, out of control, therefore endangering the nature reserve of the Lomas.

The second process taking place is the one we are interested in in this work, i.e. the process of **urban densification**. This process of growth in height takes place in the oldest parts of the already consolidated areas, responding to the lack of available lands to build and the increasing housing demand. The growth in height is most of the time not technically considered either, therefore leading to stability problems, poor living conditions, poor architectural quality, restrictions to access water, gas etc.

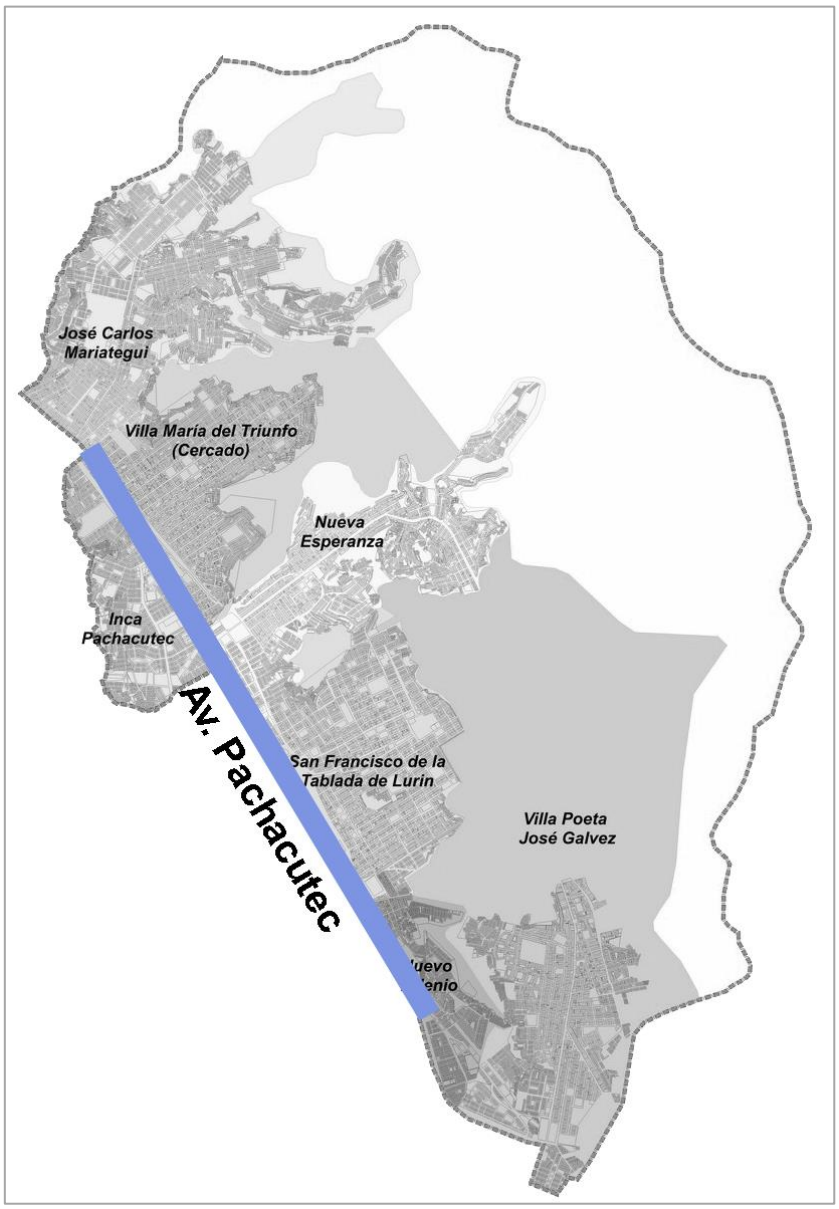

Figure 39: Location of the Pachacutec Avenue in Villa Maria del Triunfo (from Municipalidad de Villa Maria del Triunfo)

4.2.2. Urban expansion

As well as for the metropolitan scale, the urban growth of the district considers all the actual occupied lands that were not part of the urban entity before. The total urbanized area of VMT in 2007 was 2,666. ha and increased to 3,447.75 ha in 2017 while the administrative area counts 7,057 ha (including non-urban areas). In relative numbers, the urbanised area of VMT represented 37.8 % of the total area of the district in 2007 and 48.8 % in 2017. The remaining surface includes all the uninhabited areas (hills, Lomas etc). The urban expansion has a positive rate of growth of 29.3, which is a bit lower than the mean rate of growth of urbanised area at the scale of LM (CIAC-PUCP, 2020).

Now regarding the urban division of the district of VMT, seven zones are considered; José Carlos Mariátegui, Cercado, Inca Pachacutec, Nueva Esperanza, Tablada de Lurín, José Gálvez and Nuevo Milenio, all of them represented with their corresponding proportions to the total administrative area of the district (Figure 7 and Annex 9). The settlement of Vallecito Alto is located in the zone 1, known as **José Carlos Mariategui**. Figure 40 shows that the José Carlos Mariategui sector is the most urbanised area of the 7 territorial sectors of the Villa Maria del Triunfo district (FOVIDA, 2017).

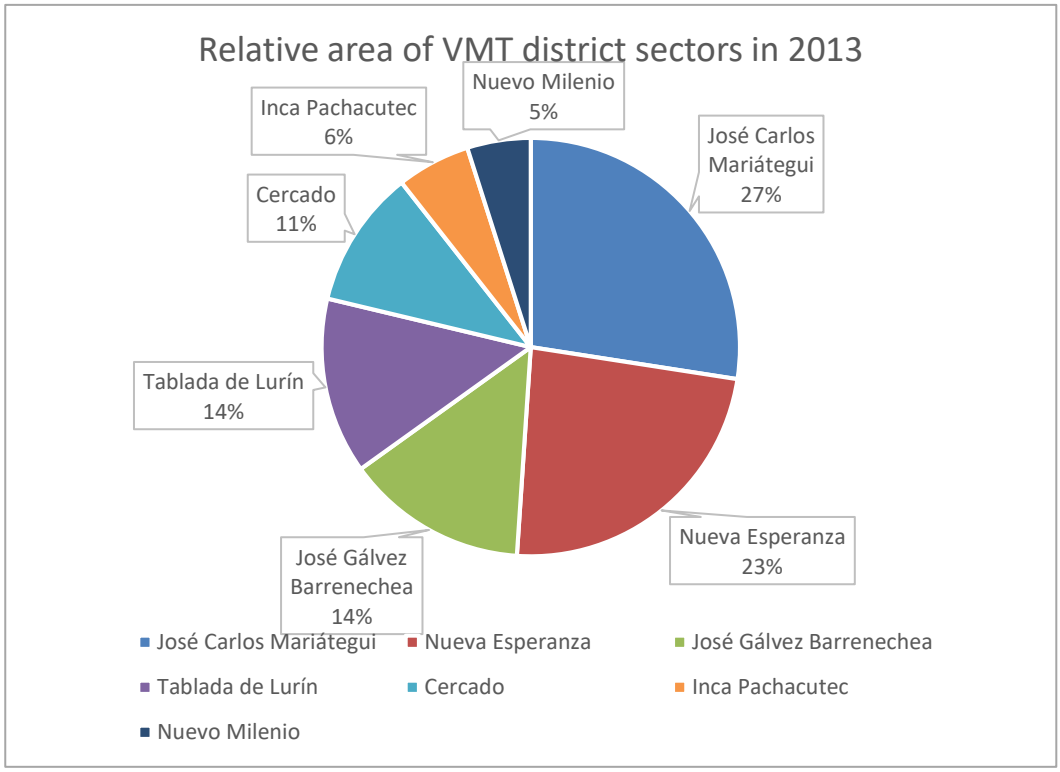

Figure 40: Relative area of the Villa Maria del Triunfo sector (source: Municipalidad districtal de Villa Maria del Triunfo)

4.2.3. Demography

With a total population of 378,470 in 2007 for 398,433 in 2017, VMT is one of the biggest and most populated districts of the 43 forming the so-called region of “Lima Metropolitana” (INEI 2007, INEI 2017). It can therefore be seen that there was a population growth over the last 10 years, as in most of the cone Sur districts. However, the VMT district does not have the highest population growth rate among the LM districts between 2007 and 2017, as it only has a positive rate of growth of 5.27, unlike other districts such as Punta Hermosa and Santa Rosa, which are experiencing a population explosion with a growth rate of over 150 in the last 10 years. In comparison to LM which has a population growth of rate of 12.7, VMT has a lower demographic rate of growth. Among that population, nearly 70,000 reside in the newly developed settlements in these last 10 years and are mostly located on hillsides areas. Villa Maria del Triunfo is part of the group of districts called Lima Sur (Instituto Nacional de Estadistica e Informacion, 2007).

The population density per urbanised area, however, has been decreasing between 2007 and 2017, going from 141.9 inhabitants/urbanised ha to 115.6 inhabitants/urbanised ha, with an absolute decrease of the population density of 26.3 inhabitants per hectare (INEI 2007, INEI 2017, CIAC-PUCP 2020). Therefore, it seems that VMT either faced a decrease of the population or an important urban expansion resulting in a smaller population density per in the urbanised area. Since the population in VMT (like in other districts of Lima Metropolitana) in continuously inceasing, the population density fall is then the consequence of an important urban expansion. In the following section, we will analyse the housing typologies in the district to relate it to the demographic and urban expansion trends. Not having this corresponding building growth would mean several things such as a reduction of personal space per person for example.

4.2.4. Households, housing typologies and informality

The district of Villa Maria del Triunfo had a positive growth rate of 11.8 in the number of households, between 2007 and 2017 according to INEI (2007) and INEI (2017). As seen in Table 5 and Figure 41, the number of detached houses increased while the

global trend at the level of LM is a diminution of detached houses and an augmentation of the number of apartments in buildings. This increase in the number of detached houses reflects a horizontal growth, mainly due to the newly created settlements and land invasions. In 2007, the number of detached houses in VMT represented 94 % of the total households of the district. This percentage was still predominant in 2007 with 94.7 % of the distric. However, even if the number of detached houses keeps increasing, it is interesting to see that the percentage of apartments in buildings rose from 1.4 % to 3.2 % of the total household number of the district (Ministerio de Salud , INEI 2017, & Municipalidad de Villa Maria del Triunfo, 2019). These evolutions are shown in Figure 42 and Figure 43 for 2007 and 2017 respectively.

However, in 2017 there is still a percentage of approximately 30% of houses without a property title, and therefore 30% of properties are considered informal from a legal point of view.

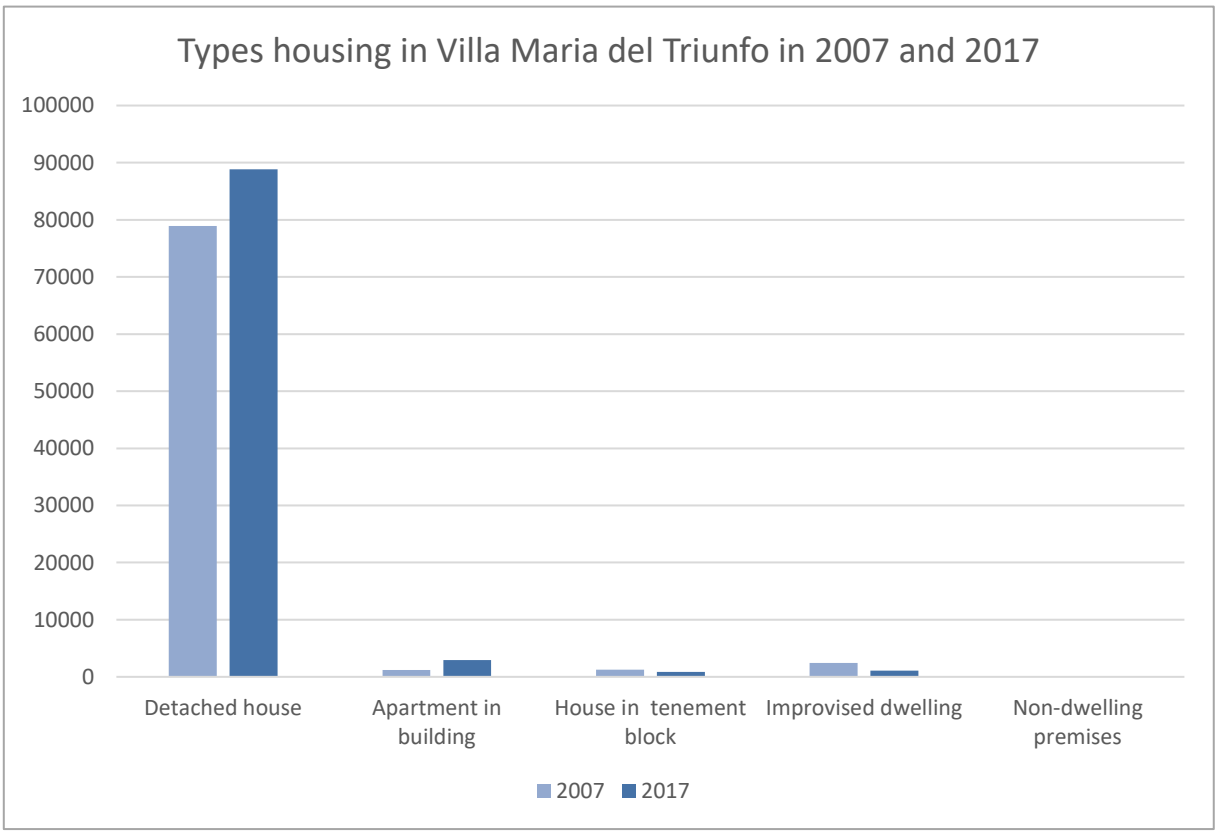

Figure 41: Types of Housing in Villa Maria del Triunfo in 2007 and 2017 (Source: INEI 2017)

Housing types in VMT	2007		2017		Growth rate
	Absolute no	%	Absolute no	%	
Total	83947	100	93821	100	11,8
Type of house					
Detached house	78933	94	88818	94,7	12,5
Apartment in building	1202	1,4	2963	3,2	146,5
House in tenement block	1278	1,5	881	0,9	-0,3
Improvised dwelling	2419	3	1073	1,1	-0,6
Non-dwelling premises	115	0,1	86	0,1	25,2

Table 5: Housing types evolution between 2007 and 2017 in Villa Maria del Triunfo (sources: INEI 2007, INEI 2017, Municipalidad districtal de Villa Maria del Triunfo)

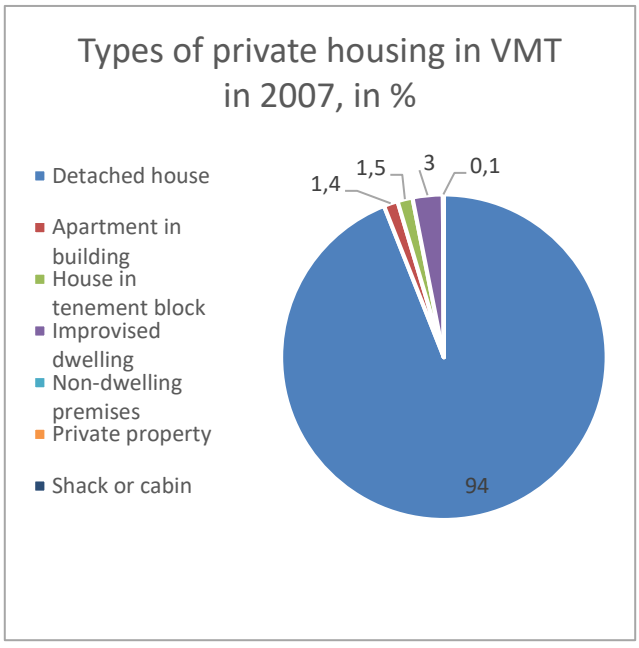

Figure 42: Types of private housing in VMT in 2007 (Data source: INEI 2007)

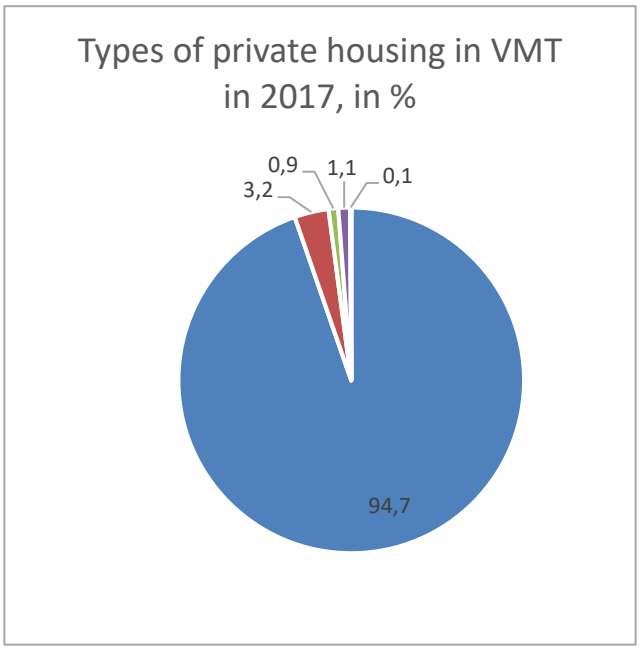

Figure 43: Types of private housing in VMT in 2017 (Data source: INEI 2017)

If we look at the household density in 2007 and 2017 (considering the urbanised area in ha only), the district of VMT had an average household density of 31.4 and 27.2 households per urbanised hectare in 2007 and 2017 respectively, which is close to the mean household density at the scale of LM. In 2007, VMT counted 29.6 detached houses per urbanised area and 0.5 apartments in buildings per urbanised area. However, in 2017 the density of detached houses decreased to 25.8 detached houses

per urbanised hectare while the density of apartments rose to 0.86 (Ministerio de Salud , INEI 2017, & Municipalidad de Villa Maria del Triunfo, 2019).

The total demographic and household evolution in VMT are shown in Figure 44. It shows that the population of VMT increased from 378,470 inhabitants in 2007 to 398,433 inhabitants in 2017, while the number of households also increased from 83,947 households to 93,821 in 2017. Which makes a decreasing number of 4.5 inhabitants per household in 2007 and 4.2 inhabitants per household in 2017, which seems to follow the same trend as the metropolitan level.

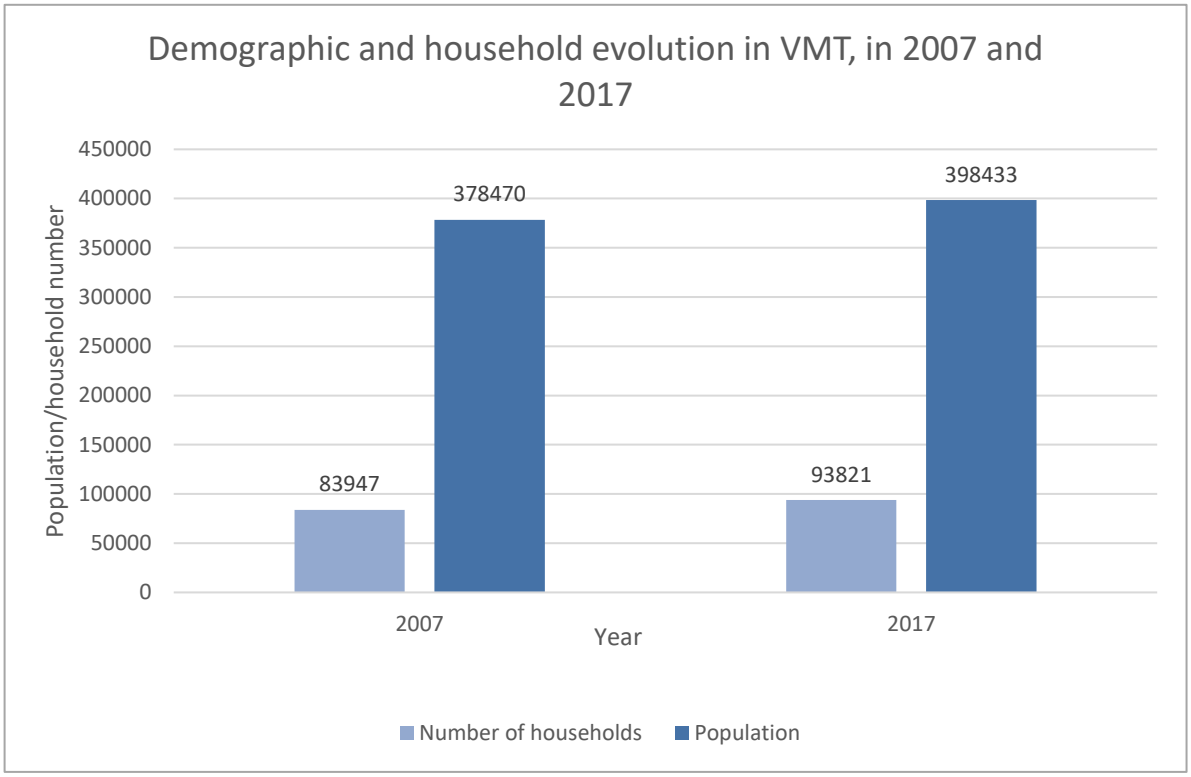

Figure 44: Demographic and household evolution in Villa Maria del Triunfo, in 2007 and 2017 (Source: INEI 2007, INEI 2017, CIAC 2020)

Through this housing typology analysis, four different housing typologies could be identified. The Figures 45, 46, 47 and 48 show the different housing typologies encountered in Vallecito Alto. These housing typologies vary a lot from one house to another in terms of shape, size, colour etc. In the case of this research, we only focused to the number of storeys of the buildings.

Figure 45: One storey building

Figure 46: Two-storey buildings

Figure 47: Three-storey buildings

Figure 48: Four-storey buildings

V. SURVEYS, INTERVIEWS AND VISUAL ANALYSIS OF VALLECITO ALTO – RESULTS

After a literature review of the area at the scale of the district and the settlement of Vallecito Alto, the applied part of this work consists of surveys, interviews and photo analysis in the Vallecito Alto informal settlement. The state of the art and analysis at the scale of LM has been done in the first part of this work, therefore leading to other research questions that could be deepened by carrying out interviews and visits onsite. The results of this field work exposed in this section will later be compared and discussed with the results from the literature and data analysis at the metropolitan and district levels.

5.1. Surveys

The results of the survey provided information at the building level on the composition of the household and the process of property division and acquisition. These results also made it possible to highlight the most important physical changes at the street level and to correlate the causes of these changes (extension, division of the building, enlargement of the family, etc.). This was followed by information on the public services and public infrastructure in the district and their possible influence on the development of the district.

5.1.1. Level of the dwelling and the street

Among the 10 people who completed the survey, 9 people have lived in the neighbourhood for more than 10 years and were therefore able to witness any changes at the urban level during the period analysed, i.e. at least from 2007 to 2017.

More than 50% of the total sample lives with 5 or more people in the same household. This is, according to INEI 2019, above the average of 4.4 persons per household across LM. Three of the respondents share the building with at least 2 other households, 3 with 2 other households and 4 do not share the building with other families/homes.

Almost all the dwellings are private properties or in-laws' property. Only one building is used for other functions than residential.

More than half of the properties of the respondents were acquired by land subdivision. Two by family inheritance and two by land invasion.

In terms of results at the dwelling level, half of the changes made are the result of an internal division of the building, resulting in a decrease in personal space per person. Three people answered that their house underwent a vertical extension (see Figure 49). These internal and external changes are most often due to a family extension (see Figure 50).

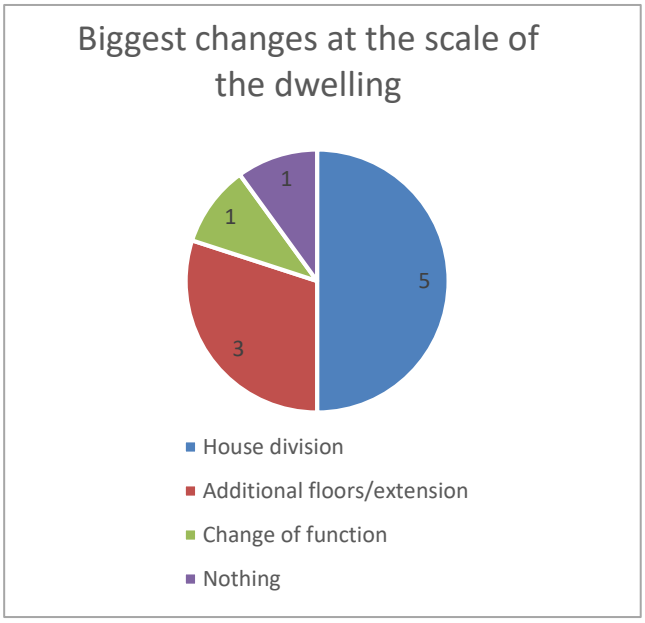

Figure 49: Biggest changes at the scale of the dwelling

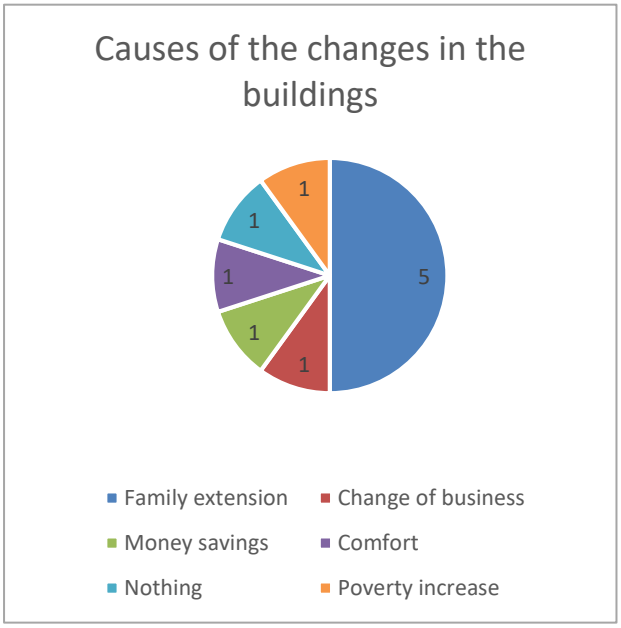

Figure 50: Causes of the changes in the buildings

Now if we take a look at a bigger scale, we also notice a majority of changes resulting in housing division at the scale of the street. Most of the changes in the housing division are also the results of family extensions. We also notice that 2 people notified changes about new commercial functions, while housing division is the most present according to the majority of the surveyed people (See Figure 51). According to 4 people, the reason for theses changes reside in the family growth and 3 to the new commercial functions (see Figure 52).

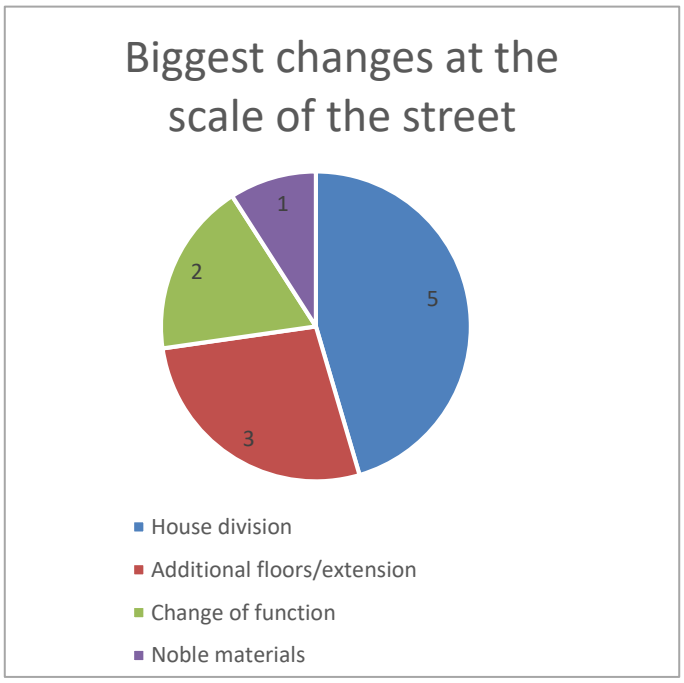

Figure 51: Biggest changes at the level of the street

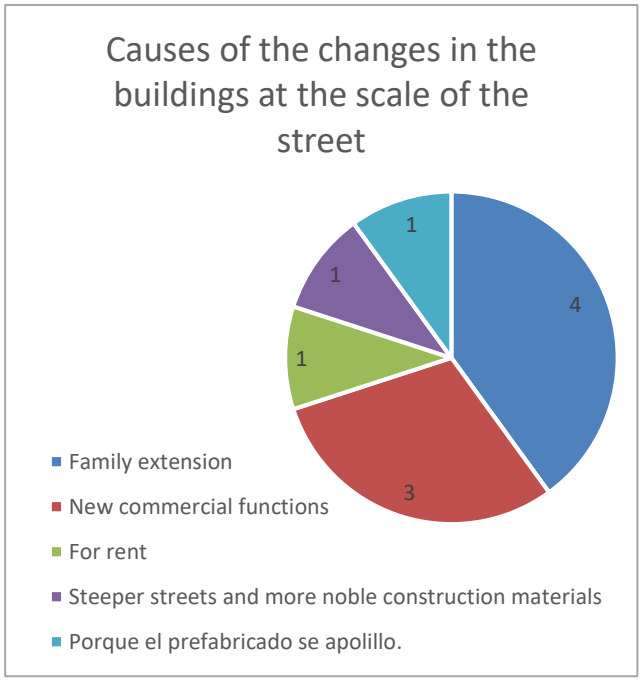

Figure 52: Causes of the changes in the buildings at the scale of the street

Relatively speaking, and for various reasons, half of the population questioned thinks that it is possible that other people may also live under the same roof and the other half do not. There are various reasons for this, including the possibility of family extension with the condition of building a higher level, or not.

When asked whether the Vallecito Alto neighbourhood was more densely urbanised than others, all the respondents answered yes and pointed to the lowest, oldest part, especially along the main avenues (See Figure 35).

Other questions were asked, particularly concerning public facilities and infrastructure, to find out whether these have influenced the development of the district. The biggest changes in public services were the addition of internet cable, the repair of some roadways and the addition of town gas (see Figure 53). In terms of public infrastructure, most of the needs of the inhabitants are the lack of green/public spaces, health centres and better management of public safety (See Figure 54 and Figure 55). However, according to the interviewees, these services and infrastructures have not influenced the densification of the built environment in any way, since these services have been paid for by the municipality of VMT and the city of Lima. Contrary to these basic services, according to the interviewees, the densification of housing is more at the household level, depending on family size and income. It is therefore interesting to look at the urban policies and practices relating to the income of the inhabitants.

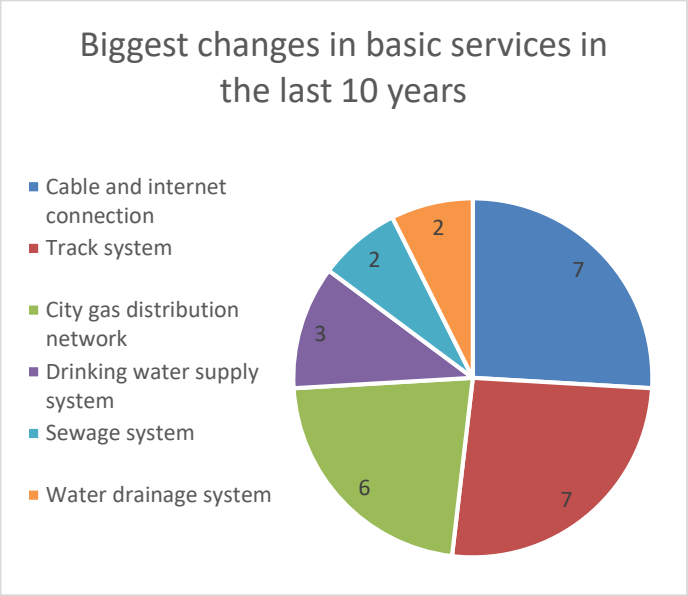

Figure 53: Biggest changes in basic services in the last 10 years

Urban planning practices and urban policies are one of the most important factors in urban development. In fact, more than 70% of the respondents acquired their property with the help of local leaders, who are, in this case, unofficial political decision-makers, mostly without any special training in the field of urban planning and mostly working through corruption from higher bodies such as the municipality of the district or the metropolitan municipality of Lima.

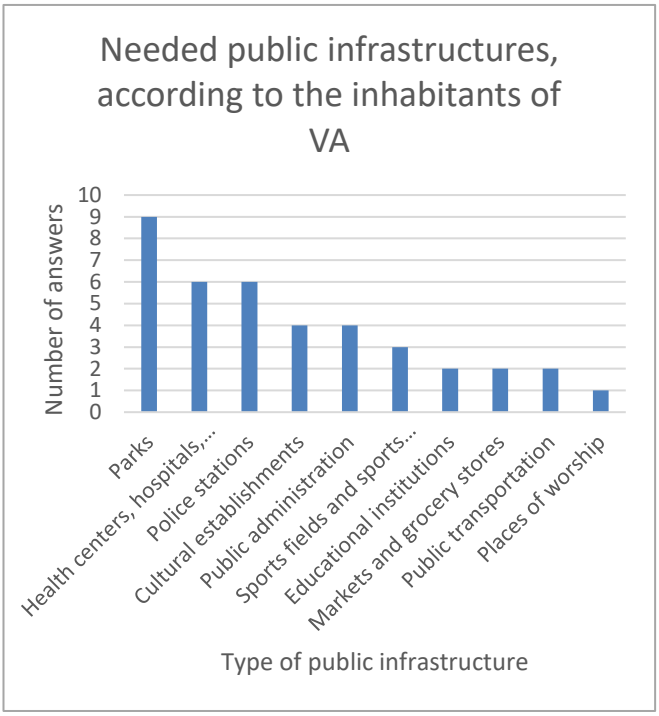

Figure 54: Needed public infrastructures, according to the inhabitants of Vallecito Alto

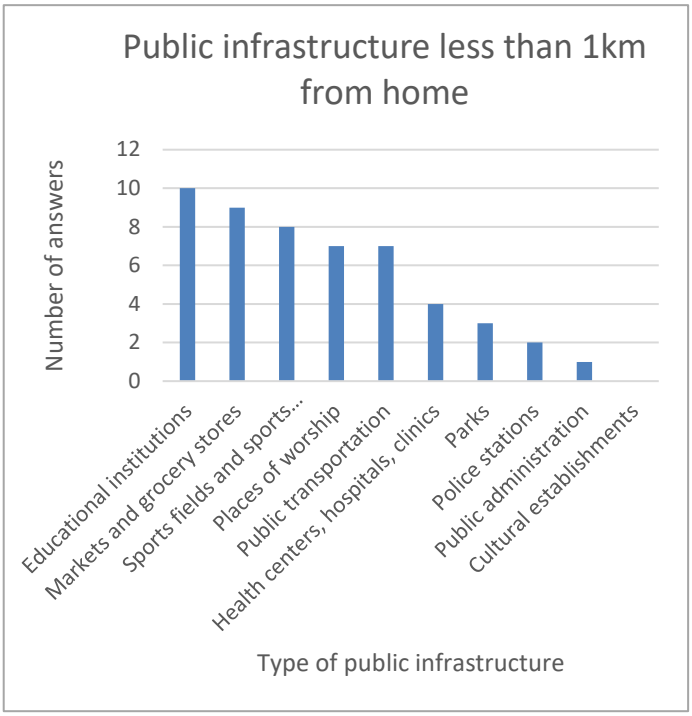

Figure 55: Public infrastructures at less than 1 km from home

5.2. Interviews

The interviews were prepared to collect some qualitative information and enable discussions with the interviewees. The goal was to add qualitative information at a larger scale than the survey. Indeed, while the surveys focused more on the scale of the buildings, the interviews aimed to collect additional information at the scale of the whole settlement. The objective was to analyse both results and draw conclusions on the collected data from the local population, mainly to add information about the processes, information that is rarely found in official, purely informative data.

5.2.1. Physical densification, causes and consequences

The first question was asked to identify the most important changes in building density in the district over the past ten years and to explain possible causes and consequences.

According to several interviewees, the most obvious changes are, of course, the urban invasions of hillside settlements. About the actual densification in the already

consolidated part of the district in the 1970s and 1980s, the recurring answer is that the lower part of the district has become denser very gradually over the past 40 years. No key events or changes in public services/infrastructure have influenced the densification. Among the respondents, four answered that the densification was relatively low and mainly dependent on family income. However, the most noticeable changes take place in the urbanised parts since the 70/80s, along and near the main avenues (see Figure 31).

Most of the physical changes in and out of the buildings are the direct consequences of the family extension. Indeed, the family has a very important part for the locals. This family extension is the cause of two main phenomenons in the housing densification:

- An **internal division** of the house into different smaller households for the different members of the family (grand-parents, parents, children, family-in-law etc). Mainly because taxes have to be paid depending on the height of the building, its materials etc. So, for the reason of low income and avoid tax pays, most of the people prefer to make an internal division of the existing house, even if It leads to less space, bad configuration of the rooms etc.

- A vertical **extension of the house**, which generally depends on family income. According to the interviewed people, this vertical extension is mostly made of 1 to maximum 3 additional levels. Examples of this vertical extension are showed in Figure 56 and 57, as well as in Annex 10. This building is the property of the same family in 2013 and 2020. Thanks to new incomes from the youngest members of the family, the whole family could afford to build extra levels to accommodate the additional members of the family.

Figure 56: Vertical extension of the house (Source: Google Street View 2013)

Figure 57: Vertical extension of the house (Vallecito Alto 2020)

"The evolution of the house follows the evolution of the family" (Inhabitant 1, 2020, translated by the author)

This sentence by one inhabitant 1, clearly states one of the causes of this vertical densification. This phenomenon usually manifests itself in awaiting reinforced steel structures at the top of the buildings. These awaiting structures can stay several years until the additional floors are added, which gives a feeling of unfinished work. In Figures 58 and 59, we clearly see the awaiting structures which are later completed with additional levels.

Naturally, the main problems pointed out by the inhabitants are the changes taking place in the newest part (from the 90s) where there are the land invasions. According to the questioned people, the causes of these land invasions are mainly land trafficking, the new Venezuelan migrations, the lack of management and corruption of the municipality, while on the other side in the oldest part where we are interested in, the

densification is mainly due to family extensions which are already settled there from more than 10 years.

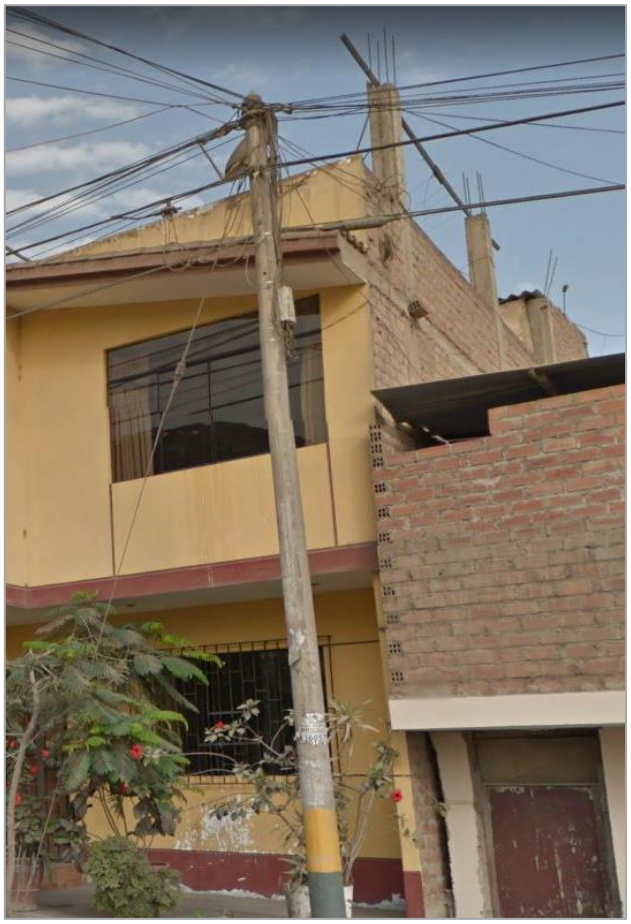

Figure 58: Awaiting structures on top of the building

Figure 59: Additional level after awaiting structures 7 years later

5.2.2. Public infrastructures & basic services

According to the interviewees, basic services such as water supply, asphalted road and public infrastructures were made progressively in the last 30 years thanks to the population pressure on the municipality. According to the inhabitants, even if these public infrastructures and public services improved the life quality of the neighbourhood inhabitants, it did not have any impact on urban development (Inhabitants, 2020). The most noticeable improvement was the gas distribution installed in the oldest urbanized part of the neighbourhood. In a general way, the settlement does not benefit from effective basic services and public infrastructures, which is also a criterion to consider this neighbourhood as informal. The basic services already supplying the different dwellings was not designed for such a large population. For example, the water distribution system is insufficient for the demand. Many other examples of poor and

insufficient design can be listed, for example the few electricity distribution systems are considered as a complete mess as it creates a poor visual comfort (see Figure 60) on front of the houses and is subjected to thefts. Except improving the life quality of the inhabitants, the basic services and public infrastructures did not have any consequences on the urban densification.

Figure 60: Visual discomfort with electricity wires (Vallecito Alto 2020)

Now speaking about the problems of public infrastructures in Vallecito Alto, all the interviewed citizens agree on the severe lack of public infrastructures (such as health care centres, schools, parks, police station etc) and the serious management deficit. The management deficit mainly takes the form of corruption between the different actors and institutions such as the municipality and the city of Lima. This lack of management is the direct consequence of different urban and political policies between the VMT municipality and the city of Lima. Hence, these differences enable the growth of corruption and illegal actions such as land traffic.

According to one of the interviewed inhabitants, due to this corruption between members of the municipality, land traffickers and companies, there is a kind of “capitalism monopoly” which involves companies buying whole housing blocks (most of the time to hide money laundering), hence preventing any further development of the area. Since most of the lots were acquired illegally, the inhabitants have no rights to contest the decisions of the municipality, often corrupted by land traffickers and

companies. This phenomenon has a direct impact on the urban development of the neighbourhood since no planning can be made because it is always countered by corruption processes.

With respect to these problems in terms of public infrastructures, corruption etc, the interviewees suggested several solutions such as an increased control of the corruption at all the levels, homogenize strict urban policies for the municipality and the city, and finally having an urban planning strategy for the neighbourhood in relation to the rest of the city.

5.2.3. Physical changes regarding the urban densification

When the inhabitants were asked what the most important changes had taken place inside and outside the consolidated area, it was first necessary to locate this so-called "denser" area. The three main avenues and the annexed streets, i.e. the oldest part dating from the 70s and 80s, are considered by most inhabitants as the area that has undergone the most changes in terms of consolidation and densification. In fact, the most visible changes in this area are:

- The new materials used (change to materials considered "noble", such as concrete or brick).
- The reinforcement of existing structures through reinforced concrete frames.
- The waiting steel structures.

These adjustments are often the result of higher cash inflows or savings. It is important to note that, according to the residents, these changes are much more frequent than vertical extensions of buildings, since significant taxes must be paid to the municipality to build higher levels. Thus, only families who have the financial means can afford to build higher. Nevertheless, one should not neglect the internal divisions of the buildings, following a family extension, which seem to be the most common phenomenon according to the inhabitants. Unfortunately, it is difficult to measure this internal division.

Most of the people interviewed were in favour of urban densification if it allows freeing spaces and buildings for public purposes, which could be more centralized, and with some financial support from the state or the municipality.

However, some inhabitants were not necessarily in favour of urban densification because there are no work opportunities close to the area, most of the people go to work quite far from their house, not in that neighbourhood. Densifying the area would be useless because a lot of children/parents start living and working in other places to sustain their family living in that neighbourhood. This remark brings out interesting questions about the attractivity of the neighbourhood. Indeed, besides some small convenience stores, the area is not an economicaly-speaking attractive area, which makes Vallecito Alto a monofunctional neighbourhood, mainly residential. Most of the residents commute to other economically attractive areas in Lima.

Also regarding the question of a possible densification, there is one factor which should be taken into consideration, which is the factor of belonging. As Angel Ramos stated (2020):

“It is a matter of belonging and lifework” (Inhabitant 2, 2020, translated by the author)

By saying this, one of the inhabitants wanted to point out the fact that densification should be a solution to free some space for public infrastructures. However, it is very difficult to relocate the inhabitants from their home, simply because of their sense of belonging and because they see their home as their lifework, accomplishment, even if their living conditions are bad.

5.2.4. Informality

As demonstrated in the first part of this work, it is difficult to determine a single definition of what is informal. As we have seen above, informality can be defined according to physical criteria or according to legal criteria. It is therefore interesting to find out how informality is viewed by residents. To this end, the question of neighbourhood informality was asked and all respondents answered the definition of informality by the legal rather than the physical criterion. In fact, it seems that, for the inhabitants of Vallecito Alto, the legal criterion largely prevails over the physical criterion and the quality of life. They all consider that a lot, a property acquired illegally, is informal, while the lack of space, architectural quality and public infrastructures are more seen as a lack of comfort. The objective of most inhabitants is therefore to acquire official and legal property titles. However, these steps can take a long time because of corruption

problems. For example, according to the interviewees, the oldest part of the district is considered to be more formal, since most inhabitants have, over the years, acquired official and legal property titles, even though these lots were acquired by land invasions several decades ago.

5.3. Visual analysis

The visual analysis will be to define the different housing typologies and highlight, in terms of verticality, the changes that took place during the studied period. Therefore, it is interesting to try later to relate the visual analysis data with the demographical data and the different factors that could influence such changes in height. We will also geographically define the location of these changes to correlate them with the rest of the data and try to determine some trends.

5.3.1. Housing evolution

Through this housing typology analysis, four different housing typologies could be identified. These typologies are the ones illustrated in Figure 45, 46, 47 and 48. The maps in Figure 65 and Figure 66 show the location of the surveyed buildings, showing the different housing typologies in 2013 and 2020 respectively. Figure 67, on the other side, shows the location where houses underwent vertical growth between 2013 and 2020.

In order to count the number of floors, all floors with a roof were considered, even if the storey was partially open (see Figure 61). In total, 414 houses of the Vallecito Alto settlement were inventoried and analysed. These 414 houses were compared for the 2013 and 2020. Among these 414 houses, we can clearly identify some urban densification. Indeed, for the same analysed sample, the number of one-storey buildings decreased by 4% while the percentage of other higher buildings increased (see Figure 62 and 63).

Figure 61: Partially opened storey

No general trend could be identified regarding the increase of building stories except a slightly bigger increase in the number of two-storey buildings. In a general way, we can clearly see a small increase in the number of storeys of the houses, which implies vertical densification of the neighbourhood.

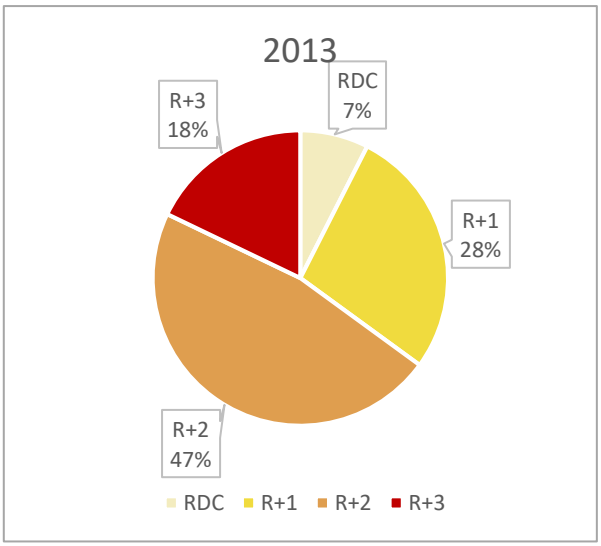

Figure 62: Housing typologies in Vallecito Alto 2013

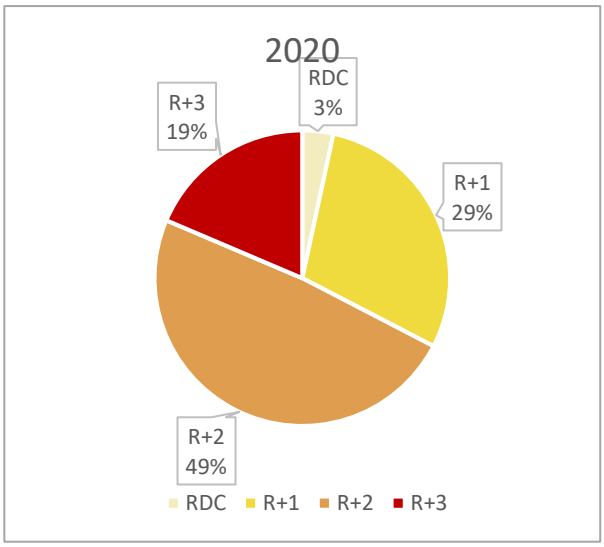

Figure 63: Housing typologies in Vallecito Alto 2020

Among the 414 surveyed buildings, nearly half of them are three-storey buildings (R+2). Their number slightly rose between 2013 and 2020 but it is not significant. The buildings with more than 2 storeys, located along the main avenues, usually have some commercial stores on the ground floor (convenience stores, hairdresser etc). Among the 414 surveyed buildings, a total of **25 houses** have undergone a vertical densification, which represents only 6% of the surveyed houses. Various examples illustrating the vertical densification can be found in Annex 10. The number of houses that underwent a vertical incrementation of one level is 20 for 5 buildings that underwent a vertical incrementation of 2 levels. All the absolute values of the collected data can be found in Figure 64.

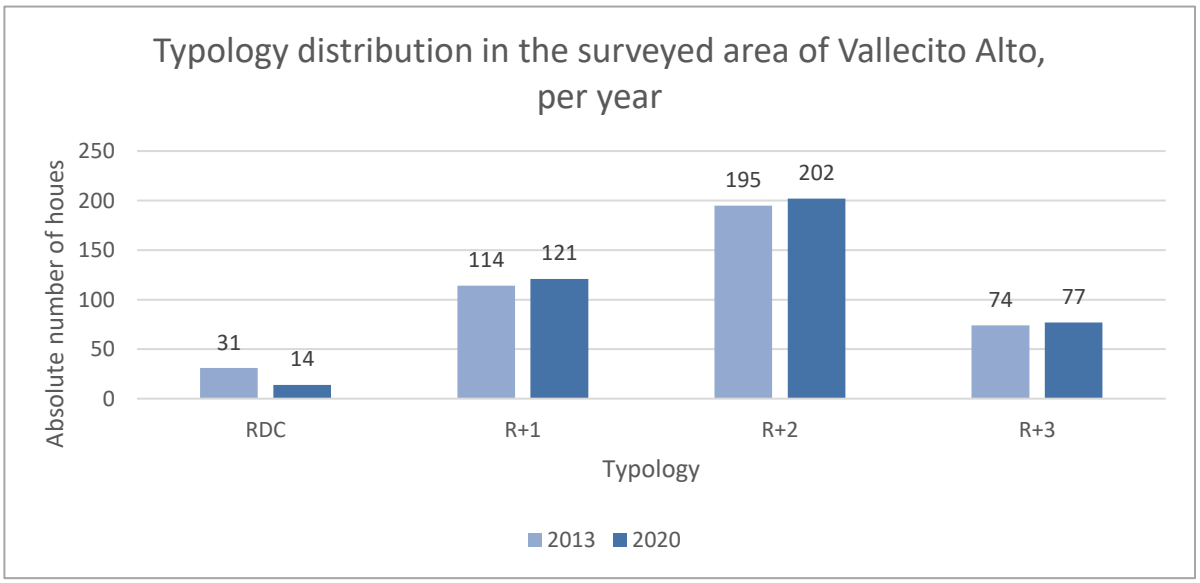

Figure 64: Housing typology distribution in 2013 & 2020

Figure 65: Map of housing typologies in Vallecito Alto in 2013

Figure 66: Map of housing typologies in Vallecito Alto in 2020

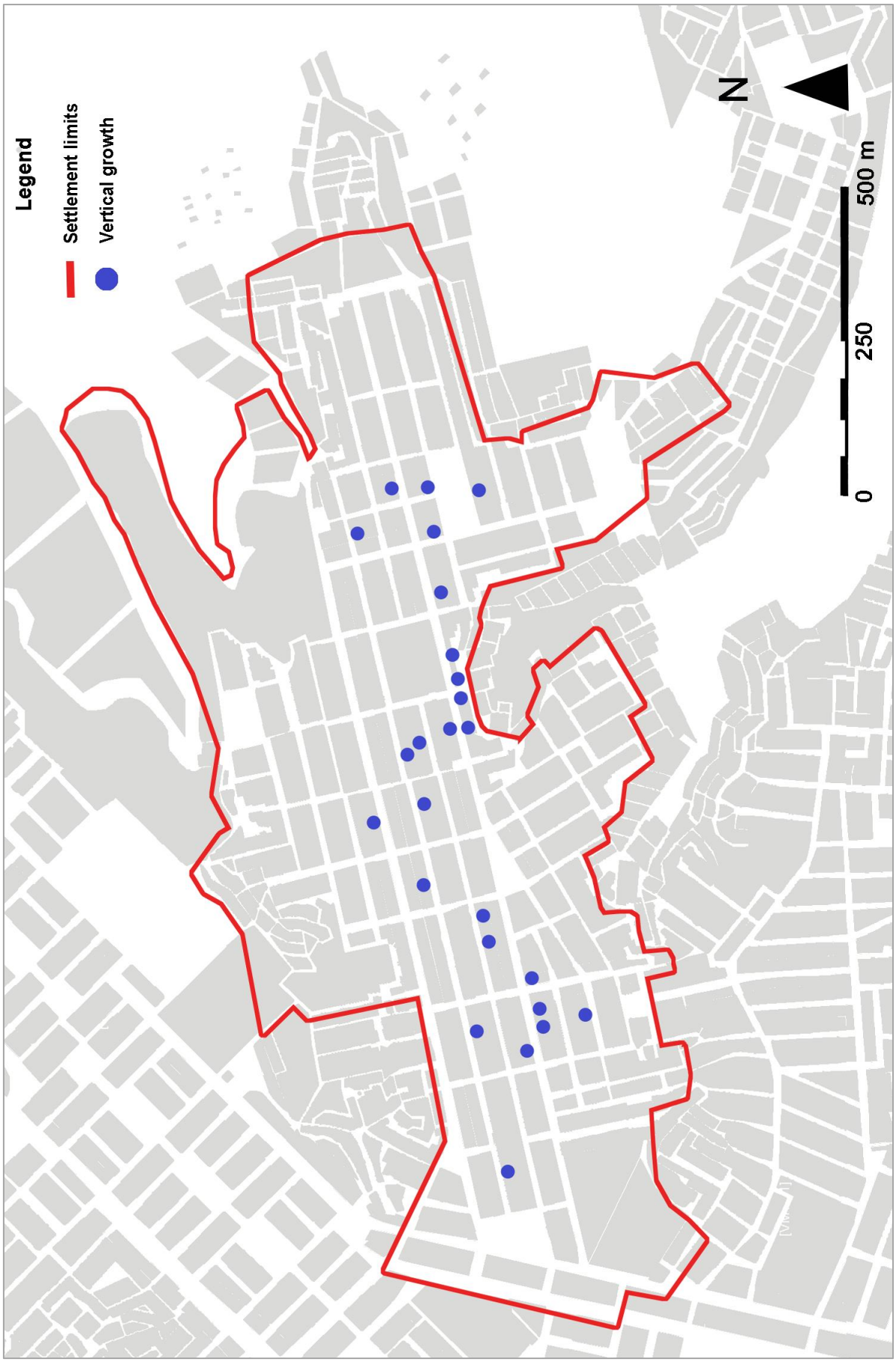

Figure 67: Location of houses that underwent vertical growth between 2013 and 2020

VI. DISCUSSION OF THE RESULTS

6.1. Urbanisation processes, demography and housing typology

The main objective of this work was to establish a link between various factors which can influence the urban development of informal neighbourhoods (population, public infrastructure, etc.). The following table (Table 6) summarises the main values discussed regarding the urbanisation processes, the demography and housing typology at both scales of Lima and Villa Maria del Triunfo. As no existing values at the settlement have been processed, the trends emerging at the district level will be extended to the settlement and supplemented by the data collected during the fieldwork.

Lima Metropolitana (without Callao)	**2007**	**2017**	**Rate of growth**	**Absolute difference**
Total population	7605742	8574974	12,7	969232
Population density (per urb.ha)	129,4	108,4	-16,2	-21
Urbanised area (ha)	58777,37	79138,43	34,6	20361,1
Total number of households	1854950	2607336	40,6	752386
Household density (per urb.ha)	28	29,6	5,7	1,6
Density of detached houses (per urb.ha)	25	23,2	-7,2	-1,8
Density of apartments in buildings (per urb.ha)	4,8	7,3	53,5	2,5
Villa Maria del Triunfo	**2007**	**2017**	**Rate of growth**	**Absolute difference**
Total population	378470	398433	5,3	19963
Population density (per urb.ha)	141,9	115,6	-18,5	-26,3
Urbanised area (ha)	2666,33	3447,75	29,3	781,4
Total number of households	83947	93821	11,8	9874
Household density (per urb.ha)	31,5	27,2	-13,6	-4,3
Density of detached houses (per urb.ha)	29,6	25,8	-13,0	-3,8
Density of apartments in buildings (per urb.ha)	0,5	0,9	90,6	0,4

Table 6: Summary of the existing results at the scale of LM and VMT (sources: INEI 2007, INEI 2017, CIAC-PUCP 2020)

In terms of population growth, the existing data from the INEI census shows a population increasing for both LM and VMT. However, even if VMT is one of the most populated districts of the metropolitan region, its demographic growth is slower with a rate of growth of 5.3 against 12.7 for LM. This phenomenon could easily be related to the urban expansion. Indeed, we can notice an increasing urban area for both LM and VMT. By analysing the urban expansion of the different districts, it seems that mainly districts from Nothern and Southern cones like VMT are facing a rapid urban expansion

in parallel to a population growth. This urban and demographic growth brings us to the population density, which was higher in VMT than the average population density of LM, both in 2007 and 2017.

The increasing population in districts like VMT seems to essentially come from the continuous and uncontrolled urban sprawl, mainly related to the population growth of the district. Indeed, according to the interviews and the collected data, there is still a process of migrations ingoing from rural to urban areas and from Venezuelan migrations. These populations usually come in the metropolitan region with very few financial savings, most of the time insufficient to buy lots and build legally. This is where the land traffickers benefit the most of the situation by selling land illegally to these people who will then settle on hillsides by the mean of land invasions. To illustrate this phenomenon, it is then pertinent to look at the household growth, which will bring us to the household density itself.

By looking at the number of households, both LM and VMT show their number rising. However, if we look at the metropolitan level, LM has a rate of growth of the number of households of 40.56, while VMT has a lower rate of growth of only 11.76. However, the number of households only will not give any information about building density. This is why comparing the housing density and analysing it by taking into account the type of housing will bring us interesting densification trends, if we consider the area of the different housing types as fixed.

Thus, by looking at the housing density, LM had its average housing density rising with a positive rate of growth of 5.67 between 2007 and 2017. This evolution can be explained by different reasons. The first one would be a significant reduction in the size of the houses in LM since the already built areas cannot really change in size anymore. This hypothesis can be disproved by a more logical one which is a general vertical densification trend in LM. Indeed, if the same average housing area is considered, more houses are built within the same area of land, which clearly shows a general trend for vertical densification (if we look at the LM scale). The assumption of the vertical densification can easily be supported by looking at the housing density by housing type. Indeed, the data analysis for LM shows a decreasing number of detached houses per urbanised area between 2007 and 2017, as well as an increasing number of apartments in buildings per urbanised area. The negative rate of growth of

detached houses density for LM is -7.2 while the positive rate of growth of apartments in buildings is 53.48, with an absolute positive difference of 2.5 apartments in buildings per urbanised area. Having an increasing apartment density clearly supports the fact that there is a general urban densification trend in LM.

If we look now at the housing density in VMT (per urbanised area), we can notice the opposite trend, which is depicted by a negative growth of rate of the housing density of -13.57. By looking at the housing density per housing type, the trends in LM and VMT are similar with a decreasing density of detached houses and an increasing number of apartments in buildings per urbanised area. However, the difference of the housing density per housing type between LM and VMT, is quite significant and could easily explain the difference of the trends for the housing density, which was growing at the metropolitan level and decreasing at the district level. Thus, it seems that the decreasing density of detached houses prevails over the apartments densification. It is important to note that, both for the LM level and the VMT, the increasing apartement density does not necessarily balance the decreasing density of detached houses. Indeed, the negative growth of detached houses density can also be the cause of the urban sprawl taking place in peripheral districts like VMT. This decreasing density of detached houses seems to prevail over the slow vertical densification process taking place in VMT.

These assumptions will be supported by data collected during the fieldwork and especially from the visual analysis.

The growth trends at the metropolitan level and at the district level show us that the urban densification does not necessarily follow the population growth. Indeed, if we look at the metropolitan level, the population density is decreasing while the housing density is rising between 2007 and 2017. This can be explained by the fact that the urban sprawl prevails over the urban densification, since fewer people live in the same urbanised area even the average apartement density is rising.

Whereas the growth trends at the metropolitan scale differ, the growth trends at the district level of VMT show a decreasing population density at the same time as a decreasing household density. As said before, the decreasing household density is mainly due to the decreasing density of detached houses, which is most probably the consequence of the land invasions taking place in the district, in the form of a rising

number of detached houses. Unlike the rising apartement density which indicates vertical densification, the development of detached houses indicates a horizontal urban growth, characteristic of the urban expansion (sprawl in this case since it is mostly uncontrolled).

The urban processes taking place at the district level will be applied the same way at the settlement level and the assumptions will be supported by the fieldwork data.

As said in section 4.2.1, the urban processes in Villa Maria del Triunfo follow two simultaneous processes. The first one is shown in the urban trends by an increasing number of land invasions resulting in a general urban sprawl at the level of the district. The other one is the process of urban densification in the already consolidated area.

According to the fieldwork, the settlement of Vallecito Alto started its urbanisation at the beginning of the 70s, at the same time as the rise of the six main urban centres of the district (Cercado, JCM etc), quickly filling all the empty spaces, therefore leaving very few spaces for public infrastructures, public spaces etc. According to the surveys and interviews, the settlement has a severe lack of public infrastructures and public green spaces.

From its birth, the Vallecito Alto settlement continued its consolidation process by filling empty spaces in the oldest part and by continuing its urban expansion. However, according to the interviews, the surveys and the visual analysis, the already consolidated area (the oldest part of the settlement located along the main avenues like José Olaya) is now in an intensification process characterised by materials consolidation (reinforced structures, use of noble materials like concrete, bricks etc) and vertical urban densification. The visual analysis, which allowed us to quantify the densification in a part of the settlement, reveals a small but existing vertical densification process in the already consolidated part of the settlement (only 25 houses underwent vertical densification out of the 414 surveyed ones). Even if we were expecting more densification in the already consolidated area, this trend corresponds to the small, but existing, densification trend at the level of the district, shown in the existing data from the INEI censuses.

The factors influencing this slow urban densification could be found in the information from the surveys and interviews. Indeed, according to some interviewees, there is not an economical attraction in the settlement and in the district.

These densification trends will probably continue to meet the rising housing demand. Although we could be expecting the vertical densification to take place closer to public infrastructures, the visual analysis shows that densification took place in quite random places of the surveyed area, which is mainly a residential area, according to the functional map analysis and the interviews. Besides, the surveys and interviews revealed that the new public infrastructures and basic services such as gas distribution, electricity etc only improved the life quality of the inhabitants at the dwelling level, but did not influence the growth in height of the buildings. Generally speaking, the new public infrastructures, improvements of basic services, uses of more noble materials reflect that there is an overall process of physical and infrastructural consolidation in the settlement, at the same time as the vertical densification and the urban sprawl on the outskirts of the settlement.

We can see that the different urban processes (vertical densification, expansion and consolidation) are occurring quite simultaneously like it was seen in the international literature (see stages and processes of urban growth in informal settlements).

By looking at the housing level, the survey and the interviews showed that the growth at the housing level can take two forms. The first one, which seems to be the dominant one, is the **internal housing division**, which results in less space per inhabitant, most of the time because of insufficient financial income to build additional levels. The second form is the **vertical extension** of the house, which is most of the time a will for more comfort, supported of course by sufficient financial income to pay the municipality taxes and building materials. These two processes are usually the consequence of a family extension. According to the fieldwork and the existing literature on the factors influencing the densification, it looks like the following factors are the main drivers of urban densification in Vallecito Alto:

- A good economic status of the family (mostly with local income from a small business or external income.
- The increasing size of the family

However, according to the overall analysis of the existing literature and fieldwork data, the following factors act as breaks to the urban densification:

- A low family income
- Existing urban and land policies of the district (taxes have to be paid to the municipality of VMT to build higher)
- Land trafficking

Obviously the surveys and interviews were conducted on a small percentage of the population of the settlement. Thus, it is necessary to be critical regarding these answers as they do not necessarily reflect the average thoughts of the population. To have a more accurate idea of the urban processes of the neighbourhood, more surveys and interviews should be conducted, which requires more time and resources.

6.2. Urban densification versus urban sprawl

Urban sprawl is a real problem in Lima, as well as in other megacities in the world. It the case of Lima, it mostly takes the form of land invasions on the hillsides, usually promoted by land trafficking. The land invasions bring new expensive challenges to bring basic services like water distribution, electricity etc to the top of the hills. Moreover, the houses built in these areas are usually built without technical advice, endangering the new settlers.

The Vallecito Alto study case shows clearly that urban densification is a process taking place at the same time as the urban sprawl. It showed us that urban densification cannot necessarily be seen as a solution to counter the process of urban sprawl, but more as a process in itself too. However, urban densification can be seen as the solution to meet the growing housing demand in LM without supporting the uncontrolled urban sprawl.

Even if urban densification could solve some problems caused by urban sprawl, the urban densification in itself has its own problems (Yadav, 2019). The best way would be to promote the urban densification by changing urban policies, attribute funds to the corruption and land traffick fight. Since the 90s and in order to protect the nature area of the Lomas, the local authorities tried to put a stop to these land invasions. However, the management of this problem by the authorities was and is still today insufficient to

counter the uncontrolled expansion trend. On the contrary, it seems that, instead of putting a stop to the development of these illegal occupations, the municipality of Villa Maria del Triunfo promotes this phenomenon through recognition, issuing illegal property titles and corruption. In general, even if some actions are taken to counter this phenomenon, the authorities seems to turn a blind eye on the problem.

The other reason for the lack of management is also about the difference between urban policies of the municipality and the city of Lima. While some districts have more accurate records of their urban development and apply specific and suitable policies, some districts like Villa Maria del Triunfo have a significant lack of data (no efficient informatics records and corruption according to the interviewees) which leads to bad management of its urban development. These different policies and management failures lead to misunderstandings in policy makings, irrelevant urban interventions and ease the development of land traffic, leading itself to broader problems like urban sprawl. This process of expansion will of course continue this way to meet the housing demand, if no drastic measures are taken to stop it.

6.3. Poverty and informality in VMT

From the information gathered in the survey and the interviews, it seems that the family income is a dominant factor for urban densification, since, according to the interviewees, the number of additional floors will depend mainly on family income. Therefore, it seems appropriate to show a zonification of the district according to the income. We can see In the case of Vallecito Alto, that the further away from the main avenues such as Mariategui Avenue we are, the higher the level of poverty is (see Annex 11). Between 2007 and 2017, the poverty rate in the neighbourhood decreased by 6.4% for the poor population and 1% for the extremely poor population respectively. This still leaves more than 20% of the population below the poverty line (see Table 7).

Year	Poor		Extremely poor	
	Absolute no of inhabitants	%	Absolute no of inhabitants	%
2007	103372	27,1	6066	1,9
2017	96407	20,7	4117	0,9

Table 7: Evolution of the level of poverty in VMT bewteen 2007 and 2017 (source: INEI, Mapa de pobreza provincial y distrital de cada unidad territorial para el ano 2013 por el numero estimado de habitantes para el ano 2017)

It is important to note that the problem of informality is brought at a national level and is one of the main issues that the Peruvian government is facing nowadays. However, some organizations as “COFOPRI” have been created to fight the informality of housing in Peru. So even if this phenomenon is continuing, some measures are already deployed to counter the problem of informality.

It appears from the interviews that the definition of informality, from the viewpoint of the inhabitants and in the Peruvian literature, is mostly based on the legal aspect rather than the physical aspect. Even if the physical criteria of informality are encountered in some parts of the Vallecito Alto settlement, these criteria can still be discussed, especially from an external viewpoint. Indeed, the physical definition of informality is based on debatable criteria of life quality, which can be very subjective. On the other hand, however, the legal aspect of informality is related to the urban policy of the country, the city and the district in this case. Thus, a settlement and a housing property could be considered as legal (and then formal) in one place and illegal (and so informal) in another one. These issues bring us again to the one found in the international literature, where it emerged that defining informality is a procedure that will be easily restrained by these kinds of problems.

6.4. Advantages and disadvantages of the applied methods

In general, it can be concluded that the existing quantitative data at the settlement level was insufficient. This is why the results collected at the district level were extrapolated to the settlement one. The qualitative data from the interviews proved to be more useful in the context of this work by bringing qualitative information on the development of the settlement. As expected, the surveys and interviews brought additional information to the existing data from the international literature and other official data sources, even if the number of surveyed and interviewed people was low. Finally, the visual analysis brought the information to support the assumptions at the district level. Even if not all the settlement was surveyed, the visual comparison between the Google Street View pictures from 2013 and the personal pictures from 2020 allowed us to illustrate and quantify the densification process taking place in the consolidated part of the settlement.

CONCLUSIONS

The study of urban densification in informal settlements is very complex, not only because of the abstract definition of informality, but also because measuring the urban densification in this kind of neighbourhoods is also challenging in itself for various reasons. To understand how informal settlements like Vallecito Alto developed, it is necessary to understand the urban processes taking place at all the other scales, from the metropolitan scale to the settlement one. This is why the data of this research were collected with a particular methodology, based on several approaches aiming to collect different information, from quantitative to more qualitative ones. As expected, the approaches at the settlement scale brought complementary information (legal, social, economic etc) on the way the settlement developed in the last decades.

The analyses realised at the metropolitan level showed that Lima Metropolitana is a megacity of South America which faced, and which is still facing, the same problematic urban process of urban sprawl. As seen, its population has been growing significantly in the last 50 years and the metropolitan region of Lima is subject to an uncontrolled process of urban sprawl, thus developing informal extensions of the urban tissue. More recently in the 10 last years, LM has seen its population shifting from more central and already urbanised districts to more peripheral districts like Villa Maria del Triunfo. However, if we consider the evolution of the metropolitan area between 2007 and 2017, there is a general trend to urban densification mostly characterised by a positive growth of apartments in buildings. At the same time, Lima Metropolitana is still facing the problem of urban sprawl in the peripheral districts.

When relating the analysis of the different scales, the surveys, interviews and visual analysis, we can conclude by saying that the district of VMT, and more precisely the Vallecito Alto settlement, were exposed to a rapid urban and demographical expansion from the 60’s, mainly through informal urbanisation processes. Even if VMT does not have the highest demographical and building density among the districts of LM, the fieldwork shows that there is a slow densification in process in the already consolidated area of the Vallecito Alto neighbourhood, at the same time as a dominant and uncontrolled urban sprawl. The densification processes ongoing in the neighbourhood of Vallecito Alto are mainly the consequences of various factors. Indeed, according to

the fieldwork, factors such as the economic status, the size of the family, the buildings location, the urban policies and land trafficking seems to influence the densification processes more than the proximity and the type of public infrastructures. This process of densification, mainly located in the already consolidated areas, takes two forms: a vertical extension by additional levels, or an internal division of the house when the economical status of the household does not allow such building

Finally, we could expect that the densification trends will continue to meet the increasing housing demand. Even if the urban sprawl is significant and keeps increasing in the peripheral areas of this kind of megacity, it seems that the areas the most prone to urban densification are the already consolidated ones. The urban densification will probably take place in the most attractive areas in terms of job opportunities, as well as where the urban policies will mostly favour this kind of urban development. Thus, urban densification can be seen as a break to the urban sprawl, but only if it is supported by appropriate interventions. To understand better the densification processes in informal settlements, it might as well be interesting to relate the trends depicted in this work with other districts, cities and countries. The urbanisation trends are growing in our contemporary world and cities transform themselves into megacities, involving a significant social and ecological impact on our present and future world. So could the densification be the solution to slow down urban sprawl? How should urban planning policies be revised to improve the quality of life in the best way possible? These are questions which are worth exploring in future studies.

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ANNEXES

Annex 1: Positive and negative effectis of urban densification (Yadav, 2019)

Categories	Positive effects	Negative effects
Energy consumption and supply	• Improved building energy performance due to reduced thermal loads (cooling demands) of buildings by overshadowing in a hot climate • reduction in heat gain and loss • reduction in energy charges due to compactness and short distances (distribution lines) • cost efficiency in energy consumption • Improvement of urban resource utilization	• Increase in heating loads (consumption of heating equipment) resulting from reduced solar availability in cold climates • growth of the urban heat island effect • Increased energy consumption • Reduced scope for incorporating renewable energy technology or rainwater collection • Low potential for PVs and other renewable sources due to reduced solar availability
Quality of life	• Healthier and safer lives due to improved air quality and physical activity (walking) by residents • greater livelihood opportunities	• Reduced living space/social stress living in small spaces • Negative impacts on physical and mental health of residents • Perceived quality of life is deteriorated • Lowers QOL of the urban residents
Mobility	• Reduced dependency on automobiles which also leads to less fuel demand • Reduced travel distances which encourage public transport • Efficient public transport, • Cost-effective transport, sustainable transport • Reduced transport energy consumption • Reduced congestion, reduction of traffic flows	• Traffic Congestion and traffic problems like increased noise and emissions
Air quality	• Less carbon emission due to reduced pollution from vehicles	• Air pollution, higher traffic emissions
Access to services and facilities	• Proximity and better access (available within short distances) to services, facilities and workplace	• Poor access to facilities
Social sustainability	• Social benefits in terms of: - Social equity/lower levels of social segregation - better Social interaction and integration - sense of community (active neighbouring, shared responsibility) - social safety and tolerance - cultural and lifestyle diversity	• Social inequity and segregation • Less community spirit and social interaction • Signs of isolation and loneliness

	• Demographical and economic diversification	
Cost	• Affordable housing, cost reduction in services and infrastructure • construction and supply chain costs • Decrease in prices with increase in density/denser cities	• Increased land prices and housing • Increased cost due to lack of social services like school and hospitals by government
Urban Green spaces	• Additional green spaces • Access to public green spaces • Preservation of urban green spaces/ green infrastructure/farmlands/agriculture land	• Loss and fragmentation of urban green space • negative effects on urban biodiversity and on the ecosystem services • increase in impervious surface • loss of urban green infrastructure (public parkland and residential tree cover) and also loss of private green spaces. • Unequal access to green spaces, which depends on pattern of distribution and access • Results in crowding of public urban green spaces affecting their recreational quality and making people employ coping behaviours.
Quality of the local environment	• Less crime/sense of safety	• undesirable impact in the period of construction and infrastructure development. • Increase in crime • Overcrowding • Increased noise
Economical effects	• Economical benefits for city: - increased productivity and wages due to agglomeration economies - higher employment opportunities - energy efficiency leads to economical benefits	
Land use	• Efficient and mixed land use, • Efficient use of urban land • Preserving rural areas and natural resources	
Water management	• Efficiency of sewerage treatment infrastructure • Mitigate the water crisis and increase infiltration to groundwater • Reduces flood - As natural environment (limited sprawl) permit more infiltration than built-up spaces	

	- By decelerating intrusion of communities in river corridors	
Access to Sun		• Lack of natural light and solar availability due to overshadowing of buildings • Change in the insolation of rooms. • loss of urban daylight in public spaces
Intimacy		• Lack of privacy
Infrastructure		• Increasing pressure on existing infrastructure
Fuel poverty		• For low-income households • high density increases fuel poverty, but not in apartment living
Waste		• Higher concentration of solid and liquid waste
Management		• Growing management challenges
Categorization		• Ghettoization

Densidad urbana en Vallecito Alto

Buenos días, soy estudiante de Ingeniería Civil – Arquitectura en la Universidad de Lieja, Bélgica. Como parte de mi tesis, analizo cómo se ha densificado el sector de Vallecito Alto, en los últimos 10 años. Mi trabajo se refiere a la densificación de los asientamentos humanos. La mayoría de estos distritos enfrentan problemas de expansión urbana e invasión de tierras con una población que crece continuamente con medios limitados frente a otros distritos. Por lo tanto, es necesaria una planificación y consolidación urbanas. Para analizar el desarrollo del vecindario (en particular en altura), recopilo información (fotos, encuestas, etc.) para comparar los cambios de hace unos años. Por lo tanto, esto permitirá destacar cómo se está desarrollando el distrito y relacionarlo con el número de habitantes.Para esta investigación necesito de información que me la puede brindar al responder este cuestionario.

Gracias por tomarse el tiempo de responder estas preguntas.
*Obligatoire

1. 1.a. ¿Calle y numero de la cuadra en que vive actualmente ? *

2. 1.b. ¿Cuánto tiempo ha vivido en esta casa? *

3. 1.c. ¿Cuántas personas viven en la vivienda? *

4. 1.d. ¿Cuántos hogares tiene en la casa ? *

Une seule réponse possible.

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ Más

5. 1.e. ¿La vivienda es ? *

Une seule réponse possible.

- ◯ Propia
- ◯ Alquila parte de su casa
- ◯ Autre : _____

6. 1.f. Cómo la adquirió ? *

Plusieurs réponses possibles.

- ☐ Lotización de la zona
- ☐ Compra a un propietario
- ☐ Invasión
- Autre : ☐ _____

Cambios en su edificio

7. 2.a. ¿Qué ha cambiado más en su edificio en los últimos 10 años ? *

Plusieurs réponses possibles.

- [ ] Numero de pisos o departamentos adicionales/extensión en cada nivel
- [ ] División de la casa en varias viviendas
- [ ] Cambio de función de una parte de la casa para el trabajo (ejemplo: tiendas, talleres, etc.)
- [ ] Autre : _____

8. 2.b. Relacionado con la pregunta #2.a...Por qué ? *

_____

_____

_____

_____

_____

9. 2.c ¿Qué servicios básicos han cambiado más en su edificio en los últimos 10 años? *

Plusieurs réponses possibles.

- [ ] Sistema de abastecimiento de agua potable
- [ ] Sistema de alcantarillado de aguas servidas
- [ ] Red de distribución de energía eléctrica
- [ ] Servicio de Gas
- [ ] Cable y conexión de internet
- [ ] Autre : _____

Cambios en la calle

10. 3.a. ¿Qué ha cambiado más en los edificios de su calle en los últimos 10 años ? *

Plusieurs réponses possibles.

- [ ] Numero de pisos o departamentos adicionales/extensión en cada nivel
- [ ] División de la casa en varias viviendas
- [ ] Cambio de función de una parte de la casa para el trabajo (ejemplo: tiendas, talleres, etc.)
- [ ] Autre : _____

11. 3.b. Relacionado con la pregunta #3.a...Por qué ? *

_____

_____

_____

_____

_____

12. 3.c ¿Qué servicios básicos han cambiado más en su calle en los últimos 10 años? *

Plusieurs réponses possibles.

- [ ] Sistema de abastecimiento de agua potable
- [ ] Sistema de alcantarillado de aguas servidas
- [ ] Red de distribución de energía eléctrica
- [ ] Servicio de Gas
- [ ] Cable y conexión de internet
- [ ] Sistema de drenaje de aguas pluviales
- [ ] Sistema de vías
- [ ] Autre : _____

Creación de capacidad

13. 4.a. ¿Cree que más personas podrían vivir en su edificio (otros miembros de la familia, otros grupos ...)? *

Une seule réponse possible.

- SI
- NO

14. 4.b. Si es así, ¿ Cuantos y por qué? *

Densidad

Densidad (de población) es el número de personas en cada unidad de superficie.

15. 5.a. ¿Cree que algunas zonas de Vallecito Alto tienen mayor densidad que otras? *

Une seule réponse possible.

- SI
- NO

16. 5.b. Si es así, ¿dónde? ¿Y a qué cree que se debe esto? *

Equipamientos públicos

Sobre las necesidades de los equipamientos públicos ...

17. 6.a. ¿Qué equipamientos públicos tiene actualmente a menos de 1 km de su hogar? *

Plusieurs réponses possibles.

- [ ] Establecimientos educativos (escuelas etc)
- [ ] Centros de salud, hospitales, clínicas
- [ ] Mercados y tiendas de alimentación
- [ ] Establecimientos culturales (museos, bibliotecas, salas de conciertos, centros culturales, etc)
- [ ] Lugares de culto
- [ ] Estaciones de policia
- [ ] Administracion publica
- [ ] Campos deportivos y complejos deportivos
- [ ] Parques
- [ ] Transportes publicos

Autre : _____

18. 6.b. ¿Qué equipamientos públicos le gustaría tener cerca de su hogar ? *

Plusieurs réponses possibles.

- [ ] Establecimientos educativos (escuelas etc)
- [ ] Centros de salud, hospitales, clínicas
- [ ] Mercados y tiendas de alimentación
- [ ] Establecimientos culturales (museos, bibliotecas, salas de conciertos, centros culturales, etc)
- [ ] Lugares de culto
- [ ] Estaciones de policia
- [ ] Administracion publica
- [ ] Campos deportivos y complejos deportivos
- [ ] Parques
- [ ] Transportes publicos

Autre : _____

19. 6.c. Relacionado con la pregunta #6.b...Por qué ? *

Lotización de la zona

20. 7. ¿Quién se ha encargado de la lotización de la zona ? *

Plusieurs réponses possibles.

- [ ] Municipio
- [ ] El estado
- [ ] Dirigentes locales
- [ ] Autre : _____

Urbanización del sector

21. 8.a. Podría decir ¿cuál ha sido para Ud. lo que se ha priorizado en la urbanización de su sector? *

22. 8.b. Y ahora? *

Espacios de Vallecito Alto

23. 9. Según usted, ¿qué parte representa Vallecito Alto ? *

Une seule réponse possible.

- ( ) La parte primera, que es de fines del 70
- ( ) Las nuevas invasiones que son del 90
- ( ) Todo en conjunto
- ( ) Autre : _____

Contactos y fotos

24. 10.a. ¿Acepta ser contactado para responder a una posible entrevista (a través de WhatsApp o otros medios de comunicación)? *

Une seule réponse possible.

- ( ) SI
- ( ) NO

25. 10.b.En caso afirmativo, ¿puede escribir sus datos de contacto para que pueda contactarlo por favor? *

26. 10.c. Cuando haya terminado este cuestionario, ¿podría enviar fotos del exterior de su casa y de las casas en la calle al siguiente whatsapp al +32 471 01 16 48 o a la siguiente dirección de correo electrónico densidad.vallecito.alto@gmail.com por favor (especificando sus datos de contacto)? O si lo prefiere, proporcione sus datos de contacto en la pregunta #10.b para que yo pueda contactarlo. Esta es la parte más importante de mi trabajo ! Gracias. *

Une seule réponse possible.

- ◯ SI
- ◯ NO

Annex 3 : Interview guide

1. ¿Podría identificar los cambios más importantes en la densidad de construcción en el barrio de Vallecito Alto? ¿Cuáles son, en su opinión, las causas y consecuencias de esta densificación?

2. ¿Cuáles son los cambios más importantes que han tenido lugar en el barrio en cuanto a instalaciones públicas y servicios básicos?
   (instalaciones públicas son tipo escuelas, establecimientos administrativos, tiendas, parques, transporte público, etc…y por los servicios básicos son sistema de abastecimiento de agua potable, gas, distribución de energía eléctrica, etc…)

3. ¿Cuáles han sido las causas y consecuencias de estos cambios? ¿Podría explicarlo?

4. En su opinión, ¿cuáles son los mayores problemas de las instalaciones públicas en el barrio y cómo cree que pueden ser resueltos?

5. ¿Cuáles han sido los cambios dentro y fuera de las casas en las zonas más densas (la calidad de los espacios interiores, las escaleras, etc.)?

6. ¿Cree que es importante hacer más denso el barrio de Vallecito Alto? ¿Podría justificarse por favor?

7. También estoy trabajando en paralelo en un proyecto estudiantil para construir viviendas, un espacio público y una escuela publica cerca del parque Ollantay. ¿Qué tiene de especial este espacio ? cómo se utiliza (funciona) y cree que se utiliza bien? Cree que una escuela publica mas grande puede esser util en Vallecito Alto ?

Annex 4: Interviews transcription

List of the interviewees:

Padre Febrero (priest, inhabitant 1), MAURICIO (old retired man, inhabitant 2), Mauricio (young man, inhabitant 3), Pillar (Young woman, inhabitant 4), Gladys (women, inhabitant 5), Angel Ramos (journalist, inhabitant 6), Elmer (Old man, inhabitant 7), Alejandro (Young man, inhabitant 8)

Date at place of the interviews:

3 and 4 June 2020 – Vallecito Alto (Villa Maria del Triunfo district, Lima)

Question 1

Causes

Usually the causes are the family extension (ex: The family increases, the children get a job, get married and with the new income, can afford building additional floors.) → Put picture of the house in front of the church of Padre Febrero., which leads:

- to a division of the house into different residences for the different members of the family (grand-parents, parents, children, family-in-law etc). Mainly because taxes have to be paid depending on the height of the building, its materials etc. So most of the people people prefer to make an internal division of the existing house, even if It leads to less space, bad configuration of the rooms etc.
- to an extension of the house depending of the family income.

"The evolution of the house follows the evolution of the family" (Febrero, 2020)

Other cause is the land traffic, which seems to be the biggest problem. People without accommodation search for a piece of land to settle but faces land trafficants who sell them lands illegally.

- Land traffic
- Migrations
- Lack of management of the municipality (doing everything on paper, they don't know register everyone correctly) → Therefore difficult to have viable information. While in the oldest part, it is mainly due to the extension of the family

Consequences

- Problems for the division of the house between the different members of the family
- Family problems (ex. New family members forced to live together).
- Even more sanitary problems (to high population density, light, structural problems)
- Changes took place progressively through more than 40 years.
- Most noticeable changes in the oldest part from the 70/80', were roads were already built, a bit of public infrastructure but only over a small area (gaz distribution)
- Obvious higher urban density in the oldest part of the neighbourhood, BUT not controlled, there is no planning for that densification.
- Not a lot of changes → Only if the family situation changes→ Only 1 or 2 more floors, but very progressively
- Usually the ground floor is for commercial activity
- A lot of inhabitants are not legally registered → Considered as informal
- Most changes occurred in the newest part (from the 90s) → land invasion
- Family extension→ ½ additional floors

- Family extension→ Additional floors for the rest of the family (when possible)→ Usually 2/3 floors
- Rapid, uncontrolled urbanization when the development or the neighbourhood started, mainly because the land price changed !
- 1000 Soles now and 100 soles before (in the 70s) for 1m² → Leads to a densification and division of the lots
- Lots of new settlements (usually land traffic and land invasion), very desiminated on the hills slopes.
- Changes in the ground floor function → going with betterments of the materials (more noble materials)

Question 2

- Additionnal basic services (water supply, roads etc) were made progressively too→ Usually with the pressure of the citizens on the municipality
- New public infrastructures/services only with pressure of the inhabitants
- But generally speaking, there was nearly no changes in public infrastructures except a little bit in some areas.
- Nearly no changes for the public infrastructures
- Only a few changes in the oldest part with the venue of gaz distribution
- Water and electricity in the urbanized area (the old one)
- Later, gaz distribution in 2013
- No changes for the roads
- Only recently that the private bus company is driving through the neighbourhood (5 years ago)
- Nearly no changes in public infrastructures. Only water and electricity brought in the first urbanized part of VA (70') and gaz in 2013.
- - Basic services not designed for so many people (insufficient potable water distribution system)
- Electrical network messed up → thefts and poor visual confort → Try to put it underground
- GOOD think → Gaz distribution was a big plus for many families but did not have any impact on the urbanistic perspective (except improving life quality of the inhabitants)

Question 3

- The new bus line makes it easier to move around and commute. But not necessarily related to the urbanism.

  Causes
- Nothing noticed yet.
- Pressure of the inhabitants on the municipality

Question 4

- Lack of management of the municipality and the state
- Sewage system too old and not efficient enough to sustain the increase of the population→Needs to be renovated
- Salted ground → damaging the buildings with the humidity and the small amount of rain (roofs not designed to harvest rainwater

Problems

- Significant lack of public infrastructures (hospitals, administration etc)
- Lack of intervention from the municipality/state and lack of management
- → even worst during the pandemic
- Not enough security/police in the streets → problems during the pandemic since everybody is still living like there is nothing.
- Not enough public schools (only in small rooms or one is a private one)
- Not enough public/open spaces, especially green ones.

- There is a kind of “capitalism” which involves big companies buying whole blocks (usually to hide money laundering) preventing any further development of the area. → Since it becomes a private property (usually agreements between land trafficants and municipality), no housing can be made, no planning etc).
- Biggest problem for him is the lack of public transportation. There is only one private bus line, which results in a critical lack of connection with the rest of the city.
- Some inhabitants maintain parts of the existing public spaces but there is no coordination between them to do it.

Solutions
- Having a urban strategy and planning for these areas
- Control more the corruption taking place between land trafficants and the municipality
- Having aggreements between the municipality of VMT and the city of Lima (there are different laws, which make it easier for corruption and illegal actions.
- Having some help for NGOs or organizations

Problems
- Not enough open spaces, especially the green ones.
- Simply an obvious lack of public infrastructures.
- Not enough maintenance of the few existing urban furniture
- No playground/space for children
- Lack of public schools, with correct size

Solutions
- Make the few public infrastructures more accessible (closer, accessible by feet, by public transportation)

Problems
- Lack of municipality management
- Corruption at the municipality
- Land traffic → Give false hopes for people moving from the countryside
- No green spaces

Solution
- Centralize the different institutions (city of Lima, Municipality of VMT) and find appropriate urbanism policies.
- → Urban planning and strict planning policies are highly needed

Problems
- Lack of space for building, no empty space for building.
- No planning
- Lack of public infrastructures (ex; schools)
- Increase of basic services demand
- Lack of market, green spaces
- Unsized roads for buses → Impossible for them to drive through
- No fixed bus lines
- Impossibility to build some public infrastructure (police station) because of personal interests of land trafficants and local leaders (corruption)

Problems
- Basic services not designed for so many people (insufficient potable water distribution system)
- Electrical network messed up → thefts and poor visual confort → Try to put it underground
- Not enough public transportation for the local population → More buses
- Some roads are not maintained which makes it difficult to access some areas of VA
- No parks

Solutions
- Make interactive parks (cultural areas playgrounds)
- Reconnect the district with the other ones of the city, in order to lower social discrimination
- Make it attractive for teachers to stay in the area.

Question 5

- The biggest changes occurred in the 3 main avenues from the 80 ies of the neighbourhood (highlight them on a map)
- The most noticeable betterments in these avenues are :
    - New noble materials
    - Reinforcement of the existing structure
    - Waiting structures for future extension of the house
- Mostly changes of housing materials (more noble and solid materials)
- The changes occurs mainly for people who can afford it
- The changes in/out of the houses depend mainly on the family incomes
- For him, there is not necessarily a big difference between different areas of the neighbourhood (except the new land invasions not densified yet.)
- Mostly changes on the oldest part (3 avenues)
- New construction materials (concrete, bricks etc)
- A few additional floors (generally around 2/3 floors)
- Difficult to build something (horizontaly or verticaly since there is no free space and authorizations of the municipality are required (pay taxes which people try to avoid).
- Difficult to see if there were any changes inside the buildings;
- Concrete/bricks (noble materials) replaced corrugated steel buildings in oldest area
- The oldest area is considered as “more formal” since most of the inhabitants have property titles.
- Plots of 20m*10m (200m²) divided between children→ No regulation for the densification and buildings in these plots.
- Betterments of housing materials
- There is no previous urbanism and architecture plans → Then the changes are very random

Question 6

- Yes it is very important to densify more the buildings in order to free some space for other functions like parks, police station etc
- No, following him it is not necessary to densify because there is no work close to the area, most of the people go to work quite far from their house, not in that neighbourhood. Densify the area would be useless because a lot of children/parents start living and working in other places in order to sustain their family living in that neighbourhood.
- Yes, for her, it will centralize for the functions and make it possible to free some space for public functions.
- Higher buildings in the bottom part of VA(the oldest one)
- Yes for her it is. Simply because it would make more free space that can be allocated to public infrastructure (parks, hospitals etc).
- Yes. For her, it is a good idea but the initiative and the funds need to come from the state/municipality. It can be a good idea, only if it accessible to the citizens. Good idea to free some spaces for parks, public infrastructure etc.
- Yes to free some space for public infrastructure BUT it is very difficult to relocate people from their house because “ It is a matter of belonging and lifework” (ANGEL RAMOS, 2020)

Question 7

Needs to put more public spaces, especially green spaces where children can play , playgrounds.

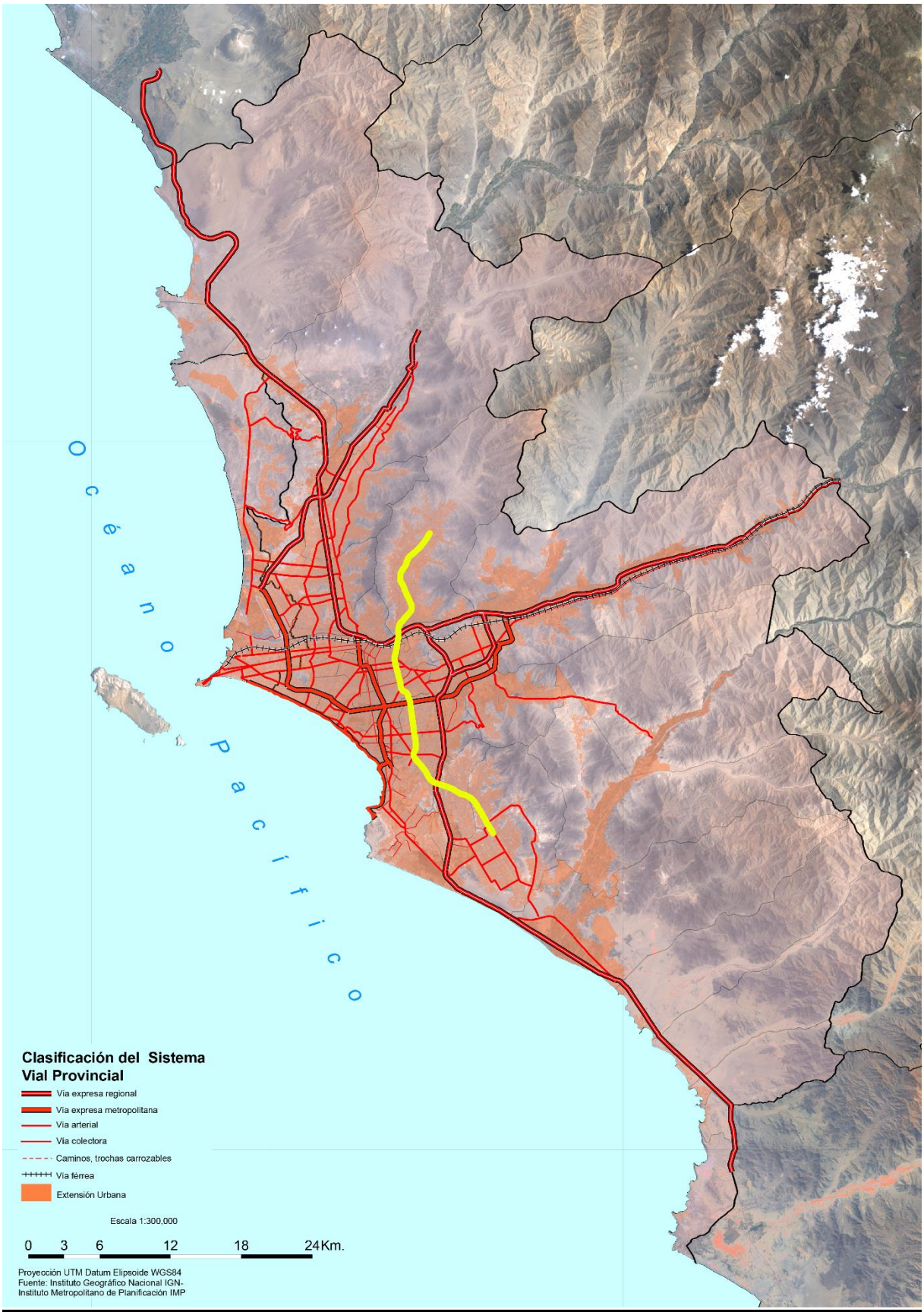
Additional comments

Padre Febrero lives there for 15 years. Only a little bit of the church, no NGOs doing anything about the life quality of the inhabitants.
Communication problems on Whatsapp

- Not available
- Too much noise, impossible to communicate

Lives there for more than 40 years
There is no structural study for the buildings, which can be dangerous !
ELMER - Parks and public spaces for festivals and public events → Good to revitalize the neighbourhood
PILLAR (Young women living in VA→ Younger perspective, viewpoint). Pour le moment, à sa connaissance, n'y a pas de futur projet de logement dans cette zone. No biking culture, topography of the site makes it difficult to bike, + criminality.
GLADYS Escema 308 → Planning for replacement and improvement of potable water distribution and sewage system in the following years in the sector 308 (VA) → Started in 2019
https://www.gob.pe/institucion/vivienda/normas-legales/279149-049-2019-vivienda-vmcs-paslc-ua
https://www.perulicitaciones.com/mejoramiento-y-ampliacion-de-los-servicios-de-agua-potable-y-alcantarillado-en-los-sectores-ampliacion-308-309-y-310-esquema-jose-carlos-maritegui-villa-maria-del-triunfo-lct141370.html
ANGEL RAMOS Size of the houses in the new parts = 50-80m²
Size of the houses in the old parts = 200 m² (sometimes redivided) → 10*20
No typology for the disposition of the interior (made freely by the owners)
There is not a lot of people renting, mainly allocated to the family members.

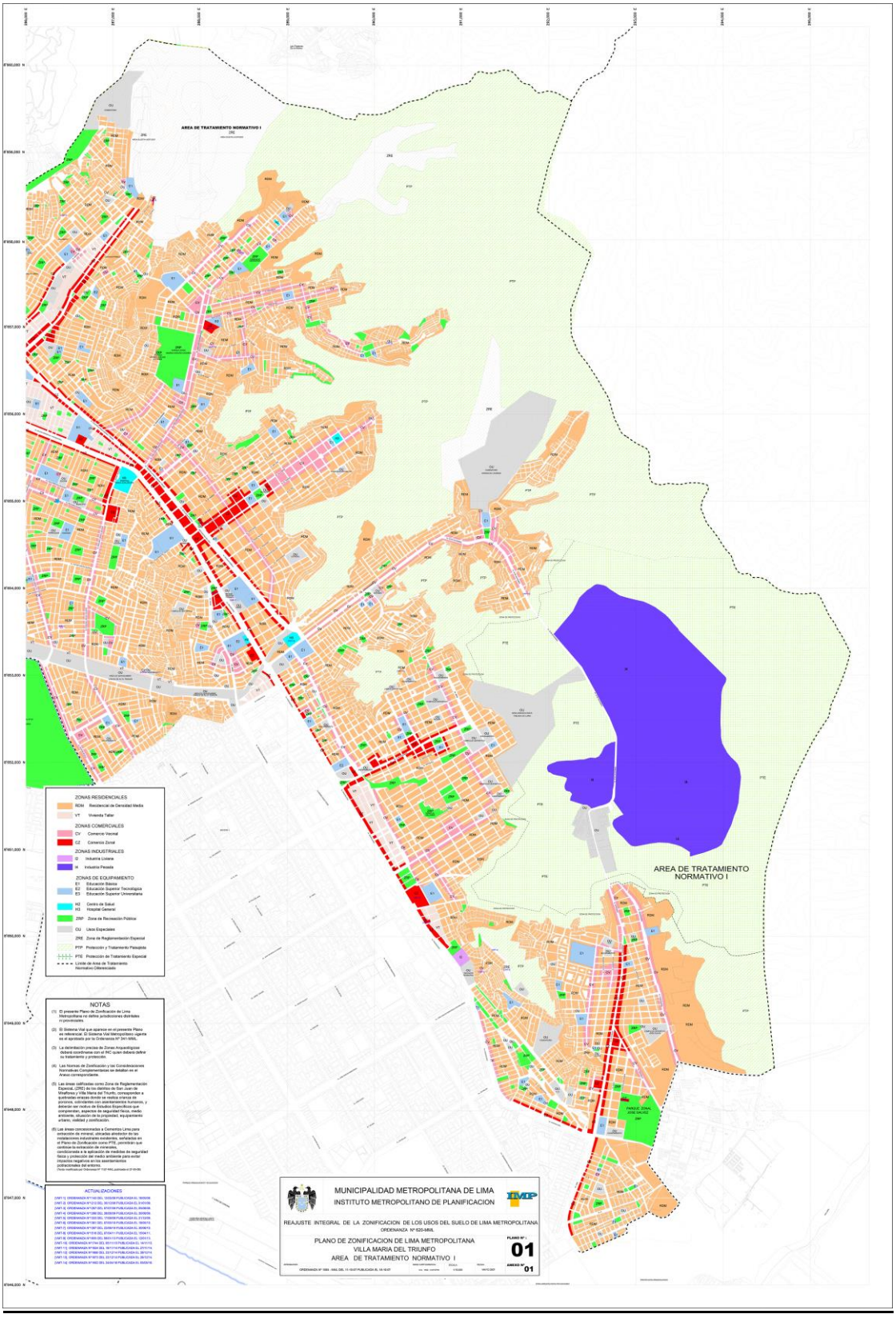
Annex 5: Mobility Network of Lima Metropolitana (Source: IGN, IMP)



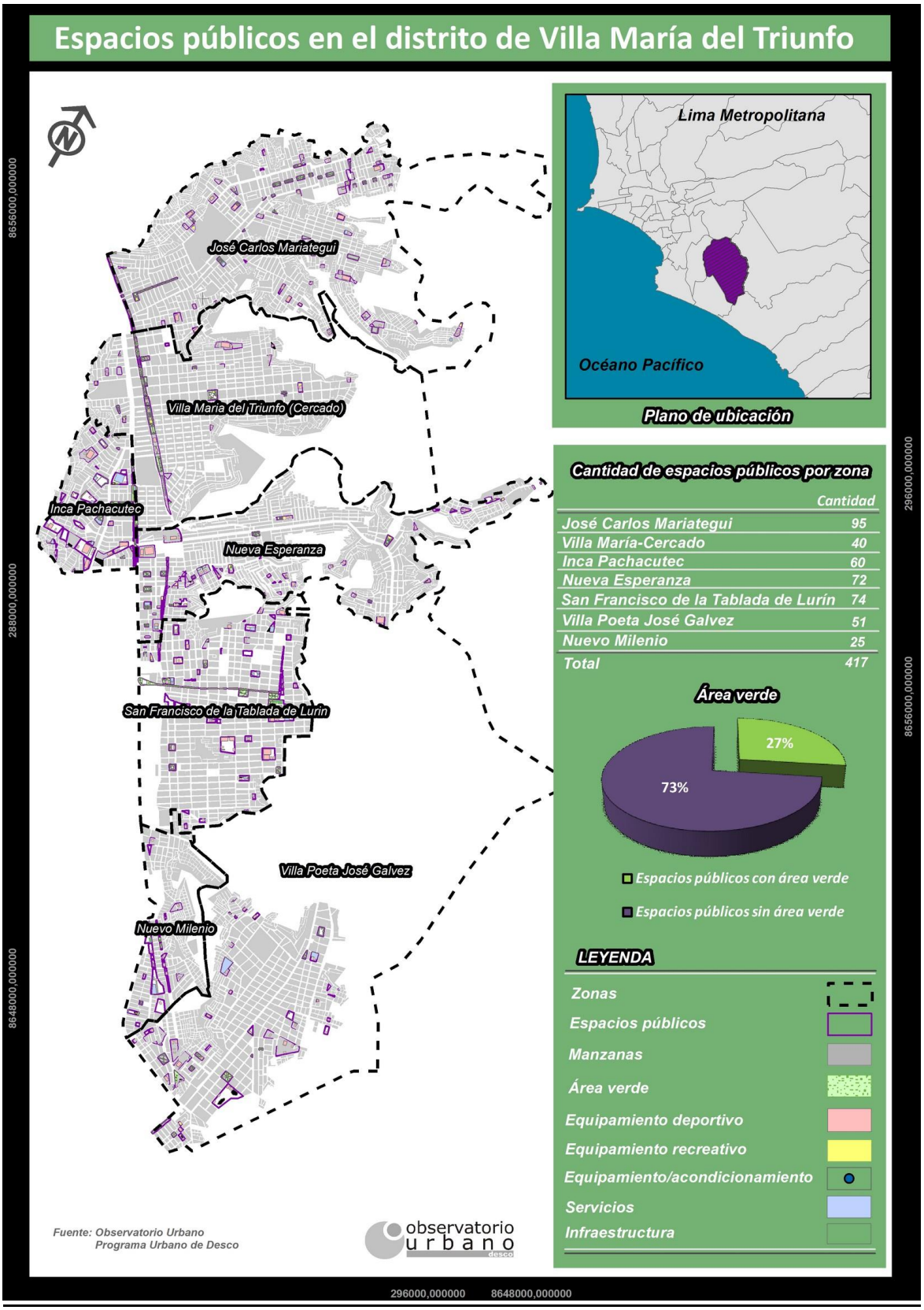
Annex 6: Map of Districts & Cones of the Metropolitan Region of Lima (Source: INEI 2017)

Fuente: Instituto Nacional de Estadística e Informática (INEI).

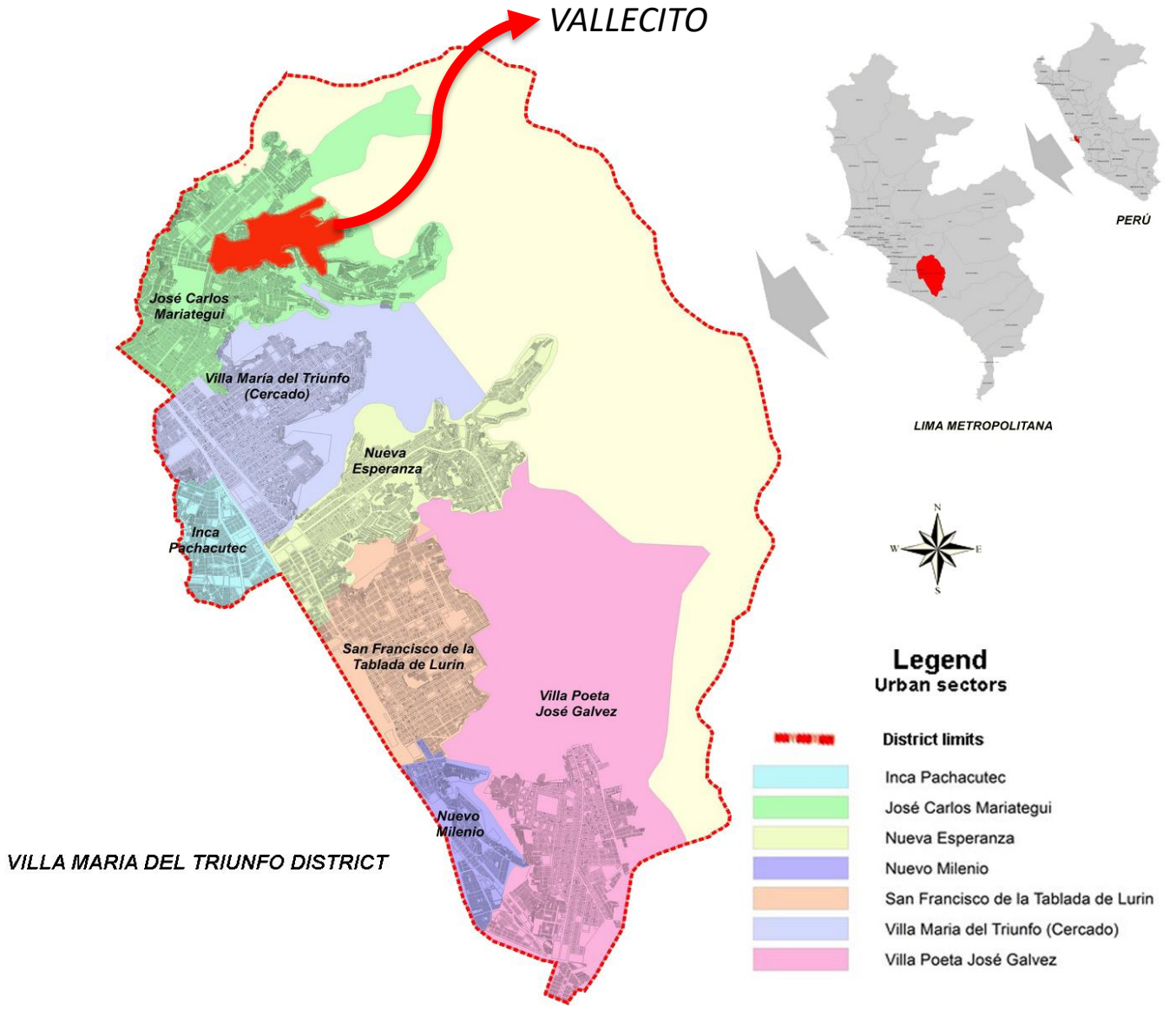
Annex 7: Functional distribution in Villa Maria del Triunfo district (Source: Municipalidad de Villa Maria del Triunfo, 2011)



Annex 8: Public space in Villa Maria del Triunfo district (Source: Desco 2009)



Annex 9: Map of the sectors of the Villa Maria del Triunfo district (Source: Municipalidad de Villa Maria del Triunfo, 2011)



Annex 10: Visual comparison examples of vertical extensions in Vallecito Alto (Sources: on the left: Google Street View pictures from 2013, on the right: personal pictures)


Google

Annex 11: Map of the income per head distribution in Villa Maria del Triunfo (Source: INEI 2017)