

# **An industry without grounds: Understanding the locational patterns of manufacturing firms in the city of Lima, Peru**

by

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## **Abstract**

We explore the locational characteristics of manufacturing firms in the city of Lima. For this we created a database of establishment locations of medium and large industrial establishments. Considering factors such as firm size, age, sector and global trade connections, we will explore where certain types of firms tend to locate. We elaborated on this information with a previous study and informational interviews.

We show that while certain industrial firms are capable of moving to the outskirts of the city, others still need to locate in close proximity to city centres. We also explored whether new smaller firms need to locate in central areas, while larger firms tend to locate on areas where low land prices and good connectivity to Global Value Chains allow better performance. This argument however turned out harder to explore, given the limited information we gathered on truly small firms.

The findings support a case for the protection and promotion of central industrial lands while also developing a theory for best practices in outskirt locations, taking into consideration that current solutions are being promoted by private investors rather than regional authorities.

**Keywords:** Lima; Peru; Location Factors; Global Value Chains; Industrial Location Theory; Manufacturing

*To my beloved wife Cathy. Your love and support helped me through the hardest parts of this journey. To my son Enzo. Heaven knows no frontiers, and I've seen heaven in your eyes.*

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## List of Acronyms

EOI	Export Oriented Industrialization
GVC	Global Value Chains
IMF	International Monetary Fund
IMP	Instituto Metropolitano de Planificacion (Metropolitan Institute of Planning)
ISI	Import Substitution Industrialization
MVCS	Ministerio de Vivienda, Construccion y Saneamiento (Ministry of Housing, Construction and Sanitation)
PDR	Production, Distribution, Repair
PMD	Planned Manufacturing Districts
PRODUCE	Ministry of Production of Peru
RUC	Registro Unico del Contribuyente (Single Taxpayer Registration Number)
SFU	Simon Fraser University
SNI	Sociedad Nacional de Industrias (National Society of Industries)
SUNAT	Superintendencia Nacional de Administracion Tributaria (National Tax Administration Superintendency)
VSI	Vertically Specialized Industrialization

# Chapter 1.

## Introduction

Over the past decade, Peruvian industrial sectors have become increasingly aware of how industrial lands all over the city of Lima are starting to convert to residential and commercial uses. One main reason for this is the fact that lower income residents in the city are becoming more economically active and their new ability to satisfy their housing needs, along with new government funded housing financing, has created a mass construction boom. Since zoning is fairly easy to change in Lima, and considering that historically the Peruvian economy did not have a strong manufacturing sector (Jameson, 1979), this construction industry quickly bought all suitable lands for residential development. After a few years prices began to rise as industrial lands, affordable for other uses, started to increase their value and soon became out of reach of manufacturing capital.

The goal of this thesis is to identify the relative importance of factors such as firm age, size, sector and global trade connections, in influencing the location choices of manufacturing firms in Lima. We wish to understand the locational patterns industrial firms face in a city with no industrial land protection policy and that tries to actively promote the migration of these facilities to the outskirts of the city.

The importance of this study relates to the fact that many cities are facing an unplanned housing boom and with such, industrial areas are the first to suffer the consequences. When industry moves out of the city looking towards low cost locations, several other activities move with it. This conversion leads to outward urban expansion, which results in several negative consequences such as inflated and inefficient costs of infrastructure and public services, environmental degradation, traffic congestion, and loss of farmland.

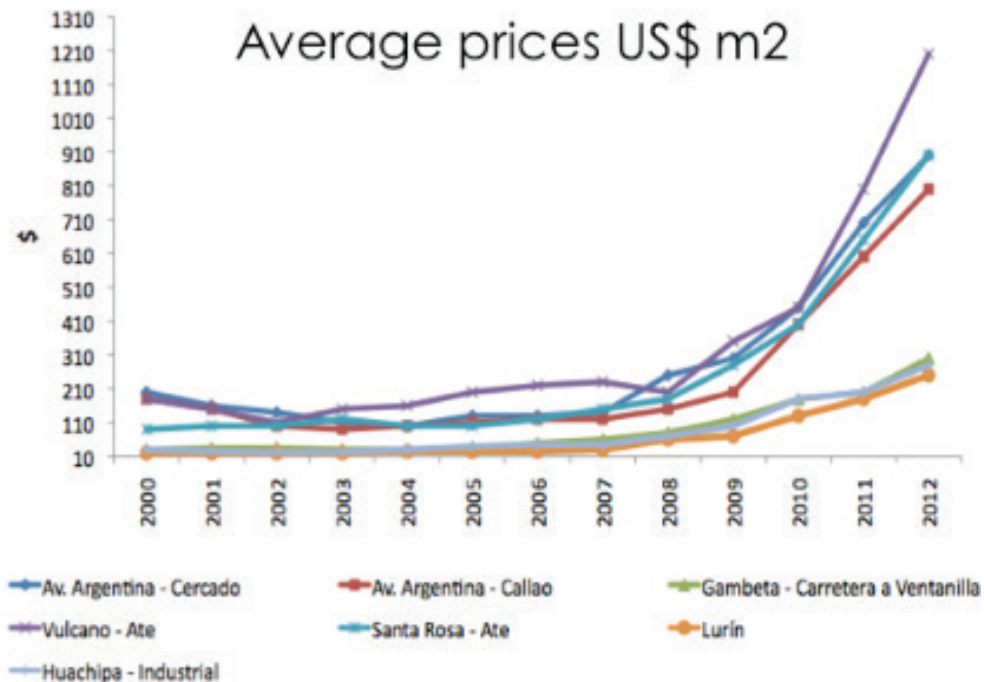
## 1.1. Lima's Manufacturing Lands

The importance of this industrial sector in Lima cannot be understated. Economically, the different manufacturing sectors of Lima represented in 2011, 17% of jobs in the city, a figure that grew from 14.2% in 2001. The numbers include both the manufacturing of final and intermediate products (Instituto Nacional de Estadística e Informática Del Peru, 2013). Niezen (2013b) states that Manufacturing industries represent only 13.9% of the Gross National Product (GNP) of the country, a number that describes it as a primary production economy, with numbers below most Latin American economies. For instance, Burgos (2006) states that in the Colombian city of Bogotá, the industrial sector is responsible for approximately one fourth of the employed workforce of the city, a number that has presented few variations in the 1992-2003 period.

These changes and growth in manufacturing sectors are mostly related to Peru's recent history, which in the second half of the 20<sup>th</sup> Century was quite turbulent. Starting in the 1960's, with a left-wing military dictatorship, and then in the 1980's with an internal war being fought against both Shining Path and the MRTA (Tupac Amaru Revolutionary Movement) terrorist groups, Peru was a socially collapsed country. The economic breakdown of the society led to a massive migration towards the capital city. From 1970 to 1993, the city doubled its size almost entirely due to internal migration (Castellanos, 2010). In the 1990's, a newfound peace along with the new foreign capital investment provided great economic growth (Borja and Castells, 1997). This growth has almost been non-stop and over the past few years most economic growth has happened on the middle and low class sectors (Maggi, 2011). Such growth, along with the constant deficit in housing, has created a great pressure on low cost lands around the city

The number of hectares of industrial lands in the city is a complex issue. For instance, according to CBRE Peru (2012), Lima had by the first trimester of 2012 around 17,000 acres of industrial land. On the other hand, the Chairman on the Metropolitan Planning Institute (Personal communication, January 13, 2014), states that this number is less than 6,000 acres, which represents less than 3% of total city lands, compared to an average 8 or 9% of comparable Latin American cities. He also stated that Lima needs at least to double these numbers.

Industrial lands have been mainly affected since their large sites are most suitable for high density, affordable housing and commerce (Málaga, 2012). The problem arises considering that an affordable housing developer is able to pay up to US\$600 per square meter, whereas a typical industrial developer can only pay up to US\$150 for the same piece of land for its business to be affordable. Commercial developments can pay much larger amounts (Flores Estrada, 2012). Table 1.1 demonstrates that in the different traditional industrial areas of Lima, prices are well above the US\$150, and therefore are all already too expensive for new industrial developments.



**Figure 1.1. Average prices from the year 2000 to 2012 of major industrial areas of Lima.**

Source: Flores Estrada (2012).

This gentrification phenomenon has many industrial entrepreneurs worried as they can no longer buy or rent affordable lands in the city and many are forced to look for far away locations. According to Enrique Cabrera, Director of CBRE Peru (2011) this problem is appearing as the country is entering an important industrial stage, which has many firms expanding, growing and modernizing their operations. Big industrial projects

require large areas in order to expand their operations for the next 40 or 50 years as well as large extensions of adequate land are needed to attract foreign investment. Since this issue seems to have caught many by surprise, current local governments seem to be unable to respond to this problem and instead are promoting the development of new zones far away from the city so these can be readily developed for the next 20 years or so (Gilvonio, 2011). Hesse (2008) notes that the outward spread of factories and manufacturing districts has been a decisive factor of North American urbanization since the mid-19th century. Mohan (1994) states that in Bogotá, the most significant locational shift has been seen in the case of manufacturing firms that have moved out of the CBD into peripheral locations, a worldwide trend observed in all large cities in both developed and developing countries for which data on employment location are available. This decentralization in Bogotá has happened in conjunction with strong manufacturing growth, something that is now visible in Lima. The importance of the locations of manufacturing activities relies on the fact that they are usually regarded as leading other activities in a city (Hesse, 2008). Their extensive backward and forward linkages often determine the location of other activities (Mohan, 1994) such as service and commercial related services.

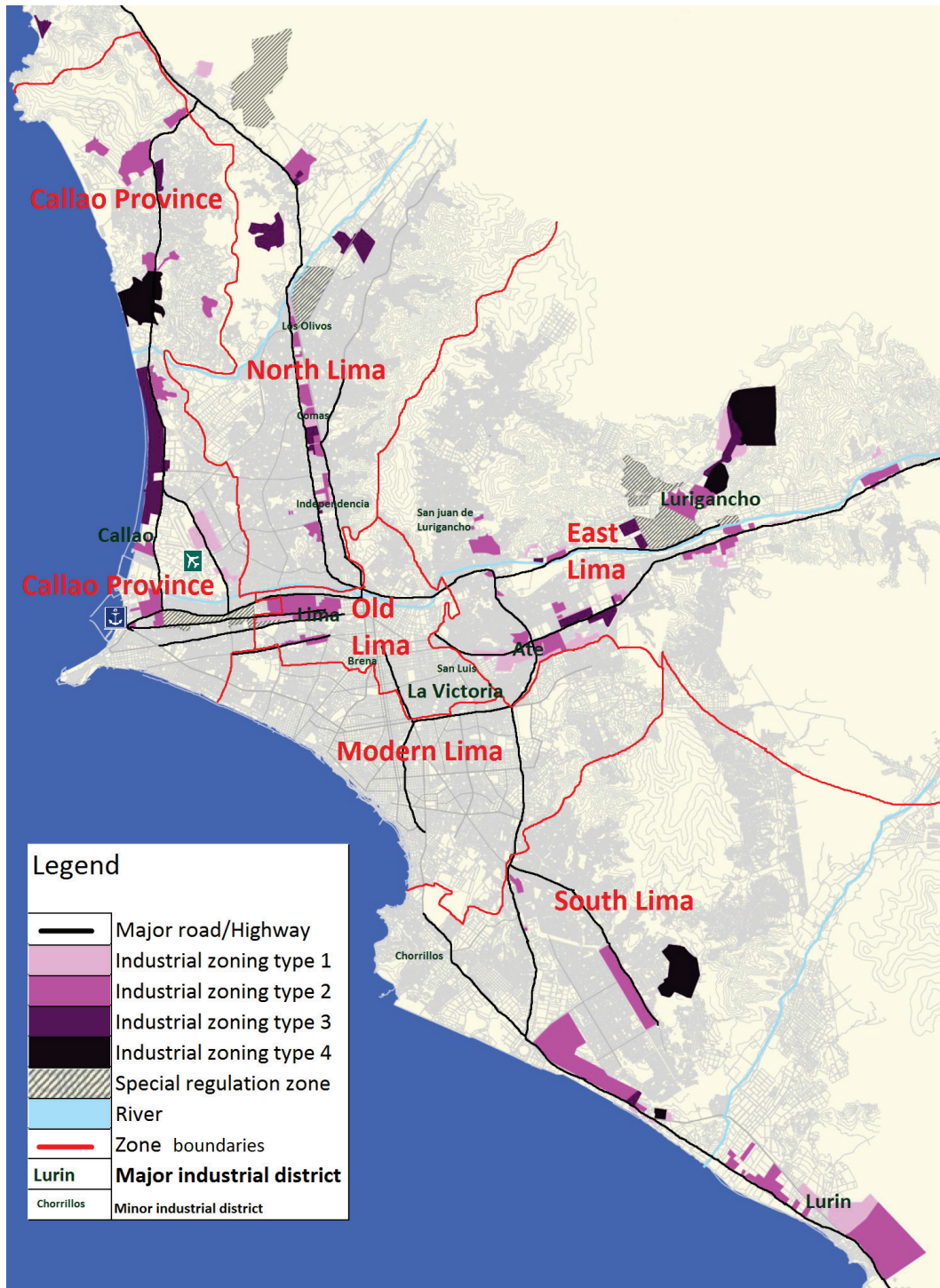
The most suitable lands for new developments, according to Cabrera (cited by Ochoa, 2013) include those located to the east of the city, but most important are those to the south (with the districts of Lurín and Chilca providing the most suitable spaces). Most of these places however do not meet the basic requirements to accommodate manufacturing activities. Málaga (2012) asserts that over 25% of the firms in the Sociedad Nacional de Industrias (SNI) are currently seeking for new areas/locations to build new factories or expand their current operations and that they are finding few alternatives within the city. Some are even reported to be considering moving their facilities outside of the country.

Within Lima there are many industries that are located in zones of non-conforming use, whether because they did not respect the existing zoning regulations or because of the migration of people into industrial areas. This phenomenon is a consequence of the lack of stable zoning regulations, lack of authority from local



governments to respect existing zonings, the chaotic growth of the city, the invasion of lands by squatters, among others (IMP-GENIVAR, 2000).

Figure 1.2 shows the main industrial agglomerations in the city of Lima. This figure shows the industrial zones identified by a key informant (Guerra, personal communication, January 13th, 2014) and does not consider the number of firms in a particular area but rather the size of the industrial zones. Some of these zones may actually be vacant lots, as is the case of the eastern areas of Lurigancho, which is a private industrial park that is still in its development phase. On the other hand, the figure shows the major and minor industrial districts based on the number of firms our study has found, rather than by the size of the industrial zoning. This explains why, for example, the district of La Victoria, appears as a major industrial district even though the map does not show any industrial zoning. This district is mostly specialized in micro and small garment industry and as such, most factories are located on multi-storey buildings mixed with commerce and housing (Keukens, 2010).



**Figure 1.2. Industrial zones of Lima**

Notes:

Source: Own, based on documents provided by Guerra (Personal communication, January 13<sup>th</sup>, 2014).

Industrial zone types described on point 2.2.1

## 1.2. The political divisions of Lima and Peru

In this project we are considering the industrial patterns within the city of Lima also considered as the Metropolitan City of Lima. This region is located inside the department (which may be understood as a province) of Lima, which is one of 24 departments in Peru (Figure 1.3).



Figure 1.3. The political divisions of Peru and Lima

The department of Lima consists of 9 provinces of which we will mention on this paper the provinces of Cañete and Huarochiri (lower map in figure 1.3). These 9 provinces respond to the department of Lima and are divided by their respective municipal districts, such as the district of Chilca, in the province of Cañete. This department also includes the Metropolitan Municipality of Lima and the Constitutional Province of Callao. These two areas will be considered in our paper as the Metropolitan City of Lima. Within it there are 49 municipal districts, 43 of which are located in the Metropolitan Municipality of Lima and 6 which are on the Callao Province (shown on figure 1.2). These districts respond not to the department of Lima (as do the other 9 provinces) but either to the Metropolitan City of Lima or the Constitutional Province of Callao.

Regarding zoning regulations, all these 49 districts are independent to organize and develop their land uses as long as they consider the overall regulations provided by the Ministry of Housing. More information on these relationships are considered on section 2.2.1.

### **1.3. Justification**

Explorations of how location choices of businesses are made follow a long and rich tradition. Starting with Von Thunen's (1826) early investigations of agricultural land use, understanding the location choices of businesses underlies the desire to understand how and why firms choose to locate in one country, city or district. Studies that have examined location choices for generic firms usually offer a "shopping list" of attributes and ask which are the most important through analysing their propensity to relocate (Jakubicek, 2010) or simply describe the most important location factors for relocation (Barkley & McNamara, 1994). This study does not use self-reported reasons for location choices, but instead relies on official publicly available data on manufacturing firm's characteristics, which include the number of employees, age of firm, number and location of establishments and global trade connections.

Explanations of industrial firms' location choices have traditionally been seen as the result of minimizing distances between suppliers and customers and minimizing

overall costs while maximizing profits. This view has its roots in Weber's hypothesis (1929) that a firm's location will be dependent on the relative expense of the transport costs of inputs versus the transport costs of finished products. These factors vary according to the specific circumstances of the firm, such as labour costs and distance to customers.

The goal of this thesis is to identify the relative importance firm factors such as age, size, sector or global trade connections, influence the locational choices of industrial firms in Lima. This is important because most of the new industrial zones in the outskirts of Lima do not seem to include the most basic characteristics (such as adequate roads, water) that industrial districts require and because there is no law to protect current industrial zones. We aim therefore, to provide a basic understanding of how manufacturing firms and related services have behaved historically and what their trends are towards the future, in an environment where zoning regulations are ever-changing, uninforced and unpredictable. For this we will consider factors of industrial location theory in order to understand the main industrial concentrations in the city and compare these to comparable examples from around the world.

We intend to fill in the gaps of industrial location theories, most importantly, as it is an attempt at understanding the most important location factors influencing industrial firms in Lima. For urban planners this thesis should be able to identify the issues surrounding industrial activities relating to land use and transportation planning. For manufacturing companies, logistics firms, municipalities and real estate corporations, this study could provide a tool to consolidate the general perceptions and views of Peruvian industrial locational factors. Finally it could be used to promote the right attributes that could be provided within regions in order to accommodate and encourage the development of old and new industrial areas as well as promote the protection of current or future industrial lands.

## **1.4. Research Question and Objectives**

The main inquiry of this thesis is to understand the locational patterns and challenges of manufacturing firms in the city of Lima. For this, we have created a

database of the locations of medium and large industrial firms operating in Lima. This database will allow us to understand where certain types of establishments tend to locate based on several factors such as size, age, sector or global trade connections.

We also compared our database with a previous industrial study from the year 2000 that, among other things, provided general location patterns of industry in Lima. This data, compared with our own database, will be helpful to understand the movement of industries in the city as well as defining the declining and growing industrial zones.

We have also used in-depth interviews, held in early 2014, in order to better understand the locational patterns that industrial firms have in the city. Several private and public organizations were contacted and we gained an industry-wide perception of the problems faced by these sectors as well as the proposed solution models that are being considered by different actors, such as creating fixed industrial zones or creating private industrial parks.

Regarding our specific objectives, we aim to show that while certain industrial firms are capable of moving to the outskirts of the city, others still need to locate in close proximity to city centres, workforce and customers, such as the textile and apparel sectors. We will also try to make the case that new smaller firms need to locate in central areas that work as incubators of industrial development, while larger firms with greater global trade connections have a tendency to locate on the outskirts to take advantage of low land prices and good connectivity to Global Value Chains. This argument, for instance, turned out harder to explore, given the limited number of truly small firms we were able to collect in our database. Instead we found mostly similar locational patterns between medium and larger firms. Finally we will make a case for the protection and promotion of central industrial lands while we will also develop guidance for best practises in outskirt locations, taking into consideration that local governments are not providing the most basic amenities for industries that need to compete at an international level and that the only solutions being promoted are by private investors rather than regional authorities.

### **1.4.1. Thesis organization**

The first chapter of this thesis introduced the topic. Chapter two will provide a general context and overview of Peruvian history related to historical economic policies and how these shaped industrial activities in Lima. Chapter two will also look at the historical context of Lima's industrial centres as well as future trends for development. Chapter three will present a literature review on (1) industrial firms location choices, (2) locational choices based on firm characteristics and (3) the different strategies cities around the world have used in order to promote the development of industrial lands. Chapter four will present the methodology used, along with its limitations. Chapter five will present the description of the different industrial areas of the city as well as the related analysis based on firm characteristics of size, age, sector and global trade connections. Chapter six will discuss the results and possible land use and general industrial policy implications and recommendations to promote and protect current and future industrial lands.

## **Chapter 2.**

### **Historical context**

This chapter was created with two objectives in mind. First, in order to understand the locational patterns of industrial activities of Lima, the reader needs to understand the historical events that preceded the current zoning issues today's industry faces. On the other hand, due to the lack of relevant Peruvian literature on the topic, and most of it being rather old, we used Latin American references as well as informational interviews in order to fill the gaps in the history of the different industrial areas of Lima.

With this clarification, we will specifically look into the history of industrial activities in Peru in the context of global and Latin American economic trends and policies; understand the specific industrial agglomerations that historically and currently are developing in the city of Lima; and try to describe the trends on location and economic policy that are taking place in order to promote industrial diversification.

#### **2.1. The history of industry and manufacturing in Lima and Peru**

In order to understand the historical patterns of industrial location in Lima, we first need to understand the industrial history of Peru. Rippy (1946) states that Peru's tardiness in industrial development was caused mainly by the defeat in the war against Chile (1897-1883), baffling topography, scarcity of water in coastal regions and the agrarian outlook of its leaders. Cabieses et al. (1982), characterizes the Peruvian economy as being based on three non-integrated key sectors: (1) The traditional and non-traditional export sector, (2) the domestic industrial sector and the (3) agrarian sector. Lima holds most of the industrial activities of Peru, as since the mid 1970's, one third of its population was concentrated in its metropolitan area. Moreover, most of the



GDP of Peru is produced in Lima, with more than three-fifths of the total number of industrial establishments and manufacturing workers concentrated there (Cabieses et al., 1982).

The Peruvian industrialization process is separated by various phases. The early industrialization period, described as the commodity export phase by Gereffi (1989) developed from the last decade of the 18<sup>th</sup> Century until roughly 1920 (Cabieses et al., 1982). This period was basically formed by an increase in the internal market as a result of increasing exporting revenues from raw materials (according to Rippy (1946) and Cabieses et al. (1982), cotton, sugar and minerals), the drop in exchange rate, the protection of industries through tariffs, the presence of local and foreign investment capital, and the favourable investment climate created as a result of the settlement of foreign debt through international contracts (Cabieses et al., 1982).

Between 1900 and 1930, large monopolies in the mining and agricultural sectors under the control of US capital were set up. In the 1940's there was considerable expansion on industrial sectors, especially during the Second World War, however this was not due to an increase in exports but due to a policy model that favoured import substitution. This period followed the general pattern of other Latin American countries such as Mexico, Argentina and Brazil, who also entered their first phase of Import Substitution Industrialization (ISI) (Gereffi, 1989; Teitel & Thoumi, 1986). After the Second World War, the industrial sectors did expand considerably due to direct foreign investment and assistance mostly from US companies and also due to the first "law on industrial promotion" (Ley de Promoción Industrial) in 1959 (Cabieses et al., 1982) which promoted mostly the export of the fishmeal industry as well as non-durable consumer goods and intermediate goods. This first law however, was quite exceptional as it was very generous and unselective, benefiting all industrial sectors (Thorp & Bertram, 1978). Industry became the most dynamic sector of the Peruvian economy and by the 1960's the country entered the second phase of ISI that consolidated during the military regime. The impressive boom in exports that continued though this period supported this industrial expansion, especially in paper, rubber, chemicals and basic metals manufacturing, many of which produced inputs for the consumer durable industries, however, most of the assembly industry depended on imported inputs (Cabieses et al.,

1982). Gereffi (2001) states that in this period, the new international division of labour implied that transnational manufacturers involved in export processing started to look for affordable labour areas, relying on improvements in transport and communication technologies to escalate on the value chain. However, this period was also represented by the increasing role of the public sector investing on the production of goods and services. These investments had little positive effect on the overall economy of the country as agricultural production decreased and the foreign debt increased dramatically (Cabieses et al., 1982). According to Dávila (Personal communication, January 7<sup>th</sup>, 2014) this import substitution model was entirely based on protectionist actions and with an industry that was almost entirely dedicated to the assembly of products rather than their manufacturing. This assembly model was rather inefficient too as their prices were much higher than comparable products from abroad. Also, during this second stage of ISI development the imports increased excessively and foreign investments stagnated (Cabieses et al., 1982).

Overall, in Latin America, the period of the 1970's was rather troublesome as manufactured exports fell in developing countries due to protectionist measures from the industrialized markets (Gereffi, 1989; Portes & Roberts, 2005). The ISI development strategy prevailed in the region as a whole until the 1970's (Gereffi, 2001; Kay, 1993). Peru was not an exception, however, as we will further describe, some characteristics of the ISI strategy prevailed well into the 1990's.

The government period of Belaúnde (1980 - 1985), although promoting change from the previous socialist military regime, did not achieve its goals. By 1982 international prices for Peru's main exports started to fall while international interest rates increased markedly. The authorities faced these imbalances with the few international reserves the country had. According to Mesones, Peschiera & Baca (2014), the government did not have the time or the political will to put in place an alternative to the import substitution strategy. On the other hand, the rise of the guerrilla movement Shining Path and climate related setbacks (Niño phenomenon) in 1983, resulted in an average decrease of the GDP of 3.9 percent a year during the years of 1980 – 1985 (Keukens, 2010). Even though Belaúnde's government tried to implement a comprehensive reform to move away from the centralized economic management of the

previous military regime, these reforms came to an end when Alan García became president in 1985 (Baracat, Finger, León Thorne, & Nogues (2013).

Alan García (president, 1985 – 1990) introduced loans, subsidies, and price control policies. The goal of these initiatives was to reactivate the import substitution of the '60s and stimulate the demand of domestic products and services (Mesones, Peschiera & Baca, 2014). The GDP increased by 10% in 1986, however, the break with the International Monetary Fund (IMF), in order to stop paying debt, proved to be detrimental (Keukens, 2010). Furthermore, the business community lost confidence in the government and invested only in short-term ventures, if any at all (Flores Estrada, Personal communication, December 30, 2013). By the end of 1989 Peru was on the verge of bankruptcy. Garcia's intention was to regulate the economy through a strong state, but instead this resulted in an economic and social breakdown. According to Mesones, Peschiera & Baca (2014), the distortion of relative prices led to an unprecedented stagflation. By 1988 the GDP contracted by 7.9% and the annual inflation rate reached 1,722%. Even worse, by 1989 GDP plummeted 11.3% and inflation reached an annual rate of 2,775%, 3,040% by the first seven months of 1990. By this period, tax revenue fell below 4% of the GDP and net international reserves became negative even though the international debt payment was virtually non-existent.

Fujimori seized power (1990 – 2000), and almost immediately induced the so-called Fujishock. This neoliberal policy framework meant the cancelling of subsidies and a drastic increase in prices of public services and goods. He later promoted the privatization of almost all the state enterprises and the recovery of IMF and World Bank relations. He also declared Peru a free market economy in the new 1993 constitution. This meant that local manufacturers had to suddenly compete with foreign products and as a result over 200,000 workers lost their job between 1990 and 1993. If still working, they earned 10 percent of what they did in 1981 (Keukens, 2010). This phenomenon is common in other Latin American countries described by Portes & Roberts (2005), where formerly protected ISI industries, unable to compete with cheaper imports, were forced to close. Portes & Roberts (2005) also mention that due to Peru's exceptional political violence (led by the Shining Path terrorist movement), the country was disqualified as a suitable export platform for labour-intensive industries promoted by Export Oriented

Industrialization (EOI) policies. On the other hand, Dávila (personal communication, January 7<sup>th</sup>, 2014) states that the few firms that remained after this period had a very limited vision of economic development and therefore the real estate construction business took place instead. Other results from this period were the increase of foreign investments and an increase in tax incomes. From 1995, the economy started to grow, however briefly, since most of Fujimori's policies were concerned with welfare policies towards the poorest population groups (Keukens, 2010) and because of the international crisis in Asia and Mexico (Dávila, personal communication, January 7<sup>th</sup>, 2014). Still, some of the strategies proposed by Fujimori have been considered a success and because they were formalized in the 1993 constitution, they have been maintained almost intact by succeeding administrations (Mesones, Peschiera & Baca, 2014).

In 2001 President Toledo (president, 2001-2006) implemented an economic recovery program. He took measures to revive the privatization program and to attract investments. In 2002, the IMF approved an arrangement with Peru to support the government's plans for economic recovery, thus introducing Peru to its first EOI stage (Baracat, Finger, León Thorne, & Nogues (2013). On 2006, Alan García was re-elected for a second term as president of Peru (2006- 2011). He built upon the measures promoted by his predecessor and since then the country has been on a steady growth promoted mostly by the service sectors and the high international prices of mineral exports. Even current president, Ollanta Humala (president since 2011), who based his presidential campaign on radical leftist policies, dropped much of these intentions and adopted many of the same development strategies originally implemented by the Fujimori administration (Mesones, Peschiera & Baca, 2014).

Even though Peru has definitively dropped its ISI objectives and is now focusing on EOI strategies towards becoming part of the global supply chain system, policies towards these goals are still almost non-existent. For instance, Niezen (2013b) observed that even though Peru's exports have increased dramatically since 1990, most of this growth has been related to minerals. From 1995 to 2012 mining related exports doubled, reaching a 60% of the national totals. She also mentions that Peru's share of high tech exports, in the period of 2000-2005 was only 0.6%. Peruvian exports in this same period involving low (13.6%), medium (3.0%) and high (0.6%) technological contents, added up

to only 17.2% of exports, implying that the remaining 82.8% had no technological content. Finally Niezen mentions (2013b), that Peru needs to promote policies that promote vertically specialized industrialization in order to take advantage of value chain markets.

For a basic understanding of these concepts we used Milberg's (2013) formulations on Vertically Specialized Industrialization (VSI). He mentions that VSI requires an industrial policy that focuses on regulating links to the global economy (trade, foreign direct investment and exchange rates) more than in the case of ISI policies, which focused mostly on building national capabilities, but also in a different way than in the era of EOI, where the focus was typically on final goods exports. He explains that ISI policies involved "producer-led" chains and EOI "buyer-led" chains (terms introduced by Gereffi, 2001), while VSI capitalizes more on existing regional Global Value Chains (GVCs). Export competitiveness remains crucial but these are now the result of participation in global production networks that in many cases depend on imports from the network. The objective of VSI is to produce for a portion of the existing GVS and upgrade form there.

As mentioned before, Niezen (2013b) mentioned the lack of an industrial policy regarding GVCs. Her article discussed the new proposed National Plan for Industrial Diversification promoted by the government, a plan that by 2013 did not even have an abstract. In May 2014 the Ministry of Production of Peru (PRODUCE) finally released the first abstract. It is important to note that even though this is an official document, since it is fairly new it is still subject to public consultation and therefore is still not yet a policy document. Regarding the importance of GVCs, the document states:

*"(...) insert the productive units in the GVC economy (not trying to produce all the value internally). This requires identifying these chains and their potential demands, and designing mechanisms to identify productivity gaps on each sector of the global economy." (Ministerio de Produccion Del Perú, 2014. Pg. 48, own translation)*

It is further clarified that there is a need to identify the opportunities created by current and future value chains, related to the productive capabilities (current and potential) of the national economy. The document also states that once these

opportunities and capabilities have been identified, instruments and policies shall be proposed in order to implement relevant diversification strategies.

These statements seem to demonstrate that even though there is a perceived need to take part in GVCs, there are currently no existing national policies towards this goal and such may take some time to be developed. We will further address the implications these evolving industrial policies have on the current and future location patterns of the city of Lima.

## **2.2. The Industrial areas of Lima:**

Finding information on industrial locational patterns in Lima and in Peru is difficult. Except for the very first industrial activities concentrated along the roads leading from Lima to Callao, references on industrial location history is almost non-existent. As Orrego (2011) mentions, this issue is probably related to the fact that since “(...) *Peru never accomplished an industrialized status, as preserving the heritage of industrial activities is considered almost an unnecessary requirement, almost exotic*” (Para. 13). He also mentions, on a personal note, that probably the lack of interest on these issues relates to the fact that society does not wish to remember or recreate horrible stories like the ones lived in mining camps, where thousands of workers died without reaching 40 years of age, or the agro industrial haciendas where thousands of Chinese workers were essentially enslaved, or the first manufacturing plants in Lima, where young children worked on inhumane conditions for more than 12 hours a day.

In spite of all these complications, some facts can be gathered from the IMP-GENIVAR study (2000), Flores Estrada (2012) and from personal interviews. When talking about the industrial expansion in Lima we must also concentrate on the expansion and transformation of the city as a whole. This expansion started as early as 1868, when President Balta decided to demolish the city walls. A new urbanization pattern took place, in order to follow European style cities, promoting the expansion of the city based on the Lima – Callao and Lima - Chorrillos axes (see figure 1.2). Between 1901 and 1945, Industry in Lima, started to develop on the Argentina Avenue (Lima - Callao corridor) and surrounding areas, taking complete city blocks and secondary

roads. The localization of large and medium manufacturing industries was promoted by the presence of the railroad which allowed easy transport of commodities and elaborated products, and by the nearby rivers Magdalena, Maranga and Rimac (the first two do not exist anymore), which were used as sources of energy as well as rubbish dumps. Most activities in this area were linked to the process and transformation of industries related to, among others, leather, silver, stone and food products (IMP-GENIVAR, 2000). This would follow what Gereffi (1989) calls the primary stage of ISI which entails the shift from imports to the local manufacture of basic consumer goods, like clothing, footwear and food processing goods.

Even though we have not been able to find literature on other industrial zones, from interviews we have been able to construct a basic idea of the times in which these zones were created. For instance, Dávila (Personal communication, January 07, 2014) explains that the area of Ate, in east Lima was the second to be configured after the old Lima – Callao corridor in the late 50's. Arce (Personal Communication, January 13, 2014) states that the northern industrial zone was configured during the mid-1960's with the first automobile assembly plants. The first one of these was established in 1964, according to Cabieses et al. (1982) during what he called, the boom in Peruvian industry. These two zones developed on what Cabieses et al. (1982) described as the second phase of ISI. According to Gereffi (1989 & 2001) in most Latin American countries this involved using domestic production in order to substitute manufactured consumer goods (automobiles), intermediate goods (petrochemicals and steel), or capital goods (heavy machinery). Following on this, De Olarte & Del Pozo Segura, (2012), state that on the eastern zone, industries related to textiles, footwear, plastics, paper, furniture, metalworking and chemical related products, located in the area.

Finally, the southern part of Lima began to develop as early as the late 70's mostly in the districts of Chorrillos and Villa El Salvador, both located in close proximity to a main highway. However, none of these districts managed to consolidate as true industrial areas due to the ongoing economic crisis of the period (Flores Estrada, Personal communication, December 30<sup>th</sup>, 2013). De Olarte & Del Pozo Segura, (2012) mention that manufacturers of plastic, paper, footwear, wood, chemicals and food processing goods originally located in this zone.

Regarding most recent and current industrial developments, the southern district of Lurín developed its first industrial settlements around 2003. This area is also currently home to 3 private industrial parks. The district of Chilca, some 62 Km south from the city centre, started giving zoning permits for industry around 2007. This area is characterized by the 5 existing thermoelectric power plants and the future development of 2 large private industrial parks (Guerra, Personal communication, January 13<sup>th</sup>, 2014). Finally on the eastern side of Lima in the area of Lurigancho, a new private industrial park is being built and developed on what is considered “*The closest industrial park to the industrial heart of the city*” (Álvarez, Personal communication, January 15<sup>th</sup>, 2014).

Within Lima there are many industries that are located on zones of nonconforming use, whether because they did not respect the existing zoning regulations or because of the later placement of residents into industrial areas. This phenomenon is a consequence of the lack of stable zoning regulations, lack of authority from local governments to respect existing zonings, the chaotic growth of the city, the invasion of lands by squatters, among other factors (IMP-GENIVAR, 2000). On the other hand, the Plan Lima 2012-2025 (2012) plan considers that decision-making processes of the city of Lima tend to be fragmented and barely coordinated within the different government levels (national, provincial, metropolitan, and municipal). The same happens with the different public and private organizations that administer the priorities, policies and public investments. All this weakens the management of the city.

### **2.2.1. Current zoning descriptions for industrial activities**

The Ministry of Housing, Construction and Sanitation (Ministerio de Vivienda Construcción y Saneamiento, - MVCS), is the governing body of land uses in the country and provides the general outlines and norms regarding national zoning policies. This ministry also coordinates, with regional and local governments, the plans and programs related to housing, construction, sanitation and overall urban development. According to the current zoning code provided by this Ministry (2006a) these are the characteristics of the four different types of industrial zones (Own translation). See figure 1.2 to find these zones.



**I1: Elemental and complimentary industry. These zones are destined for complimentary industrial establishments or as support for large-scale manufacturing:**

- Medium technological scale
- Quantity production
- Reduced operating capital
- Tendency to cluster on urban areas
- Are not annoying or dangerous

**I2: Light Industry: Is the zone destined for industrial establishments with the following characteristics:**

- Oriented towards local markets and Urban road infrastructure
- Has contact with the central area
- Provides retail sales.
- Medium technological dimension
- Are not annoying or dangerous

**I3: Grand industry: Is the zone destined for industrial establishments with the following characteristics:**

- Shaped as industrial concentrations, which utilize large volumes of commodities
- Oriented towards regional road infrastructure (highways, railways)
- Large scale production
- Peripheral areas better satisfy their needs
- External economies. Their complementarity and their inter-industrial relations promote their concentration.
- Are annoying and/or with some degree of danger

**I4: Basic heavy industry zone: Is zoned towards the establishment of firms that manufacture inputs to support industries:**

- Large scale basic processes
- Large economic dimension
- Oriented towards regional road infrastructure and large markets
- Annoying and dangerous due to noises, vapours, gases, odours and vibrations they may produce.

Additionally there are zones of special regulation (Zonificación de Reglamentación Especial). In the case of Lima it is not possible to apply a single or precise regulation to these due to their special urban characteristics. In figure 1.2, the areas shown as zones of special regulation are considered to be mostly industrial zones.

Decision making responsibilities in land use and zoning changes in Peru is given to local governments, which in Lima are represented by each of the 49 municipal districts (43 in Lima and 6 in the Callao Province) within the Metropolitan City of Lima. These districts are politically, economically and administratively autonomous to organize their physical space and regulate their land uses. The provincial authorities (in this case The Metropolitan Municipality of Lima and the Callao Province) promote, regulate and approve these district zoning plans based on the regulations provided by the MVCS (2006a). In the Metropolitan City of Lima, even though most municipal districts have a zoning plan, only 15% of these have a complete, updated, integrated and functioning plan, as required and mandated by the MVCS (2006b).

Regarding these zoning types, regulations and limitations, it is important to understand, in the case of industrial zoning, that not a single municipal district has ever allocated industrial zoning to a specific area or zone. Zoning is provided on a single case scenario where industrial investors ask for zoning permits to local municipal districts for specific projects. Dávila (personal communication, January 7<sup>th</sup>, 2014) states that industrial zones have been created in other Peruvian cities, like Cuzco or Trujillo, but this has never happened in Lima. Flores Estrada (personal communication, December 30, 2013) states that, even though municipal districts have the liberty to allocate industrial zonings, the Metropolitan Municipality of Lima has some veto capabilities on these decisions, particularly over I3 or I4 developments, as these zoning types can go against the principles determined by the MVCS (2006a).

According to Alvarez (personal communication, January 15<sup>th</sup>, 2014) changes in industrial zoning are ongoing and depend on the needs of the people that live nearby, in many cases, squatters. These residents push for changes in zoning of their industrial neighbours, using the excuse of pollution concerns. She also mentions that municipal districts allow land invasions and after some time, firms are forced out. Dávila (personal

communication, January 7<sup>th</sup>, 2014) mentions that changing zoning in Lima is “(...) *perceived almost as easy as changing your shirt*” and that such facility is what makes industrial investors hesitate when thinking on relocating. Finally, a few of our respondents also mentioned that these, and other zoning changes are allowed and promoted by the “entrepreneurial behaviour” of district authorities.

### **2.2.2. Future trends**

Considering that land prices are already too high for new industrial developments in the areas described, new solutions or frontiers are needed in order to solve the lack of adequate industrial lands. Towards this we need to understand how the city of Lima views this problem and what actions are being considered as possible solutions. We looked at the Plan Lima 2012-2025, (IMP, 2012), which is the latest complete document regarding urban planning issues in Lima, and we will also include other sources and future plans that are being developed.

The Plan Lima 2012-2025 (IMP, 2012) does understand that in order to make Lima an attractive centre for investment, it needs to offer adequate logistic costs, security, basic services such as energy and communications, urban facilities and adequate qualified human resources (IMP, 2012. Pg.31). From all these, they mention that the hardest to achieve are the low logistical costs and the sense of security.

The Plan Lima 2012-2025 has the following objective: “*Strengthening of metropolitan manufacturing and competitiveness through the reorganization of territory, development of manufacturing industry and investment promotion through the impulse and integration of inter-district economies and consumer markets*”. (IMP, 2012. Objective 3.3 Pg.72, own translation):

Looking deeper into this objective, it is stated that Lima needs to “*(re) locate industrial activities within the city and promote the real estate markets, consolidating the main urban centres and sub centres, under a process of deconcentration of activities and territorial reorganization*” (IMP, 2012. Objective 3.3.1 Pg.72, own translation).

More specifically, it is stated that *“Generation of clusters within industrial parks in peripheral areas of Lima, or on local areas with a strong presence of economic agglomerations” are needed* (IMP, 2012. Program 3.3.3.1 Pg. 73, own translation).

On the other hand, the new PLAM Lima-Callao 2035 (2014), still under development, is the new metropolitan plan considered by the city. Even though this plan is under development, a few ideas of where industry may locate in the future are determined based on their website information (own translation).

*“In the self-sustained cities of Ancón and Lurín, industrial and manufacturing poles are expected with industrial Eco parks and technological parks that allow the promotion of innovation. Diversifying production, concentrating the manufacturing and generating employment in order to increase the competitiveness of the city on the medium and long term”* (<http://plam2035.gob.pe/lima-emprende/>).

No other mention to the topic is made on this website and no representative of the organization responsible for this plan was available for interview. It is important to provide a brief description of the areas mentioned on this quote. Ancón is a district in the far north of Lima. From our database we can say that few industrial establishments are located here, as our database only has 10 establishments on this district (representing 0.4% of overall establishment distribution). Lurín is a district on the southern fringe of the city and over the past 12 years has increased dramatically its number of industrial activities. Our database shows this district has 109 establishments representing 4.4% of the overall distribution.

This chapter served as an introduction to the economic and industrial policies that shaped the current locational patterns that we will describe in subsequent chapters. We looked at the historical context in which industrial activities in Peru took place as well as understood the policies that shaped the current initiatives to promote new industrial areas in the city of Lima. In the next chapter we will review literature on locational theories. More precisely we will look into general locational theories for manufacturing firms as well as the crucial role transportation plays in theories on the topic. We will also look into the specific firm characteristics that influence location decisions and research locational policies and protection initiatives for industrial lands from successful case

studies. This review will provide the necessary tools to understand the methods we will use, and subsequently our results.

## **Chapter 3.**

### **Previous Inquiry**

The last chapter served as an introductory context to the Peruvian economic reality and specific locational patterns of industrial activities in Lima as well as reviewed the current trends and policies that are taking place to promote new industrial areas in the city. In this chapter we will look into previous research on locational theories and patterns as well as specific firm characteristics that define their locational preferences. We will start this chapter by defining general locational theories for manufacturing firms as well as the role transportation and connectivity plays in such. We will then look into specific firm characteristics such as firm sectors, age, size and global trade connections in order to determine how these different firm characteristics define individual locational patterns. Finally we will research locational policies for industrial lands from other comparable urban contexts in order to understand possible policy implications for our study.

Previous research shows how the locational choices of firms depend on various factors. The most important factors that most authors agree on include transportation access, the size, nature of operations, and the relative distances to both suppliers and markets. Despite the fact that each individual firm's location is determined by their own needs and objectives, these goals do sit within the context of regional land use and zoning. While each firm's location choices may appear different, we expect to find that they are most often than not quite similar, with few manufacturing firms in isolation from the broader consensus of locational theories.

### **3.1. General Location Theory**

The study of industrial locational choices has a rich history of over two centuries. Starting with Von Thünen's (1826) theory on the use of agricultural lands based on competitive industrial location theory and oligopolistic competition, Fujita (2009) reviews the evolution of spatial economics, i.e., general location theory, of which he states, Thünen is the pioneer. Fujita (2009) also mentions the celebrated and early work of Marshall (1890) who presented his study on industrial agglomeration, where he examines systematically the reasons for the concentration of specialized industries in specific localities. According to Marshall (1890), externalities are crucial in the formation of economic agglomerations and generate something like a lock-in effect. Overall the theoretical and empirical literature suggests that firm location is the result of profit maximising location decisions by individual firms, where the decision is based on the future profits that a firm expects to earn (Holl, 2003).

#### **3.1.1. Locational choices of manufacturing firms**

Literature available on manufacturing firms' locational choices usually does not focus on a particular industry or sector within manufacturing, but instead typically describes the location choices of firms in specific areas (Holl, 2003; Mohan, 1994; Barkley & McNamara, 1994; Flores Estrada, 2012). This literature also provides locational factors in the form of "shopping lists", not providing any relative importance on some over others. Their analysis is mostly based on 3 or 4 of their most important factors, while almost neglecting the relevance of others. Others, like Kadokawa, (2011) do provide an exact example of the relevance and importance of each and every factor considered.

The typical findings from all these studies include the importance of considering the size and nature of businesses as well as transportation factors. For instance, Hesse (2008) considers that location choices are particularly made with respect to supply of land, transport access, and distance to suppliers and consumers. Transportation access therefore seems to be the most influential factor regarding locational choices, probably

because the provision of such is seen as an opportunity to provide decision makers with information regarding how to place infrastructure in order to attract firms.

Barkley and McNamara (1994) consider the effectiveness of surveys investigating the location choices of manufacturing firms in order to evaluate the locational characteristics within their region. Barkley and McNamara (1994, Pg. 28) evaluate the locational decisions based on regional industrial factors and local factors of location, as shown in table 3.1. Their results indicated that proximity to highways is one of the most important factors for generic industrial firms location choices. Barkley and McNamara (1994) consider that industrial location theories are considered macro level decisions; involving choosing how and whether a firm will serve any particular market. Following these decisions, firms create a list of alternative locations that would best fulfill their needs, while at the same time they will examine possible trade-offs that could be made. These researchers explain this issue, asking about the macro level factors that influence a firm's location in the context of southeastern US, considering then micro level location factors for the specific site selection.



**Table 3.1. Location Choice Factors included in Barkley and McNamara (1994)**

<b>Regional Industrial location factors</b>
• Closeness to output markets
• Closeness to input sources
• Labour availability
• Availability of non-union labour
• Low labour costs
• Lower taxes
• Government location inducements/services
• Regional quality of life/amenities/climate
• Other (please list and rate)
<b>Assessment of Local Factors</b>
• Skilled labour availability and costs
• Unskilled labour availability and costs
• Availability of technical training programs
• Availability of land for construction and expansion
• Availability of vacant facility
• Proximity to interstate highway
• Proximity to product markets or supplies
• Proximity to college or university
• Proximity to airport with commercial air service
• Proximity to metro area
• Adequacy of water supply and waste disposal facilities
• Local government incentives/services
• Availability of housing
• Quality of primary and secondary education
• Availability of recreational opportunities/cultural resources
• Other (please list and rate)

On the same topic Button et al. (1995) conducted an analysis of how transportation infrastructure impacts the location factors based on the origin of firm, size of firm, location of parent company, and attitude to transport links by mode. Their study surveyed all commercial and industrial properties within the Strathclyde region of Scotland. They found that transportation infrastructure provision, mostly roads, is a major criterion for new site searches and firms looking to relocate (with 81% of respondents answering “Important” or “Very Important”), however poor transportation infrastructure does not seem to be a strong stimulator on firms that are not considering relocation. Targa et al. (2006) validate Button’s observations as they found, studying firms in Maryland, that accessibility to roads with higher functional form and capacity is a very important factor in determining a firm’s propensity to relocate. Button’s locational factors are provided in table 3.2.

**Table 3.2. Locational Factors included on Button et al. (1995)**

Factors of Location Choice	
Road links	Governmental assistance
Lease/rental costs	Access to support services
Building layout	Access to public
Car parking	Bus links
Access to markets	Rail links
Site amenity	Air links
Access to required staff	Access to education facilities
Image of area	Access to executive housing
Access to suppliers	Access to recreation facilities

As stated before, Kadokawa (2011) is the only author that actively provides an analysis in the order of locational factors. He does so by analyzing the actual locational reasoning of manufacturing plants, exploring why firms in Japan cluster and for what locational reasons, using Marshallian clustering advantages as a model. For these inquiries he looks at a location survey conducted by the Japan Industrial Location Centre and performs an exploratory factor analysis to analyze its results. The objective of this survey was to research the actual reasons behind the location choices of new manufacturing plants in Japan, and the results were used to reorganize land development and improve the efficiency of location decisions. This questionnaire specifically asked why plant managers chose to locate in a particular region. The reasons of location choice are listed in table 3.3, which are the exact choices given to plant managers and given in order of importance ranked by the respondents

**Table 3.3. Locational Factors included in Kadokawa (2011).**

Factors in order of importance:	
1. Availability of land	9. Personal ties
2. Land Price	10. Access to logistics and business services
3. Proximity to Market	11. Support from national government
4. Proximity to headquarters	12. Co-location with other firms
5. Proximity to related firms	13. Availability of industrial water
6. Availability of labour	14. Technical skills of labour
7. Support from local government	15. Amenities (education, leisure, shopping)
8. Acces to raw material inputs	16. Acces to research insitutions.

It is important to note that this survey is not concerned with the location points chosen by firms. Rather it looks at the choice of a specific region within the country, reason why other important factors, such as access to highway or industrial zoning, are not included in the choices. In this case land factors seem to be the major issue since, according to the author; Japan has limited options towards developing industrial areas.

### **3.1.2. The Role of Transportation and Connectivity in Industrial Land Location**

One common theme that has appeared in the literature is that of the importance of transportation facilities. We will therefore further explain the different roles and changes in industrial land location transportation has had over the past decades. There is no doubt that industrial lands all over the world have moved out of cities and into suburbs and outer regions. However, even though these processes have been going on for many years, and are mostly considered as a problem for our cities, today the world seems to be able to manufacture and move goods as fast and as efficiently as ever before.

This phenomenon is described not so much as a technological revolution but as an organizational change. Gilbert and Perl (2010) state that one of the greatest transport revolutions was the reorganization of global logistics networks. Internet offered the unprecedented ability to manage and track all aspects of the shipping network. This so-called “revolution” came together as the freight container was starting to become the norm in freight delivery systems. *“The container became the core of a highly automated system of goods from anywhere, to anywhere, with a minimum of cost and complication on the way”* (Pg.18). Because of this, industrial activities are technologically more capable of moving across long distances, as their technological organization has made them more competitive and efficient, therefore making longer distances less of a problem.

It is no secret that large manufacturing and logistical sites are currently unavailable near the centre of some main urban areas. As containerization and high levels of performance have led to the need for large single-story distribution centres, industrial (and mostly freight) activities have to move out from their original city centres.

On the other hand, since freight traffic has increased in volume and is greatly international, it has concentrated in fewer ports and gateways, which in response have become more congested (Cidell, 2010). Lima could easily have this problem, as the airport and port of Callao are both congested, as so are its road accesses. This is a further problem if we consider the intention the authorities of these transportation facilities have on making these regional hubs (Gestión, 2013; APN 2011; Silva Guevara, 2014)

On the other hand, commercial and industrial land use patterns within an urban area determine the types and quantities of goods produced, consumed and transported. Allen, Browne and Cherrett (2012), argue that in the case of English cities, most of them, except the ones near ports, have become net importers of goods, while the ones in ports are exporters and distributors within the country. They also state that most warehousing and industrial growth has developed near port cities. The new industrial zones promoted for Lima are located very far from the port of Callao, which with traffic congestion could become virtually inaccessible.

Holl (2003) argues that transportation network improvements affect the spatial distribution of firms in Spain. Better transportation connections can make areas of lower economic activity more attractive for firm location as they gain better access to markets in the core areas. His study was conducted during a period (1980 to 1994) when Spain's transportation network grew considerably. Connectivity therefore, has become the most important factor in manufacturing and logistics development. Industries needed to locate near major highways, ports and airports, which created a new geography of logistics. For example, Bowen (2008) finds an interesting correlation between network accessibility and county level importance in several regions across the United States. The growth in the number of establishments (mostly warehousing) at the county level was positively correlated to the accessibility of highways and airports. It is important to consider that traffic congestion is capable of threatening this correlation, as firms would have to move to farther, non-congested locations. Hesse (2008) also considers traffic congestion has, and could potentially continue being, a problem in the Eastern Bay area of Oakland and San Francisco. Traffic congestion, we believe, is a major threat to Lima's old and new industrial sites.

This information is of particular importance as Lima has the major port within the region. It is expected that the area is going to need more industrial and logistical lands than its surrounding regions and it is imperative to protect and promote the existing ones as well as potentially look for new ones in strategically connected places as the San Lorenzo Island port project which is close to the Callao Port (Guerra, Personal communication, January 13<sup>th</sup>, 2014)

This situation is particularly true when talking about small or medium sized operators, as well as certain types of locally oriented industries. Some of these operators need smaller sites that, in some cases are available in the surrounding areas of a city. Hesse (2008) explains this phenomenon by considering the situation in Berlin, where gentrification has taken place and new industrial activities have moved towards the southern suburbs of the city. These new industrial locations are well connected to the city, and have created new jobs within their surrounding suburbs. However, when asking particular people in charge of industrial operations, Hesse (2008) argues that most of them agree that even though they are doing well and they appreciate the extra space in the suburbs, they wished they could have stayed in the city centre, either because transportation costs are lower, their clients are near, the city provides better image to their companies, or better workers can be found within the city. We believe all these conclusions are transferable to the case of Lima.

It seems, as Hesse argues (2008), that industrial activities are capable of moving around within a region as long as they are able to fulfill certain requirements. First of all, land cost and competition is a major factor as well as is strategic transport access, seen as long distance / regional or as rapid accessibility to customers. Also, regarding most distant locations, firms need to consider the affordability of the workforce, in terms of delivering low wages, and the low cost of living in the area for the employees. This particular information is of vital importance, especially considering the options Lima is promoting for future industrial development.

Taking these ideas into consideration, some of the future industrial developments of Lima may be better understood. The southern districts of Lurín and Chilca, already at or close to the US\$150 per m<sup>2</sup> payable limit by new industrial developers; show

expensive prices considering their remote locations. However, we may understand that since the South Pan-American freeway, a rather congestion-free road, passes by these locations, good connectivity is appreciated. Also, and since it is far from Lima, there is no competition from commercial or residential developers and will probably stay that way for a long time. The Eastern district of Lurigancho follows a similar trend; it is far from the city centres but fairly well connected by the Ramiro Prialé freeway. Its expansion areas are also surrounded by hills and therefore it is hard to imagine any squatters invading the surrounding areas (Álvarez, personal communication, January 15<sup>th</sup>, 2014). Finally, all these areas are close to small towns, therefore are provided with potentially very cheap labour. Skilled labour however will have to travel longer distances from the city.

With these considerations and the database of firms created, we will try to show that the distribution of the logistics and distribution activities should be changing over time, as logistic activities tend to move from the city centres to outskirts locations such as the far southern areas of Lima.

## **3.2. Locational Choices based on type of firm**

There are several reasons why a manufacturing firm chooses to locate at a specific site. However there are different types of firms, and the particular characteristics of each of them can play a role in determining their locations. We aim to understand the particular decisions firms may take depending on their age, size, sector, and global trade connections.

### **3.2.1. Differences in Manufacturing Sectors**

Different manufacturing activities have different needs in terms of location. Transportation costs play a central role in explaining these differences, as explained in Alfred Weber's first formulations (1929). Weber focused on identifying which spaces would be attractive to particular industries within transportation networks (Alonso, 1964). This implies that manufacturing processes which increased in weight as they get closer to the market, such as brewing beer, are most likely to locate near their markets (market-oriented). Processes which lose weight, such as lumber milling, would most likely locate

near to their input sources (material-oriented) as they tend to waste, expend or wash their input materials. Alonso (1964) also describes firms locations based on specific factors. For instance, transport oriented industries find extreme importance on their transportation costs when defining their locations. Typically these are industries with a high bulk-to-weight ratio for products or materials. Labour-oriented industries are those that are attracted to nearby low cost labour, like textiles. Power-oriented industries are oriented to cheap electricity as are the cases of aluminum (Alonso, 1964) and glass (Flores Estrada, Personal communication, December 30<sup>th</sup>, 2013) production. Finally amenity-oriented industries are those related to research industries, like electronics. These have small transportation costs but require specialized workers. To attract them they need to locate where there are climate, cultural or amenity advantages. Finally foot-loose industries are those that do not have strong locational preferences. Alonso (1964) argued that technical developments are making more industries foot-loose as transportation costs become cheaper and production processes tend to become more efficient.

On the other hand, Vernon (1972) presented the concept of “external economies”, based on his research in the New York metropolitan region of the 1950’s. He defines external economy industries as those producing unstandardized goods with continually changing processes or products. Due to the nature of these industries they mostly avoid committing to machinery, buildings and other types of fixed capital. Their locational needs are to tap into pools of facilities, space, skills and suppliers and to share these facilities with other producers. Face to face contact is also a crucial factor for these external economies to happen. Agglomerations of these types of firms would suggest areas similar to Markusen’s (1996) Marshallian or Italianate industrial districts, where locally owned firms make production and investment decisions with almost no scale economies. Even though many industrial sectors can work on these types of districts, examples of the ones that rely heavily on external economies are those related to fashion as well as printing and publishing. These sectors tend to rely on external economies due to the uncertainty about product and demand. Following this trend, and while analyzing decentralization of manufacturing industries in Bogotá, Mohan (1994) discovered that decentralization occurred in most sectors however, only the printing and apparel industries were still concentrated in the centre, having the least decentralization.

Pérez Burgos finds, over a decade later (2006) how these sectors are still concentrated in the centre of the city while others have kept sprawling. Dablanc & Frémont (2013) also mentioned, while explaining the multiple scales logistic activities can have in the Île-de-France region that these two manufacturing sectors remain inside the city of Paris, as they have high rates of shipment and delivery. These two sectors are some of the most important ones in Lima, representing together over 26% of medium and large manufacturing firms in the city (Ministerio de Producción, 2011). The total national percentage of medium and large firms in these sectors is of 22.6% (INEI, 2012).

This previous information will help us prove that the sectors of printing and publishing as well as those related to textiles and fashion, will tend to locate in the central areas of Lima, while all other sectors seem capable of moving out.

### **3.2.2. Size and age of firm**

The actual size of a manufacturing firm is one of the most influential factors when determining location patterns. For instance, Barkley & McNamara (1994) found that the regional characteristics described by them were a major concern for larger firms compared to smaller ones. They also found that smaller firms do less extensive site searches than larger firms. When looking at new establishments, it is likely that smaller firms restrict their search for locations to geographically limited areas. Searching for alternative locations is costly and therefore firms setting up small plants are more likely to locate close to where they reside or previously worked (Holl, 2003). Vernon (1972) argues that smaller and newer firms tend to locate in central areas where external economies are strong and therefore can rely on external help in order to cope with the uncertainty of products and demand. Mature and bigger firms tend to move production towards low cost locations since they are not as reliant on these external economies. Alonso (1964) argues that new firms locate near the centre of the city where they can rent space relatively inexpensively. When the firm becomes successful and needs more space it will move to the outskirts. These statements need to be carefully considered as in the 1960's urban regions tended to be smaller, logistical advancements minimum and the ISI movement was preponderant.



In more recent studies, Mohan (1994) also found that in Bogotá larger firms move longer distances to the periphery, whereas smaller firms move just short distances, most likely because they require protecting their labour force. Among small firms, accessibility to local input and output markets was the most important factor in the location decision. The benefits of accessibility to the central area compensated for the high rents and congestion. Small firms, especially new ones, still prefer locations close to the traditional centres and they usually locate in the premises vacated by other firms and close to many input services (financial institutions, raw material suppliers, equipment repair shops and residences of prospective workers). Large establishments, which were usually more export oriented and require more plant space with modern production technology, located in the outer areas, where more space was available at lower costs. Pérez Burgos (2006) argues that in more recent years this tendency has slowed down. Central areas have become more expensive and both intermediate and outskirts zones have relatively good accessibility to markets, making these attractive to smaller firms. He states, as did Mohan (1994) that these intermediate and outskirts zones have certain negative characteristics. Among these, dissatisfaction with municipal and public services increased with distance from the centre which suggests that when firms move to the periphery, they need to lead infrastructure investments, which follow them with some lag. This negative aspect of the new locations is traded off against advantages associated with greater space and low cost lands (Mohan, 1994). Firman & Dharmapatni (1995) have found similar limitations in the outskirts of the Jakarta Region of Indonesia, particularly related to access to electricity and water supply for new industrial sites.

However, the size of the firm cannot be simply described as small or large. Many types of firm scales exist and as such we will try to evaluate these when working on our database. Firms can be relatively small but have several separated establishments, while very large firms may be concentrated on one or few large establishments. Today most large firms tend to have several separate establishments while few firms concentrate their activities in large sites.

When comparing concentrated firms with multi-site firms it is important to consider how industry has changed over the past decades. The role of manufacturing

companies has changed from supplying domestic markets (ISI), via supplying international markets through exports (EOI), to supply international markets through local manufacturing (VSI). As a result of this globalization process, the vast majority of manufacturing in large companies is carried out in value networks (Rudberg & Olhager, 2003). This implies that concentrated firms tend to agglomerate on central areas while new and multi-establishment firms will tend to locate on the outskirts taking advantage of better connectivity and lower land prices. Such are the cases of Bogota (Mohan, 1994; Pérez Burgos, 2006), Jakarta (Firman & Dharmapatni, 1995) and Manila, (Kelly, 1996). Massey (1979) states that in earlier periods, different sectors concentrate all their capacity in terms of their requirements for production, locating their facilities near ports (for exports and imports) and near the supply of skilled labour. She also argues that due to the new spatial division of labour, firms tend now to separate and hierarchize technical, control and management functions as well as production itself into separately functioning stages and that every industrial sector determines its specific needs regarding these divisions. When talking about the importance of multi-establishment firms, Álvarez (Personal communication, January 15<sup>th</sup>, 2014) mentioned that today's firms in Lima require dividing their production, R & D and logistics needs in separate areas, however her explanation for this phenomenon related more on the lack of space for expansion in their main establishments rather than on spatial divisions of labour.

In the next sections we will try to use this information to demonstrate that small firms tend to locate in central areas while large firms tend to locate in the outskirts. To go even further we will try to describe how new smaller firms will look for central locations while new large firms will take advantage of lower land prices and greater connectivity, available in the outskirts. We will also try to prove how big concentrated firms locate in central areas.

### **3.2.3. Global trade connections**

There are further considerations that may define the location of specific firms. Agglomeration or clustering initiatives are an important factor for certain firms. Kadokawa (2011) identified that that agglomeration benefits are more important for modern high-tech industries than traditional light manufacturing industries. This implies

that high-tech production is more oriented towards formal linkages and global trade connections. In contrast, light manufacturing industry sectors place more importance on proximity to raw materials and markets. On the other hand, Pérez Burgos (2006) found that there was no particular clustering pattern among industries in Bogotá, while Mohan (1994) was not able to find it for either Bogotá or Cali. Jameson (1979) found the same lack of clustering in Peru, with the exception of the garment industry in La Victoria, Lima.

Mohan (1994) also found differences in location patterns between firms with different global trade connections. Firms that sold a large portion of their output within Bogotá, tend to choose sites near the centre, while export oriented firms usually locate near the peripheries. Similarly, firms that rely on local suppliers tend to locate near the centre and tend to be small. Button (1994) argues that the location of a parent company, for those firms who have one, influences the importance attached to road and air transport links. Rail and bus links are usually not considered, due to the need for intra-organisational communications.

We will try to determine the importance of these global trade connections in the locational patterns of firms. Firms with global trade connections should locate in the outskirts and/or close to the port/airport, locations that provide them with greater connectivity. On the other hand we expect firms without these global trade connections to locate in the city centres where they focus mainly on local markets.

### **3.3. Locational Policy for Industrial Lands**

The stresses industrial lands have are fairly similar all over the world as populations grow and space in cities become scarcer. Towards this problem, many cities have promoted various policies towards protecting and promoting industrial land uses. On this section we will describe these challenges and initiatives, looking at some comparable cases. We will review some foreign examples of industrial land policies from around the world, considering mostly examples from North America and Europe. Examples from Asia, although interesting, usually include limited land bases and strong government agencies, as is the case of Singapore (Zhu, 2001) or Hong Kong (Vance & Associates, 2011), and therefore will not be considered. The examples provided here will

provide insight on potential policies government officials may consider for the case of Lima.

On November 10th, 2013, the Metropolitan Municipality of Lima released the 2035 Urban Development Plan for Lima and Callao (Plan de Desarrollo Urbano de Lima y Callao al 2035) – PLAM. According to Andina (2013), this plan considers eliminating over 5,000 hectares of inner-city industrial lands and converting them to residential and commercial developments while taking manufacturing and logistic activities to the outskirts of the city<sup>1</sup>.

### **3.3.1. Latin American Policies**

Málaga (2012) provides the only comparison made for policies promoted by other Latin American countries. She states that Peru needs to follow the examples of its neighbours from Chile, Colombia and Argentina. In these places, and even since the 1970's, industrial parks were created on the outskirts of their cities. An example is given in the case of Chile, where industrial parks were created, with various basic services, such as water, electricity, roads; and complimentary ones, such as restaurants, fire stations and security. In Colombia, industrial parks were located on tax free zones in order to promote their competitiveness. All the countries mentioned have between 10 and 42 industrial parks and in many cases their strong regulation seems to be keeping speculators out and promoting positive industrial practises. Mohan (1994) and Pérez Burgos (2006) provide studies of industrial sprawl and policies in the Colombian city of Bogotá while Briano, Fritzsche & Vio (2003) provide a comparative analysis of 3 industrial parks on the greater Buenos Aires region in Argentina.

### **3.3.2. North American and European Policies**

There has been huge interest on knowing the different strategies cities around the world have taken in order to protect and promote their industrial lands. Such is the

<sup>1</sup> This is a very new initiative and so far we have only been able to read newspaper reports related to it.

case of CitySpaces & Harris (2007), Vance & Associates (2011) and Metro Vancouver (2012). From them we explore the following examples, taking into consideration that all these cities have major port facilities as in the case of Lima. Many other examples could have been used, such as New York or Barcelona which include industrial lands under threat and policy responses. However, we have chosen not to include examples where the industrial lands are concentrated in highly populated areas and dense manufacturing or warehousing sites converted into other uses; characteristics not found in Lima

### ***Chicago***

Chicago was one of the first cities in North America to create policies for its industrial lands by creating Planned Manufacturing Districts (PMDs). The purpose of these policies was to (Rast, 2005, Pg. 10):

- Foster the city's industrial base.
- Maintain the city's diversified economy for the general welfare of its citizens.
- Strengthen existing manufacturing areas that are suitable in size, location, and character and which City Council deems may benefit from designation as a PMD.
- Help, plan and direct programs and initiatives to promote growth and development of the city's industrial employment base.

The city also implemented Tax Increment Financing Districts, which gave businesses the opportunity to save on their property taxes for a 23-year period. This assistance promoted private investments. Finally, the City has also implemented Enterprise Zones, which sought to stimulate economic activity and revitalize declining neighbourhoods. According to Cityspaces & Harris (2007), Chicago's PMDs continue to be strong even though manufacturing jobs have been in steady decline, although at a slower pace than the rest of the region. However, the Tax Increment Financing Districts seem to have been successful in generating new investments. Land use speculation seems to continue a problem however.

### ***San Francisco***

San Francisco is one of the oldest industrial areas of the Pacific region and has been in constant evolution since. The San Francisco area is a major hub within the

Pacific Rim and logistic industries play a vital role in its development. Industries have moved their establishments throughout the years in the Bay Area and for such reason the city itself has lost most industrial lands due to the pressure of the market and the number of affordable possibilities in surrounding areas (Hesse, 2008).

San Francisco created two forms of industrial zoning, light industry and heavy industry. Both of these zones have allowed for residential development, and as a consequence, industrial developments have moved elsewhere (Vance and Associates, 2011). San Francisco is currently encouraging certain industries, as Production, Distribution and Repair (PDRs) to locate within the remainder of its industrial zones. PDR districts are usually located in historic industrial buildings, some of which are multi-level (Metro Vancouver, 2012). The creation of these innovative zonings and regulations (Cityspaces & Harris, 2007) showed how well certain industries can operate, while at the same time can also accommodate residential and commercial development. Finally Chapple (1999) describes the importance of short-term interventions like jobs training, rent subsidies and low cost loans as the first steps to promote the apparel industry in this area. However, just as in the case of Chicago, further long term strategies need to be considered.

### ***Rotterdam***

Rotterdam is currently the most important port in Europe. Several agencies, including the metropolitan region, municipality and province, worked together in order to create new space for both their port and industry. Their objective was to improve the ports efficiency and capacity while at the same time, improving the environment around. They built the Maasvlakte 2, a 2,000-hectare land reclamation that was capable of accommodating modern port facilities. At the same time they created a 750-hectare recreation centre and executed projects within the existing port to provide both better use and intensification of existing industrial areas, while improving the liveability of the region. They also promoted the use of certain industrial lands for housing and residential friendly activities (Cityspaces & Harris, 2007).

On the other hand, and considering the importance of freight activity in the area, the city created the “distripark concept” These are logistical distribution centres that are

able to respond to “just in time” deliveries at low costs while providing value adding activities. These distriparks have various important connections to the motorways, railways and even waterways, providing transport options across Europe (Metro Vancouver, 2012). Rotterdam has moved successfully around these principles, mainly considering the efforts between multiple levels of government activities. They have created more industrial lands while at the same time improved the environment for the areas new residents.

The case studies illustrated above show the importance of having strict zoning controls in order to prevent non-industrial incursions into industrial areas. From these examples we can also include the importance industrial protection has played on the development of certain sectors within their industrial base. Using the example of San Francisco, the best way to describe these would be Production, Distribution and Repair industries, however it is important to mention all the sub-industries that require operating in central areas (Cityspaces & Harris, 2007; Hesse, 2008; Rast, 2005; Vance & Associates, 2011):

- Food and beverage manufacturing, wholesale and distribution
- Delivery services, event production and catering
- Fashion/garment design and manufacture
- Publishing, printing, photography, fine arts, digital arts
- Construction constructors, furniture, equipment, appliances retail
- Car and truck repair and services

### **3.3.3. Lessons learned from these examples**

These examples are important as they provide us with valuable information and ideas on ways to intensify, promote, develop and protect industrial lands. From Chicago we can conclude that without actual preservation of industrial lands (PMDs), many manufacturing jobs could have been lost. However, just protecting industrial lands seems not to be enough, as the creation of the Tax Increment Financing Districts is considered the actual promoter of new employment. Also, and even though manufacturing sectors declined, they did so at a slower pace than the rest of the region while other industrial sectors on the PMDs grew.

From San Francisco we can extract the importance of the creation of PDR districts, since these are capable of accommodating certain residential and commercial activities, while at the same time promoting industrial jobs. Considering the Bay Area region as a whole (Hesse, 2008), we can learn that there are certain factors that help industrial activities thrive while being far from central cities. Industries need to have access to low cost lands, plus they need to be close to major roadways, ports, airports and their customers.

Finally, Rotterdam shows us the importance of multi-level agency regulations, working with all the related actors in industrial activities. If any work has to be done to protect and promote industrial lands, it must include all the different actors affected. This city is an example also for technological innovation, as better technologies help save time and increase productivity. Finally, and if industrial lands are scarce, there is always the option of creating new industrial islands, a possible option for Lima since it is located next to the pacific ocean. These examples show the many ways manufacturing and industrial activities can be promoted and developed without moving all industrial lands to the outskirts of the city.

In this chapter we have looked at previous research on locational theories, focusing mostly on the specific firm characteristics that tend to predict or define locational choices, as well as comparable industrial land policies from other urban contexts. In the next section we will describe the methods and data we used to carry out this study as well as explain their attributes and limitations.



## **Chapter 4.**

### **Methodology**

In the previous chapter we looked at previous research on locational theories. We focused mainly on the most important firm characteristics that tend to influence locational choices. From these characteristics, such as size, age, sector and global trade connections, and based on the information we were able to gather from our locational database we created the methods we will currently review. Three methods were employed in this research to address the research questions relating to manufacturing location patterns. First, a locational database for industrial establishments in Lima was created. This database was used to understand the current locational patterns of manufacturing industries and compare these with previous literature and interviews on the topic. We also used this database to compare some of the information gathered with a previous study conducted by the Metropolitan Institute of Planning (IMP) and the GENIVAR group in 2000. Although limited, the comparison of this information will reveal some distribution changes on Lima's industry at the district level. Finally, semi structured interviews were also held with public and private institutions involved with industrial activities and land use planning. Within this chapter, a discussion of the methods used will be presented and justified in the context of how similar studies have conducted analysis of this topic. Finally, the limitations of the methods and research are highlighted.

#### **4.1. Locational Database Variables**

Understanding the locational patterns of industrial activities in Lima is the primary goal of this research. Towards this goal, we created a firm database in which we gathered the information of 1251 medium and large industrial firms from different areas and zones of the city. Our main source of firms came PRODUCE. From here we were able to download the National Registry of Manufacturing Firms (PRODUCE, 2011), a

dataset updated to the year 2011, that included all the manufacturing firms in Lima regardless of their size and with incomplete information. Having this problem, we sent an email to the Industrial Statistics and Intern Commerce Area at PRODUCE and asked for information on medium and large firms of Lima. This new database only included the main address of each firm, not contemplating whether these addresses had any manufacturing or warehousing activities nor stating if the firms had other establishments within the city. After receiving this information, and defining the Industrial sectors needed for this study, we used the Single Taxpayer Registration Number (Registro Único Del Contribuyente - RUC) from each firm and compared these results with the National Tax Administration Superintendence (SUNAT) registry. This database included the same information but expanded on some other variables that were useful towards our analysis and that we will further explain.

#### **4.1.1. Location types**

As stated before, The PRODUCE database only included the main or fiscal address and some incomplete contact information. Therefore we searched the SUNAT registry using the RUC numbers we had on the PRODUCE database. The SUNAT registry includes the same information on main addresses, without elaborating on their specific activities, but included all the other locations that a firm had in Lima and Peru. These extra locations were numbered and categorized by the following categories:

**Administrative office:** Main address of the firm.

**Parent establishment:** Place where the firm centralizes the operations made by agencies/Branches

**Agency:** Must report its operations to the parent establishment or administrative office

**Warehouse:** Establishment destined to the storage of produced goods

**Commercial establishment:** Where the firm provides its commercial activities or services

**Production facility:** Where the manufacturing process of goods sold by the company is made

**Branch:** Decentralized establishment in charge of operations in a specific geographical area.

From these, we chose to concentrate only on the warehousing and manufacturing establishments, as these tend to locate on industrial areas and zones. Since logistic and distribution firms do not have manufacturing establishments, but did seem to concentrate their branches on industrial zones, we considered their branch addresses as warehousing establishments. Finally, we had to try to determine what type of activities occurred at the main addresses, since such information was not available. In order to determine if these main establishments are manufacturing establishments or not we applied a basic principle. Since these are all manufacturing firms they should all have at least one manufacturing establishment. If the main address is the only address the firm has, this is assumed to be a manufacturing establishment. The same principle was applied if any other establishments recognized are only warehouses. They were considered unidentified addresses if they had at least one other manufacturing establishment. Exception: If on the SUNAT database there is a manufacturing establishment located on the same block of the main address, the main address is considered manufacturing and the second address is not considered as it is assumed to be all part of the same manufacturing complex. The final location types that we considered were:

- 1 Manufacturing facilities:** Establishment where the manufacturing process of goods sold by the company is made.
- 2 Warehousing facilities:** Establishment destined to the storage and distribution of produced goods.
- 3 Administrative office:** Main address of the firm where no manufacturing or warehousing processes are undertaken.
- 4 Unidentified establishments.**

#### **4.1.2. Districts and Zones of Lima**

For this database we considered all 49 districts in Lima (43 districts for the Metropolitan Municipality of Lima and 6 districts from the Callao Province). To this we added information from other 6 locations surrounding Lima, either to the north, south or east of the city. This gave us an overall of 55 districts. Since analyzing this number of districts, and considering that most of these have little industrial activity, we had to find a way to analyze larger areas and zones. After looking at several zoning profiles we took the one by Ipsos Apoyo (Figure 4.1), one of Peru's most respected statistical and market

research companies. Their division of the city consists in 6 grand zones created in 2007 (updated in 2012) and is based on economic and consumption criteria (Cabrera, 2011). We believe this specific representation is useful for us because all the zones (except for Modern Lima) separately represent each of the 5 industrial “clusters” the city has. Table 4.1 shows the distribution of the districts that compromise each of these 6 zones. All the districts, along with their respective zone were included in the database.



**Figure 4.1. The six main zones of Lima**  
Source: Apoyo, 2012

**Table 4.1. Relation of Districts in the 6 zones**

<b>North Lima</b>		<b>Old Lima</b>	
Carabaylo	Independencia	Lima	
Puente Piedra	Ancon	Rimac	
Comas	Santa Rosa	Breña	
Los Olivos	Chancay*	La Victoria	
San Martin de Porres	Huaral*	San Luis	
<b>East Lima</b>		<b>Modern Lima</b>	
San Juan de Lurigancho	Cieneguilla	Pueblo Libre	Miraflores
El Agustino	Chaclacayo	Jesus Maria	Surquillo
Santa Anita	Lurigancho	Magdalena	San Borja
Ate	Huachipaqui*	Lince	Barranco
		San Miguel	Surco
		San Isidro	La Molina
<b>South Lima</b>		<b>Callao Province</b>	
Villa Maria del Triunfo	San Juan de Miraflores	Ventanilla	
Villa el Salvador	Santa Maria de Mar	Callao	
Chorrillos	San Bartolo	Carmen de la Legua	
Pachacamac	Quilmana*	Bellavista	
Lurin	Asia*	La Perla	
Punta Hermosa	San Vicente de Cañete*	La Punta	
Punta Negra	Chilca*		

### 4.1.3. Sectors

The next step towards completing this database was to determine what the different industrial sectors of these firms were. On the database we had a total of 96 different ISIC codes, therefore sectors. First we grouped the results into the manufacturing sectors of the ISIC coding (revision 3.1), gathering a total of 21 sectors. Even though this number was much more manageable than the original 96 codes, we found that most of these sectors were small and no possible analysis could be done on these. For instance, sectors such as Manufacture of office, accounting and computing machinery, Manufacture of tobacco products, and Manufacture of coke, refined petroleum products and nuclear fuel, only provided one result each. Overall, 11 of the 21 sectors had fewer than 30 results; therefore we decided to further amalgamate them in order to be able to analyze as many sectors as possible. Table 4.2 shows the Original ISIC sectors and how they were reorganized

**Table 4.2. ISIC sectors converted into sector categories**

<b>ISIC Sectors.</b>	<b>Sector Name (Number of results)</b>
34 - Manufacture of motor vehicles, trailers and semi-trailers 35 - Manufacture of other transport equipment	Manufacture of transport equipment (20)
11 - Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying 40 - Electricity, gas, steam and hot water supply	Manufacture and distribution of electricity and fuels (22)
22 - Publishing, printing and reproduction of recorded media	Publishing, printing and reproduction of recorded media (35)
26 - Manufacture of other non-metallic mineral products	Manufacture of non-metallic mineral products (48)
20 - Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials 21 - Manufacture of paper and paper products 36 - Manufacture of furniture; manufacturing n.e.c.	Manufacture of wood and paper products (49)
29 - Manufacture of machinery and equipment n.e.c. 30 - Manufacture of office, accounting and computing machinery 31 - Manufacture of electrical machinery and apparatus n.e.c. 32 - Manufacture of radio, television and communication equipment and apparatus 33 - Manufacture of medical, precision and optical instruments, watches and clocks	Manufacture of medical, communication, electrical or office equipment (78)
18 - Manufacture of wearing apparel; dressing and dyeing of fur 19 - Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	Manufacture of general apparel (106)
17 - Manufacture of textiles	Manufacture of textiles (107)
27 - Manufacture of basic metals 28 - Manufacture of fabricated metal products, except machinery and equipment	Manufacture of basic and fabricated metals (108)
15 - Manufacture of food products and beverages 16 - Manufacture of tobacco products	Food and beverages (113)
25 - Manufacture of rubber and plastic products	Manufacture of rubber and plastic products (124)
23 - Manufacture of coke, refined petroleum products and nuclear fuel 24 - Manufacture of chemicals and chemical products	Manufacture of chemical and chemical related products (130)
60 - Land transport; transport via pipelines 61 - Water transport 63 - Supporting and auxiliary transport activities; activities of travel agencies 75 - Other business activities	Logistic and distribution activities (223)

By identifying these different sectors we were able to identify our first hypotheses based on the locations of several important sectors within the city and the relevant literature previously described.

- Hypothesis 1: Printing and publishing as well as sectors related to fashion tend to locate in central areas. All other sectors seem to be capable of moving out.
- Hypothesis 2: The distribution of the logistics and distribution activities sector are changing over time, as logistic activities tend to move from the city centres to the outskirts.

#### **4.1.4. Firm Age**

The SUNAT registry provided information on the dates when firms started their activities. The next step was to define how to determine locational patterns of firms based on their starting years. In order to define these patterns we used the literature reviewed as well as information from our interviews.

1928 – 1994. This period includes the very first industrial developments, the boom of the 60s and 70s, the collapse of the economy of the 80s and the economic shock of 1992, which lasted up to 1994.

1995 – 2006. These is the period of slow recovery which started around 1995 until 2006 and it included the resettling of old industrial zones that were lost in the crisis years of the 1980's and early 1990's.

2007 onwards. This is the time of economic expansion. It is also the time when prices started to rise on industrial lands due to the previous development of the housing market (see Figure 1.1).

It is important to note that the information gathered does not include firm closures as such data is unavailable. This probably explains the small numbers of industrial establishments with start dates in the early years. Another limiting factor is that since this is not historical data, there is no way to know if a firm has changed its legal name, been bought out, or undergone some sort of merger. Finally, and this was observed in our analysis, this variable is fairly effective in determining declining zones (since new firms will not locate in them), however growing zones will be harder to analyze due to the fact that an old firm is perfectly capable of having new establishments on new zones as they expand in time. With this information, plus the relevant literature reviewed, the following hypothesis was made:

- Hypothesis 3: New smaller firms will still look for central locations. New, large multi-establishment firms will look for outskirts locations taking advantage of greater connectivity and more affordable land prices.

#### **4.1.5. Global trade connections**

Our database also indicated the global trade connections firms have. The information we found from SUNAT relates to the “External relationships” of firms. The options provided were whether a firm was an (1) importer, (2) exporter, (3) both or (4) none. Since the importers (9%) and the exporters (5.1%) only accounted for 14.1% of firms, and analysis on such small numbers was not possible, we instead grouped those firms with global trade connections (Importers, exporters, both) representing a total of 67.5% of firms, and those without (32.5%).

- Hypothesis 4: Firms with global trade connections locate in the outskirts and/or close to the port/airport, locations which would provide them with greater connectivity. Firms without global trade connections would tend to locate in the city centres since they are focused on local markets.

#### **4.1.6. Size of firm**

Firm size may be measured by a series of variables (number of employees, net production, number of establishments, net revenue, etc.). In Peru several different agencies use different methods towards calculating this. Considering that neither from the SUNAT nor from the PRODUCE databases could we determine if firms were medium or large, we had to create our own way of determining this. From this database we had access to only two variables that could determine firm scale: number of employees and number of establishments.

In order to determine the respective scales of the firms in this database we ran, on SPSS, the mean number of workers and mean number of establishments per firm. Firms were categorized as medium if they had less than the mean number of workers or establishments, large if they had more. In both cases means were rounded to their



nearest round numbers<sup>2</sup>. With this information we created four firm types that represent the different sizes or scales of firms.

- 0 Firms that are under the mean of both number of workers and establishments for each sector. These firms are **small-scale medium firms**. Following Vernon's concepts (1972), we expect these firms to be near the central areas of the city where they can take advantage of external economies. Agglomerations of these types of firms would suggest areas similar to Markusen's (1996) Marshallian or Italianate industrial districts.
- 1 Firms over the mean of employees per sector, but below the mean of number of establishments, are **big concentrated firms**. These firms could probably be on the outskirts because they are large and probably have everything they need on site, plus they require affordable land prices (Mohan, 1994). They could also be located in central areas if they are older firms. Following Massey's (1979) formulation described earlier, we would expect these types of firms to be mostly concentrated in the old Lima and Callao zones, areas that had those requirements in the early 20<sup>th</sup> century.
- 2 Firms under the mean of employees per sector but over the mean of establishments, are considered as **multi-site firms**. They could be on a variety of locations.
- 3 Firms that scored above the mean in both number of workers and number of establishments, are considered **large multi-site firms**. Firms could be located in several districts and zones and are most prone to locate on the outskirts of the city having establishments in various zones.

We tried also to determine these scales by using the absolute means rather than by sectors. This meant trying to use a standardized 2 or fewer establishments for every firm in every sector in order to be medium and 3 or more establishments to be considered large. It also implied using the absolute mean of employees for every firm at 208, towards determining if the firm is medium or large. We decided not to use this categorization since this way we would have a skew towards more small scale medium firms (0) and because on the logistics and distribution sector, this skew would make most firms fall under the average number of workers. Based on this information and the literature reviewed, we have drawn the following hypothesis:

<sup>2</sup> In this database we worked exclusively with medium and large firms. We did not include smaller firms for several reasons. Most importantly working on a database with small firms would have implied creating a database 10 times bigger. Also, this database would not have been necessarily representative due to the large number of informal firms in Lima that do not exist in any registry. Finally, large and medium firms represent most of the industrial land usage and their locational sprawl drive suburbanization.

- Hypothesis 5: New smaller firms will still look for central locations. New, large multi-establishment firms will look for outskirts locations taking advantage of greater connectivity and affordable land prices. Old big concentrated firms would locate in central areas while newer ones would locate on the outskirts.

## **4.2. Comparison with Metropolitan Institute of Planning data**

As mentioned before, we are using our own database in order to compare the distribution of manufacturing activities with another study conducted in the year 2000. In the late 1990's the IMP, along with the GENIVAR group, worked on the first ever initiative to categorize and describe the industrial activities in Lima. This project sought to understand the economic, social and environmental aspects of industry in the city. Unfortunately, the project was never finished due to lack of funding and political support (Martinez, personal communication, January 14, 2014). Nonetheless, the first document from this project was finished by the year 2000. Although unpublished, this document was given to us by the general director of territorial planning at the IMP during the interview we held in January 2014. The document provides a general overview of the location of industries in Lima as well as environmental analyses of select manufacturing establishments. The major contribution of this document to our research is the categorization of small, medium, and large firms and their locations by district. From this document (Pg. 64) we extracted all the medium and large firms in order to compare them with our own database.

It is important to consider that while this information is important and useful, the collection methods of this document and our database are different. We are mostly uncertain on how the IMP-GENIVAR information was gathered, however we were able to infer some clues in order to replicate their results. The authors' state that they have used similar databases than the ones we used (SUNAT and PRODUCE), however they did not mention in the document how they assigned locations to their firms. Since this study includes small, medium and large firms, and considering that we observed a rather high proportion of firms in modern Lima in their data, we believe they collected their data based on the head offices or fiscal addresses for each firm. At no point do they make a distinction between different types of establishments. It seems, from the information

provided, that they considered one district per firm regardless of the different activities that could take place. Considering all this, we had to be careful when comparing this information with our database.

In order to replicate the IMP-GENIVAR model, we analyzed the frequency of the districts and zones in which the fiscal addresses were. However, since we believe this model missed out on the manufacturing establishments of large firms with head offices in central or financial centres, we decided to create a weighted model by describing the “MainDistrict” variable on our SPSS dataset.

By doing this we wanted to be sure that we were able to capture main manufacturing establishments and locations for each firm. Naturally, firms with only one establishment would have their district considered as the main district. For firms with more than one establishment we defined a series of guidelines. First of all, we only considered manufacturing establishments, not warehouses, since the IMP-GENIVAR study was concerned with the environmental effects of manufacturing firms. Also, if the firm only has one manufacturing establishment, we considered that one as the main district. For firms with more than one manufacturing establishment, we looked at the district that had most establishments and chose that one. If a firm had an equal number of manufacturing establishments in different districts, we broke the tie by choosing the district where the fiscal address was. If the fiscal address was coded as a 9, “unidentified establishment” and we still had a tie, we looked at the district with most warehousing establishments. As a last resort, and this was used in very few cases, if there was a tie and there were no warehousing establishments to break it, we assigned the main establishment to the one that appears first on the list. We were able to do this because, although the SUNAT registry did not mention when each establishment was opened, it did number the establishments in the order in which they were opened, therefore we used the logic that the oldest manufacturing establishment is the primary one. This way we defined the main district for each of these firms and could provide a comparable and weighted frequency of districts and zones compared to the IMP-GENIVAR database.

After identifying the main district of all firms, we ran the frequencies for both these and the fiscal districts in order to compare them to the IMP-GENIVAR frequencies.

The analysis of fiscal addresses was called “Unweighted data” while the analysis on main districts was called “Weighted data”. Since the number of firms was not comparable (the IMP-GENIVAR database had more firms than our own) we chose to compare the percentage of firms each district or zone had. The ten districts with most industrial representation are shown in the tables, and the remaining districts would be considered as “others”.

It is important to consider that the IMP-GENIVAR study considered all the same SIC manufacturing sectors as we did except for those considered under our “logistics and distribution”, and “manufacture and distribution of fuels and electricity” sectors. We chose therefore to eliminate these two sectors from this part of our analysis in order to replicate as accurately as possible the IMP-GENIVAR results<sup>3</sup>. When doing this we found an interesting fact: our firm database had an overall of 987 firms (1251 when considering all of our sectors) compared with the 1552 firms found by IMP-GENIVAR in 2000. This happened because the IMP-GENIVAR and our database used different categorization systems when determining what medium and large firms are. IMP-GENIVAR used the National Institute of Computing and Statistics (INEI) categorization system where a firm is considered medium when it has 20 or more employees (IMP-GENIVAR, 2000 Pg. 43) As mentioned before, our database was created on the basis of the PRODUCE’s database (2011), and as such they consider medium firms not by the number of employees they have but by their net annual sales.

Medium firms are those that have sales for over 1700 UIT (Tax Units) on a given year (PRODUCE, 2011). In 2011, when this database was completed, the value of the UIT was S/. 3,600<sup>4</sup> (SUNAT, 2014), therefore a medium firm would need to have net sales of at least S/. 6,120,000. Looking at Peru’s national accounts we found that the mean share of employee compensation (based on 2007 currency) in the manufacturing sector represents 29.8% of the added gross value (INEI, 2014, Pg.122). Ministry of Labour (Ministerio de Trabajo Del Perú, 2012. Pg. 122) information tells us that the average annual wage (taxes included) for the year 2012 in the manufacturing sector is

<sup>3</sup> Percentages and distributions remained fairly similar when we analyzed the information including these two sectors.

<sup>4</sup> The conversion rate per S/. 1.00 is equivalent to CAN \$ 0.38 in 2014.

S/. 22,152. This adds up, on average, to over S/. 440,000 per year for 20 employees, an approximate 14% of the added gross value. Using this basic comparison, an average medium-sized firm, in order to be considered as such by PRODUCE's standards, would need to have around 40 workers to achieve the 29.8% of added gross value shown by the national accounts. This difference in size considerations helps explain the larger number of firms considered on the IMP-GENIVAR study, as having 20 or more employees would be easier to achieve for a firm than selling over S/.6 million per year.

### **4.3. Interviews**

As previously mentioned, the database created and further analysis of its contents will provide important information at a firm and establishment levels. In order to better understand these locational patterns, 6 interviews were conducted with firm, industry, and municipal authorities. Interviews on locational factors have been conducted by Holl (2004), who interviewed managers in the food industry of Spain. Juckubiceck (2010) also used interviews to analyze the most important locational factors for logistic firms in the Greater Toronto Area. Barkley & McNamara (1994) mention how even though surveys can be useful when carefully disaggregated, interviews have the ability to provide in-depth considerations or details of non-mentioned attributes. These interviews have also been important in order to better understand the decision making process of firms that are choosing to relocate and those that wish to do so but for some reason are not able to. In order to recruit participants to interview, we travelled to Lima during the months of December 2013 and January 2014 and contacted several private and public institutions. We interviewed a representative from the SNI, two from a real estate company, one from the IMP, one from the Metropolitan Municipality of Lima, and one private investor in industrial parks. We tried to contact a representative from PRODUCE however we did not have a positive response. We held in person interviews with all the respondents. We encouraged respondents to advise us on other possible informants, and by doing so, we were able to have interviews with the representative of the IMP and the sales manager of an important private industrial park located on East Lima.

The major objective of these interviews was to obtain detailed perspectives on past, current and future trends in the location choices of manufacturing firms and their policies. We created an interview structure, which was used with all our respondents (Appendix A). We used this structure as a template in order to code, label and interpret the results. This allowed us to use and compare different opinions on select topics by different types of interviewees. These interviews also provided important information relating to the literature on the differences between medium and large firms or sectors, to name a few.

We intend to learn about how trade-offs are made regarding locational problems in order to continue with operations, as well as identify issues that may have not been included in the database part of the study. Also, we elaborated on the issues regarding the firms that are relocating, mostly to confirm whether or not they are trading off some important factors, such as amenities or public services, in order to achieve more important factors (access to adequate roads and large lots of land for example) as mentioned by Mohan (1994).

#### **4.4. Risks and Limitations**

Regarding the methods used for this study, results suggest that in order to evaluate locational choices and patterns of manufacturing firms, surveys are the most effective instrument. These must be conducted with great care, as they must differentiate stages of location search as well as firm characteristics (size, ownership, production processes). Locational factors should also be reported on surveys as highly disaggregated categories in order to improve the consistency of ratings (Barkley and McNamara, 1994). Our original intention was to conduct a survey about locational challenges. We even had an agreement with the SNI in which they would deliver our survey to over six hundred of their industrial associates, however this proposal did not prosper. We could have delivered the survey on our own, however this type of instrument requires to be filled out by individuals who made or know the locational challenges of their respective firms (Jackubiceck, 2010; Barkley and McNamara, 1994), This is, a task reserved mostly to CEOs, directors or general managers, a population sample that we could not gather without the help of the SNI. For a comprehensive

description of the survey instrument we developed, see Attachment B. To understand the relationship agreement with the SNI, and the things we could have learnt from such a survey, see attachment C.

Regarding the database created, the main limitation was the inability to find information on establishment births and closures. This information would have been fundamental in order to create a historical view on the different zones and time periods. Also, as mentioned before, as we only have the firm's birth years, determining growing zones is fairly hard if we consider how old firms are capable of locating their new establishments in new zones. On the other hand we were not able to find information on the number of small firms in each of the districts/zones we analyzed. While this information is not essential for our analysis, understanding where smaller or "external" economies locate would have been very useful to understand our zones and the possible relationships between smaller and larger firms. Limited information provided from the IMP\_GENIVAR (2000) database was considered, however we would have needed this same type of information for more current years.

Regarding the literature found on the general context of industry in Peru, we also had serious limitations. Our review on Peruvian industrial policies is limited and most of it is rather old. When looking at locational patterns for the city of Lima, only the old industrial centres are considered, as we have not been able to find literature references on the industrial areas created after the 1970's. Most of the literature found on the topic is related to small contributions from authors analysing the Latin American context, where most examples provided explain the Brazilian, Mexican or Argentinian reality. Because of this limitation we created the descriptive zone results (chapter 5.1), so we could describe and understand the different industrial zones of the city, complementing the information found with relevant interview questions.

There is another limitation regarding the database dates compared with the newspaper articles and interviews we held. Our database includes those firms that were created up to 2012. If we consider that our database has only 5 firms created on 2012, compared to 19 in 2011 and 24 in 2010, we can determine that this data does not even include the first half of the year 2012. The lack of industrial lands was first noticed by the

SNI on an article in August 2012 (Chaparro, 2012). This means that our database pre-dates the perceived problem while our interviews and newspaper references provide a story already in progress. Our database on its own cannot tell the whole story, but in our analysis we will have to consider the latest developments and trends not necessarily shown on our results. The only way to address these limitations is by comparing our results with the relevant literature. Interviews conducted will help correct, argument and compare our database results (Creswell, 2009).

In this chapter, the three methods employed in order to understand the locational characteristics and patterns of the manufacturing industry in Lima have been presented. We described and explained the characteristics of the locational database for industries in Lima, which will further be used to understand the current and past locational patterns of manufacturing industries. We also described the information gathered from the IMP-GENIVAR (2000) study and its relation to our own database. Finally, semi structured interviews have also been held with experts on industrial development, planning and real estate. In the following chapter we will describe and understand the basic characteristics of the 6 zones we have previously identified in point 4.1.2 and analyze the different hypotheses related to sectors, age, size and global trade connections.



## **Chapter 5.**

### **Results**

In the previous chapter we highlighted the main characteristics of the methods we chose in order to understand the locational patterns of manufacturing firms in Lima. We identified the importance of the database created; the comparison with a previous study conducted by a third party, and explained the significant contributions of the interviews we held. This current chapter has two main objectives. Describing and understanding the basic characteristics of the 6 zones we identified in chapter 4, and analyzing the different hypotheses related to sectors, age, size and global trade connections. We will determine particular locational patterns based on these concepts in order to further understand the locational patterns of manufacturing firms in Lima.

#### **5.1. Descriptive zone results**

In this section we will describe each one of the 6 zones based on several statistical analyses related to sectors, firm ages, size and establishments. We will also compare this data with those distributions made by the IMP-GENIVAR study.

Table 5.1 shows which manufacturing sectors are most represented in which zones. This table was elaborated on an establishment basis and crosstabulates the different 6 zones with the 13 sectors. It also separates the data into manufacturing, warehousing and total establishments. Finally, instead of providing the number of establishments or percentages for each zone, we show the results using location quotient. For example, the “manufacturing of textiles” sector shows a clear overrepresentation in old and east Lima, while the rest of the zones are considerably underrepresented. This shows that this sector is concentrated on these central areas. Data contained in this table will be further discussed when looking at the different zones.

**Table 5.1. Sector cross tabulations and location quotients.**

TIPO		Bisector													Total
		MNFC AND DISTR OF ELECTRICITY AND FUELS	MNFC OF FOOD AND BEVERAGES	MNFC OF TEXTILES	MNFC OF GENERAL APPAREL	MNFC OF WOOD AND PAPER PRODUCTS	PUBLISHING , PRINTING AND REPRODUCTN OF MEDIA	MNFC OF CHEMICAL AND CHEMICAL RELATED PRODUCTS	MNFC OF PLASTIC AND RUBBER PRODUCTS	MNFC OF NON METALLIC MINERAL PRODUCTS	MNFC OF BASIC AND FABRICATED METALS	MNFC OF MEDICAL, COMINICTN, ELECTRICAL OR OFFICE EQUIPMENT	MNFC OF TRANSPORT EQUIPMENT	LOGISTICS AND DISTR	
Manufacturing Facilities	ZONA North Lima	1.92	1.10	0.36	0.60	0.73	0.00	1.46	1.00	1.18	0.98	1.38	2.02	2.06	1.16
	Old Lima	0.33	0.81	1.32	1.43	1.33	0.84	0.82	0.99	0.61	0.88	1.41	0.31	0.00	1.02
	East lima	0.19	0.82	1.40	1.37	0.73	1.05	0.82	1.18	0.99	0.91	0.64	1.17	1.23	1.13
	Modern Lima	0.00	1.73	0.59	2.19	1.03	4.44	1.20	0.00	0.28	0.29	0.65	0.00	0.00	0.83
	South Lima	2.65	0.65	0.58	0.28	1.24	1.62	1.03	1.24	1.91	1.19	1.20	0.41	1.90	1.05
	Callao Province	1.82	1.95	0.73	0.00	1.24	0.00	1.19	0.57	0.62	1.57	0.78	1.71	0.00	0.64
	<b>Total</b>		<b>15</b>	<b>164</b>	<b>138</b>	<b>120</b>	<b>59</b>	<b>41</b>	<b>168</b>	<b>144</b>	<b>73</b>	<b>139</b>	<b>94</b>	<b>32</b>	<b>7</b>
Warehousing Facilities	ZONA North Lima	0.93	0.83	0.23	0.00	0.70	0.60	1.37	0.33	0.96	1.05	0.93	0.93	1.36	0.82
	Old Lima	0.71	0.96	1.53	1.25	1.06	0.61	1.08	0.84	0.81	0.93	1.88	0.94	0.93	0.97
	East lima	1.04	0.80	1.39	1.85	0.87	2.02	0.98	1.25	0.60	0.78	0.35	1.04	1.02	0.85
	Modern Lima	0.65	0.58	0.32	1.72	0.65	0.00	0.54	0.15	0.44	0.00	0.43	0.00	1.97	1.19
	South Lima	1.66	0.81	0.83	0.66	1.00	1.72	0.90	0.79	1.60	1.50	1.99	1.99	0.88	0.95
	Callao Province	0.95	1.55	0.76	0.25	1.32	0.24	0.99	1.49	1.43	1.28	0.63	0.76	0.67	1.40
	<b>Total</b>		<b>22</b>	<b>172</b>	<b>44</b>	<b>33</b>	<b>44</b>	<b>17</b>	<b>105</b>	<b>92</b>	<b>32</b>	<b>78</b>	<b>33</b>	<b>11</b>	<b>383</b>
Total	ZONA North Lima	1.36	0.97	0.37	0.55	0.73	0.14	1.47	0.82	1.20	1.04	1.38	1.95	1.14	270
	Old Lima	0.54	0.88	1.38	1.41	1.22	0.78	0.92	0.94	0.67	0.90	1.55	0.47	0.89	449
	East lima	0.62	0.80	1.49	1.55	0.79	1.35	0.89	1.23	0.93	0.90	0.62	1.21	0.88	694
	Modern Lima	0.46	1.05	0.46	1.87	0.82	2.62	0.86	0.07	0.32	0.16	0.53	0.00	2.29	134
	South Lima	2.06	0.72	0.65	0.36	1.14	1.67	0.99	1.09	1.85	1.31	1.42	0.81	0.85	326
	Callao Province	1.26	1.72	0.61	0.08	1.25	0.10	1.01	1.04	0.89	1.29	0.60	1.09	0.93	387
	<b>Total</b>		<b>37</b>	<b>336</b>	<b>182</b>	<b>153</b>	<b>103</b>	<b>58</b>	<b>273</b>	<b>236</b>	<b>105</b>	<b>217</b>	<b>127</b>	<b>43</b>	<b>390</b>

Note: A Location Quotient of 0.00 represents no establishments in the respective sector for the respective zone.

Table 5.2 looks at historical trends based on the time when firms started their activities. This cross tabulation looks at the number of establishments firms have in different zones in different time periods, based on the years firms started their operations. The results are also separated into manufacturing, warehousing and overall establishments. From this table we can see that overall old Lima and the Callao province have declining numbers of new establishments (2007-2012), while modern and south Lima have relatively increased their share.

**Table 5.2. Inscription years cross tabulations by zone. Number of new firms per period.**

**ZONA \* Inscriptionyear \* TIPO Crosstabulation**

TIPO				Inscriptionyear			Total
				1928-1994	1995-2006	2007-2012	
Manufacturing Facilities	ZONA	North Lima	Count	76	76	14	166
			% within Inscriptionyear	13.9%	14.8%	10.5%	13.9%
	Old Lima	Count	131	84	28	243	
		% within Inscriptionyear	24.0%	16.3%	21.1%	20.4%	
	East lima	Count	177	198	40	415	
		% within Inscriptionyear	32.4%	38.4%	30.1%	34.8%	
	Modern Lima	Count	23	26	10	59	
		% within Inscriptionyear	4.2%	5.0%	7.5%	4.9%	
	South Lima	Count	64	80	36	180	
		% within Inscriptionyear	11.7%	15.5%	27.1%	15.1%	
	Callao Province	Count	75	51	5	131	
		% within Inscriptionyear	13.7%	9.9%	3.8%	11.0%	
	Total	Count	546	515	133	1194	
		% within Inscriptionyear	100.0%	100.0%	100.0%	100.0%	
Warehousing Facilities	ZONA	North Lima	Count	39	56	9	104
			% within Inscriptionyear	8.4%	11.2%	9.3%	9.8%
	Old Lima	Count	91	104	11	206	
		% within Inscriptionyear	19.5%	20.7%	11.3%	19.3%	
	East lima	Count	125	131	23	279	
		% within Inscriptionyear	26.8%	26.1%	23.7%	26.2%	
	Modern Lima	Count	28	35	12	75	
		% within Inscriptionyear	6.0%	7.0%	12.4%	7.0%	
	South Lima	Count	59	66	21	146	
		% within Inscriptionyear	12.6%	13.1%	21.6%	13.7%	
	Callao Province	Count	125	110	21	256	
		% within Inscriptionyear	26.8%	21.9%	21.6%	24.0%	
	Total	Count	467	502	97	1066	
		% within Inscriptionyear	100.0%	100.0%	100.0%	100.0%	
Total	ZONA	North Lima	Count	115	132	23	270
			% within Inscriptionyear	11.4%	13.0%	10.0%	11.9%
	Old Lima	Count	222	188	39	449	
		% within Inscriptionyear	21.9%	18.5%	17.0%	19.9%	
	East lima	Count	302	329	63	694	
		% within Inscriptionyear	29.8%	32.4%	27.4%	30.7%	
	Modern Lima	Count	51	61	22	134	
		% within Inscriptionyear	5.0%	6.0%	9.6%	5.9%	
	South Lima	Count	123	146	57	326	
		% within Inscriptionyear	12.1%	14.4%	24.8%	14.4%	
	Callao Province	Count	200	161	26	387	
		% within Inscriptionyear	19.7%	15.8%	11.3%	17.1%	
	Total	Count	1013	1017	230	2260	
		% within Inscriptionyear	100.0%	100.0%	100.0%	100.0%	

Table 5.3 analyzes which sizes of firms are most represented in each zone. Once again we separated manufacturing and warehousing establishments. Overall, from this table we can determine that north and modern Lima have more small-scale medium sized firms than the average. Big concentrated firms are slightly more representative in the Callao Province, a zone that also has a large overrepresentation of large multi-site firms. Callao and Northern Lima also concentrate medium multi-site firms.

**Table 5.3. Firm scale cross tabulation by zones.**

				ZONA * SECTORSIZE * TIPO Crosstabulation					
TIPO				SECTORSIZE				Total	
				SMALL SCALE MEDIUM FIRM	BIG CONCENT RATED FIRM	MULTISITE FIRM	LARGE MULTISITE FIRM		
Manufacturing Facilities	ZONA	North Lima	Count	103	12	24	27	166	
			% within ZONA	62.0%	7.2%	14.5%	16.3%	100.0%	
	Old Lima	Count	135	37	27	44	243		
		% within ZONA	55.6%	15.2%	11.1%	18.1%	100.0%		
	East lima	Count	232	45	55	83	415		
		% within ZONA	55.9%	10.8%	13.3%	20.0%	100.0%		
	Modern Lima	Count	49	5	0	5	59		
		% within ZONA	83.1%	8.5%	0.0%	8.5%	100.0%		
	South Lima	Count	105	24	12	39	180		
		% within ZONA	58.3%	13.3%	6.7%	21.7%	100.0%		
	Callao Province	Count	57	32	14	28	131		
		% within ZONA	43.5%	24.4%	10.7%	21.4%	100.0%		
	<b>Total</b>			<b>Count</b>	<b>681</b>	<b>155</b>	<b>132</b>	<b>226</b>	<b>1194</b>
				<b>% within ZONA</b>	<b>57.0%</b>	<b>13.0%</b>	<b>11.1%</b>	<b>18.9%</b>	<b>100.0%</b>
Warehousing Facilities	ZONA	North Lima	Count	40	6	31	27	104	
			% within ZONA	38.5%	5.8%	29.8%	26.0%	100.0%	
	Old Lima	Count	61	27	48	70	206		
		% within ZONA	29.6%	13.1%	23.3%	34.0%	100.0%		
	East lima	Count	83	28	74	94	279		
		% within ZONA	29.7%	10.0%	26.5%	33.7%	100.0%		
	Modern Lima	Count	43	14	3	15	75		
		% within ZONA	57.3%	18.7%	4.0%	20.0%	100.0%		
	South Lima	Count	46	16	35	49	146		
		% within ZONA	31.5%	11.0%	24.0%	33.6%	100.0%		
	Callao Province	Count	48	25	60	123	256		
		% within ZONA	18.8%	9.8%	23.4%	48.0%	100.0%		
	<b>Total</b>			<b>Count</b>	<b>321</b>	<b>116</b>	<b>251</b>	<b>378</b>	<b>1066</b>
				<b>% within ZONA</b>	<b>30.1%</b>	<b>10.9%</b>	<b>23.5%</b>	<b>35.5%</b>	<b>100.0%</b>
<b>Total</b>	ZONA	North Lima	Count	143	18	55	54	270	
			% within ZONA	53.0%	6.7%	20.4%	20.0%	100.0%	
	Old Lima	Count	196	64	75	114	449		
		% within ZONA	43.7%	14.3%	16.7%	25.4%	100.0%		
	East lima	Count	315	73	129	177	694		
		% within ZONA	45.4%	10.5%	18.6%	25.5%	100.0%		
	Modern Lima	Count	92	19	3	20	134		
		% within ZONA	68.7%	14.2%	2.2%	14.9%	100.0%		
	South Lima	Count	151	40	47	88	326		
		% within ZONA	46.3%	12.3%	14.4%	27.0%	100.0%		
	Callao Province	Count	105	57	74	151	387		
		% within ZONA	27.1%	14.7%	19.1%	39.0%	100.0%		
	<b>Total</b>			<b>Count</b>	<b>1002</b>	<b>271</b>	<b>383</b>	<b>604</b>	<b>2260</b>
				<b>% within ZONA</b>	<b>44.3%</b>	<b>12.0%</b>	<b>16.9%</b>	<b>26.7%</b>	<b>100.0%</b>

Table 5.4 looks at which type of establishments are most common in each zone. North and east Lima have more manufacturing establishments, while the Callao province shows a stronger coincidence of warehousing establishments. Modern Lima has most

fiscal addresses, which relates to the main addresses of firms whose manufacturing establishments were located elsewhere.

**Table 5.4. Location type cross tabulations by Zone**

**ZONA \* TIPO Crosstabulation**

			TIPO				Total
			Manufacturing Facilities	Warehousing Facilities	Only fiscal addresses	Unidentified	
ZONA	North Lima	Count	166	104	2	13	285
		% within ZONA	58.2%	36.5%	.7%	4.6%	100.0%
	Old Lima	Count	243	206	4	29	482
		% within ZONA	50.4%	42.7%	.8%	6.0%	100.0%
	East lima	Count	415	279	3	27	724
		% within ZONA	57.3%	38.5%	.4%	3.7%	100.0%
	Modern Lima	Count	59	75	108	10	252
		% within ZONA	23.4%	29.8%	42.9%	4.0%	100.0%
	South Lima	Count	180	146	3	5	334
		% within ZONA	53.9%	43.7%	.9%	1.5%	100.0%
	Callao Province	Count	131	256	0	0	387
		% within ZONA	33.9%	66.1%	0.0%	0.0%	100.0%
Total		Count	1194	1066	120	84	2464
		% within ZONA	48.5%	43.3%	4.9%	3.4%	100.0%

Finally tables 5.5 and 5.6<sup>1</sup> explore the establishment location changes comparing our database data with the information provided by the IMP-GENIVAR data (2000). Table 5.5 shows this information at a district level, most importantly showing the reduction of establishments in the district of Lima (zone of old Lima) and the appearance of new industrial districts such as Lurín and Lurigancho, which do not appear on the 2000 column.

<sup>1</sup> On tables 5.5 and 5.6 the first column describes the 2000 IMP-GENIVAR data. The unweighted data column reflect our database information using the same methodology used on the IMP-GENIVAR (based solely on firms main or fiscal establishments) while the weighted data reflects firm distribution based on the main district variable described on point 4.2.

**Table 5.5. Firm distribution by district, comparing years 2000 and 2012.**

IMP-GENIVAR 2000 DATA		UNWEIGHTED DATA		WEIGHTED DATA	
OTHERS	28.6%	OTHERS	33.8%	OTHERS	28.6%
BRENA	3.0%	SANTA ANITA	2.9%	LOS OLIVOS	3.1%
INDEPENDENCIA	3.0%	LURIGANCHO	3.4%	SAN LUIS	3.3%
LOS OLIVOS	3.2%	SAN LUIS	3.5%	LURIGANCHO	4.4%
SAN LUIS	3.2%	LURIN	4.3%	CHORRILLOS	4.8%
SAN JUAN DE LURIGANCHO	3.6%	CHORRILLOS	4.9%	LURIN	5.0%
CHORRILLOS	4.1%	SAN JUAN DE LURIGANCHO	5.7%	LA VICTORIA	5.6%
LA VICTORIA	5.5%	LA VICTORIA	6.2%	SAN JUAN DE LURIGANCHO	6.3%
CALLAO	7.6%	CALLAO	6.4%	CALLAO	9.8%
ATE	19.0%	LIMA	11.0%	LIMA	11.0%
LIMA	19.3%	ATE	17.8%	ATE	18.1%

Source: Own Elaboration based on IMP-GENIVAR data (2000) and own database

Table 5.6 shows the same data provided in table 5.5, but compares zones rather than individual districts. The most important consideration from this table is the confirmation of the establishment decline in old Lima, the establishment increase in south Lima and the differences between weighted and unweighted data in modern Lima.

**Table 5.6. Firm distribution by Zones, comparing years 2000 and 2012.**

IMP-GENIVAR 2000 DATA			UNWEIGHTED DATA			WEIGHTED DATA		
Zone	Position	Percentage	Zone	Position	Percentage	Zone	Position	Percentage
SOUTH	6	6.3%	SOUTH	4	13.2%	SOUTH	3	15.2%
NORTH	5	9.4%	NORTH	5	10.8%	NORTH	4	12.5%
CALLAO	4	9.9%	CALLAO	6	8.0%	CALLAO	5	12.1%
MODERN	3	16.3%	MODERN	3	14.2%	MODERN	6	6.0%
EAST	2	26.2%	EAST	1	31.0%	EAST	1	32.3%
OLD	1	31.9%	OLD	2	22.8%	OLD	2	22.0%

Source: Own Elaboration based on IMP-GENIVAR data (2000) and own database

Having explained the different analyses and tables we have used, and providing some general considerations of the sector, size and age factors for the overall metropolitan region, we will now explore the developments in each of our 6 zones. We will discuss each of these based on the tables described above as well as on our informational interviews, which will provide both an historical overview and current considerations.



## 5.2. Zone # 1: Old Lima

As the name of the zone states, this is the oldest area of the city and is located on the centre of the metropolitan region of Lima as a whole. When searching for history of industrial activities in the city, literature references on this zone were most abundant, while almost all other zones were ignored. As stated before, industry in the city developed on the west of the city towards the port of Callao and along the Argentina, Benavides and Venezuela Avenues and took advantage of the nearby roads and rivers. According to Dávila (Personal communication, January 07, 2014) this area was the only truly consolidated industrial zone of the city, with entire areas devoted to industry with few residential developments nearby. Flores Estrada (Personal communication, December 30, 2013) mentions that the district of Rimac, just north of the old city centre, used to have industrial activities, however back in the 1970's most of these were asked to relocate to east Lima due to environmental concerns. Also, la Victoria is the national industrial centre for the garment industry, however most of this production comes from small firms (Keukens, 2010) not represented in our study. La Victoria along with the district of Lima, are the two districts with most small firms in the whole metropolitan area according to the IMP-GENIVAR study (2000). Such characteristics make this zone appear as a Marshallian or Italianate industrial district, following Markusen's (1996) considerations. In these types of districts small and medium scale industries prevail, and just as described by Vernon (1972), firms in these types of districts consciously (or unconsciously) network to solve problems of cycles and over capacity. Overall, old Lima has the second largest proportion of industrial establishments and firms in the city.

From our statistical analysis we can determine that this zone has a fairly equal number of manufacturing (50.4%) and warehousing (42.7%) establishments (Table 5.4). The most representative sectors in old Lima (Table 5.1) are the textile and general apparel sectors as well as the "medical, communication, electrical and office equipment" sector. Historically (Table 5.2) this zone has been losing establishments regularly, from having 21.9% of overall establishments before 1994 which still survive, to just over 17% in the 2007-onwards period. Warehousing establishments, having around 19.5% of these in previous periods but only 11.3% in recent years, represents most of this loss, a result that is consistent with the theory that warehousing is more sensitive to high land

prices. Also, and even though there is a majority of small-scale medium firms, Old Lima is slightly overrepresented by large concentrated firms (Table 5.3). Following Massesy's arguments (1979) these types of older firms concentrate their capacity on single sites near ports and skilled labour. It is important to consider that up until the 60's or 70's, skilled labour lived close to the city centre, a trend that has since dramatically changed.

Comparing our data with the IMP-GENIVAR study (Table 5.5) we can tell that in 2000, the district of Lima was the district with most firms in the city (19.3%). La Victoria had 5.5%, San Luis had 3.2% and Breña had a 3.0%. This means that four districts within the top 10 industrial districts of metropolitan Lima belonged to this zone. By 2012, the district of Lima has 11.0% of firms (second overall), La Victoria and San Luis have fairly similar representations, and Breña has disappeared from the most representative industrial districts. Overall as a zone, old Lima has an average of 22% of firms (weighted and unweighted). This appears as a rather big loss since the previous percentage, from the 2000 IMP-GENIVAR data, was of 31.9%. This demonstrates the declining pattern of Old Lima as a manufacturing centre, now being the second largest industrial zone, after east Lima.

### **5.3. Zone # 2: Callao Province**

The Callao zone has the same history and evolution as Old Lima. The very first industrial developments of the city took place on the several corridors that connected these two cities, some in Lima, some in Callao. Therefore all that was previously mentioned about the history of old Lima is relatable to the Callao province as well. As Flores Estrada (Personal communication, December 30<sup>th</sup>, 2013) mentioned: *"(...) these were basically two cities. You would live in Lima and have your factory on the way to Callao. And remember that back then the railway, the Cerro de Pasco Mining Corporation, brought mineral material from the La Oroya foundry (East of Lima, high in the Andes) in order to either leave minerals directly to the factories along the way or directly to the port for shipping. Similar thing happened with agricultural products"*. He even mentioned that back in the 90's the whole Callao area was full of abandoned industrial sites that his firm unsuccessfully tried to sell. Most of those sites ended up

being sold to residential or commercial developers, and even today (El Comercio, 2014a) the change of these zones from industrial to residential is being celebrated.

Even though this area is similar to Old Lima, we decided to analyze them separately for two reasons. First of all, Callao is a separate constitutional province, which means that it is not regulated under the same parameters as Lima, and because this zone is home to the main airport and port of the country. Because of this, we expected a few different results and considerations when compared to Lima, therefore we expected this zone to have its own particular characteristics, such as more warehousing activities and more multi-establishment firms.

When analyzing firms and establishments, we found that this zone has the lowest percentage of manufacturing facilities but is overrepresented on warehousing. As table 5.4 shows, only 33.9% of its establishments are related to manufacturing activities, while 66.1% are warehousing, compared to an overall 48.5% and 43.3% respectively for the city as a whole. Even though its proportion of manufacturing establishments is rather low, Callao does specialize on the “manufacturing of electricity and fuels”, “manufacture of basic and fabricated metals”, “food and beverages” and “transportation equipment”. In warehousing the only two sectors that are overrepresented are those of “food and beverages” and “plastic and rubber products”.

Historically we can see that this zone is also losing its share of establishments (Table 5.2), and at faster rates as east and old Lima. Its manufacturing establishments have dropped from around 14% to as little as 3.8% post 2007. Its warehousing establishments have also dropped down but at slower rates.

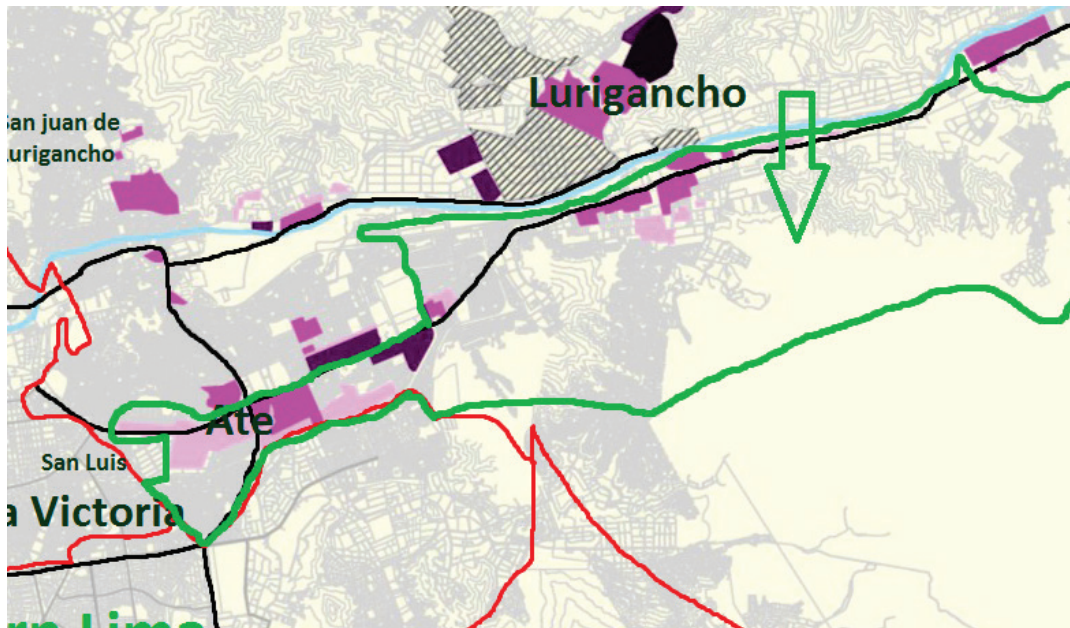
Callao is the only zone where small-scale medium firms are not the norm (Table 5.3). Rather, Callao specializes in both types of multi-site firms, specially the large ones. It also has a fairly large representation of big concentrated firms. These characteristics seem to describe Callao as a Hub-and-Spoke type of industrial agglomeration (Markusen, 1996) where a number of core industries serve as a hub for economic development and smaller firms. Data from the 2000 survey provided by IMP-GENIVAR does show that Callao has a significant small firm population too. Markusen (1996) also argues that core firms in these types of districts tend to buy from local and external

suppliers and sell mainly on international markets, hence the importance of the airport and port in this area.

Of the 6 districts in the Callao Province, only the district of Callao represents a large number of firms. IMP-GENIVAR shows this zone as the fourth largest one, while our weighted and unweighted analysis both show a drop in this share, confirming a decline in its number of establishments.

#### **5.4. Zone # 3: East Lima**

East Lima has a strange configuration. Some of its districts are adjacent to old Lima (Santa Anita, & El Agustino) and its main Industrial district, Ate, extends from west to east, making it part centre and part outskirts at the same time. Figure 5.1 shows how most of the industrial areas in Ate are located on the western side of the district; therefore it can be considered central. According to Dávila (Personal communication, January 07, 2014) this zone was the second to be configured after the old Lima – Callao corridor. Even though it was never really designed as an industrial area, it was mostly formed by the overflow of the textile industry in the district of la Victoria in the 1950's and 1960's. Dávila also states that this is the area where industries from near the city centre, in the district of Rimac, were relocated, as the area had the advantages of being located upstream of the Rimac River and close to the main highway intersection, going to the north, south and east. According to IMP-GENIVAR (2000) the area between the Central Highway and the Separadora Industrial Avenue, in Ate, concentrates most industrial activities.



**Figure 5.1. The district of Ate, highlighted in green**

From our statistical analysis we can determine that this zone has the majority of industrial activities of all zones. It has the largest number of establishments in almost all sectors except for “fuels and electricity” and “medical, communication, electrical and office equipment”. It is not overrepresented by any sector except for the textile and apparel sectors. Along with old Lima, east Lima agglomerates 73.1% and 75.8% of these sectors respectively, reinforcing Dávila’s argument. Finally it does show overrepresentation of warehousing for the printing and publishing sector (but not manufacturing). This area coincides with the impact of the Import Substitution Model of the 1950’s and 1960’s, which was considered as the time of greatest industrial expansion in Peru (Cabienes et al., 1982). According to Dávila (Personal communication, January 7<sup>th</sup>, 2014) it was mostly on this zone, and on this time, that the Import Substitution Model took place in Lima. If we consider the data provided by IMP-GENIVAR (2000) on small firms, the district of Ate (particularly its western side) shows many of the same characteristics as old Lima and therefore shows the same sort of Marshallian characteristics described by Markusen (1996).

Historically, this zone had a slight increase in its number of establishments in the second period (1995-2006) however since then (2007-onwards) this relation has dropped slightly. In 2000, the district of Ate had 19.0% of industrial firms while San Juan

de Lurigancho, 3.6%. By 2012 Ate had around 18% of firms and San Juan de Lurigancho, around 6 % (weighted and unweighted), confirming a slow decline in one district and growth in the other. Also, the district of Lurigancho appears on this list with around 4% (In 2000 it had 0.3%) showing a large increase. From our personal communications we can state that 5 out of our 6 respondents considered this district as one of the future poles of industrial development.

Following on this, we collected information on a 600-hectare private industrial park project that is being developed in the far northeast corner of Lurigancho. Álvarez (personal communication, January 15<sup>th</sup>, 2014) stated that most of the firms allocating establishments to this industrial park are established firms looking for additional locations, mostly warehousing establishments, rather than new firms trying to start up new business. This would follow the trends described by Rudberg & Olhager (2003) who state that multi-establishment firms tend to locate their establishments on the outskirts, taking advantage of better connectivity and lower land prices. Thanks to the growth of Lurigancho, as a zone, east Lima appears to have increased its share from 26.2%, to about 32% (weighted and unweighted data).

## **5.5. Zone # 4: North Lima**

The northern industrial zone of Lima was first developed during the earlier part of the military regime of the early 1960's and concentrated around the north Pan-American Highway and surrounding avenues (Arce, Personal Communication, January 13, 2014). According to Guerra (Personal communication, January 13, 2014) due to the large extensions of industrial lands available and the high population density, most of the large sites that have been sold in this area were to build large shopping centres and malls, the first of which was inaugurated some 15 years ago and is still the most successful mall in Peru (Megaplaza). This area developed along with residential developments and for such reason never really took off as an industrial centre.

From our analysis we can tell that the sectors most represented in this area are (Table 5.1) those of “manufacture of chemicals and chemical related products”, “manufacture and distribution of electricity and fuels” and “manufacture of transport

equipment". This last sector has an interesting story. According to Guerra (Personal communication, January 13, 2014) and Flores Estrada (Personal communication, December 30, 2013) as part of the ISI scheme implemented by the military government of the 70's, several car assembly plants were installed in this area. By the late 80's, none of these existed anymore. However, our data shows that several related activities in the manufacture of transport equipment are still agglomerated in this zone.

As previously described, manufacturing sites have been lost in this area since the late 90's. Our data shows that there seems to be a slight loss in the number of new establishments locating on this zone, particularly starting on the third period (2007 onwards, table 5.2). On the other hand, most firms in this zone are small-scale medium firms, but we can also find representation of establishments from multi-site firms (Table 5.3). 58.2% of establishments in this zone are manufacturing while 36.5% are related to warehousing activities (Table 5.4). Finally, of the top ten industrial districts of Lima for 2012, (Table 5.5, weighted data) only Los Olivos appears from this zone with 3.1% of firms located in this district. In the year 2000, this representation was fairly similar (3.2%). Unlike the 2000 IMP-GENIVAR data, the district of Independencia no longer appears on this list. As a zone, North Lima continues to be relatively small as the IMP-GENIVAR study (2000) considered it to be the fifth largest zone while our data (both weighted and unweighted) shows similar patterns.

## **5.6. Zone # 5: Modern Lima**

This zone is the modern, residential, and commercial centre of the city. Even though many of the districts on this zone cannot be actually considered "modern", as large inequalities between districts exist, few industrial activities are expected throughout. The only information we were able to gather from our interviews related to this zone came from Flores Estrada (Personal communication, December 30, 2013) who mentioned that some industry is found in the district of Surquillo, related to micro or small textile, furniture, or repair related factories. Apart from this information none of our remaining participants mentioned any information about the industrial heritage of the zone. From our analysis we can state that this zone has the least number of overall manufacturing and warehousing establishments, however it does show some

specialization in specific sectors as well as it does have the largest number of identifiable fiscal addresses (42.9% of its establishments, Table 4.4). Related to this, Massey explains (1979) that central areas are important for industry as they concentrate the higher hierarchies of research, design and development, and by the presence of managerial and technical strata.

For instance, this zone is overrepresented (Table 5.1) by the general apparel sector, probably relating to high-end apparel and jewellery manufacturers that need to be close to consumers. The same consideration could be taken to explain the overrepresentation of the “manufacture of food and beverages” sector, probably represented by bakeries and other locally focused food producers. The “publishing, printing and reproduction of media manufacture” also shows overrepresentation in this zone as so does the logistics and distribution sector, probably relating to the closeness with headquarters, fiscal addresses or distribution to markets.

As stated before, this zone has the smallest number of establishments. Nonetheless its share has gone up from around 5% of establishments before 2007 to 9.6% (Table 5.2). This growth is represented mostly on its share of warehousing establishments (From an average of around 6% pre 2007, to over 12%). This growth may be explained as part of the booming economy of Lima in the past decades. We infer this from the data on small firms provided in 2000 by the IMP-GENIVAR research, which shows that after old Lima, modern Lima has the largest number of small firms. These firms may have grown over the years and become medium sized with the addition, for example, of a warehouse close to their main manufacturing establishment. This would be further confirmed by the strong specialization in small-scale medium firms as well as on the warehousing activities of big concentrated firms (Table 5.3).

In 2000, none of the districts on this zone were among the top ten, the only district with a fair representation would be Surquillo with 2.9% of firms, as was described by Flores Estrada. Still, by 2012 no district in the zone appears on the list of top 10 establishments (Table 5.5). As a zone (Table 5.6), describing the evolution of modern Lima is tricky since our unweighted data shows a similar trend while our weighted data shows it only represents a 6% of firms. It was because of this zone that we decided to



compare fiscal addresses and main districts (unweighed and weighted data respectively). We believe from our weighted method that Modern Lima is the zone with least industrial representation of medium and large-size establishments.

## **5.7. Zone # 6: South Lima**

The southern part of Lima has a relatively new industrial tradition. Most of it started in the late 70's and early 80's, mostly in the districts of Chorrillos and Villa El Salvador, both located in close proximity to the South Pan-American Highway. None of these districts managed to consolidate as true industrial areas due to the ongoing economic crisis that lasted till the early 90's. (Flores Estrada, personal communication, December 30<sup>th</sup>, 2013). Most recently, by the late 90's and with the start of the economic recovery, the district of Lurín started to issue industrial zoning permits. Even though this area started to grow and develop as an industrial pole, its closeness to the Lurín River and valley has made the Metropolitan Municipality of Lima go against these projects. This conflict has had these two forms of government fight against each other due to conflicting interests, having the Metropolitan Municipality of Lima envisioning Lurín as an ecological pole and the district of Lurín wanting to sell industrial zoning permits. Without a clear view of what needs to be done, this area has developed in a chaotic way. Dávila (Personal communication, January 07<sup>th</sup>, 2014) states that today there seems to be a consolidated vision of how to use these lands and that a fairly coherent industrial pole is being created. Guerra (Personal communication, January 13<sup>th</sup>, 2014) states that today, in order to receive industrial zoning in Lurín; the local municipal district requires large percentages of free space (as much as 50% in some cases). He also states, along with Flores Estrada, that several small private industrial parks are being created in the area. Recently a new plan proposal was made for the integral plan of the district which separates industry, housing and commercial areas (Figure 5.2)



**Figure 5.2. New plan for the district of Lurín (PLAM 2012-2035, 2014)**

Notes:

Current and expected Industrial lands shown in light and dark purple respectively

Source: <http://plam2035.gob.pe/pampas-de-lurin-se-converteran-en-el-polo-industrial-mas-importante-de-la-ciudad/>

In more recent years, and in an area that is actually not part of Lima's metropolitan area, large Industrial developments have occurred in the district of Chilca, (Province of Cañete). This area started developing in the past 5 or 6 years thanks to the regulations made by the local municipal district. Since this area is not governed by Metropolitan Lima, the change of land use was a fairly easy task for the local municipal district and industrial firms heading there. Niezen (2013a) demonstrates that while the district did announce the availability of new industrial zonings in Chilca's lands, it was the only thing that was actually done, not providing the most basic facilities like roads, water or electricity. Also, since lands all over Lima are expensive, and Chilca being one of the few affordable options nearby, the municipal authorities were not able to cope with

the success this region had and even today do not have the capability to respond to the needs of both their population and their new industrial neighbours. Our analysis will not be able to show us any important information regarding Chilca due to the fact that by 2012, lands were bought by large firms but not built. Further analysis of the Chilca district would need to be done in several more years in order to truly understand its importance and challenges.

Regarding our analysis we can tell that by 2012, and after east and old Lima, this zone is the third most important industrial zone of the city. Table 5.1 shows that this zone is overrepresented by the “manufacture and distribution of energy and fuel” sector, as the early developments of Chilca are related to a few thermoelectric power plants as well as the gas pipeline that comes through the province. Analysis also shows that the “printing and publishing of media” (mainly in the district of Chorrillos) and the “manufacture of non-metallic mineral products” is overrepresented in this area.

South Lima is also the zone with most overrepresentation of warehousing activities, as it has the highest location quotients for 6 of the 13 sectors (Table 5.1). These includes the sectors mentioned above plus, “manufacture of basic and fabricated metals”, “medical, communication, electrical and office equipment” and “manufacture of transport equipment”. Guerra (Personal communication, January 13<sup>th</sup>, 2014) states that in recent years, firms in need of more space tend to locate, mostly their warehouses, in this area (or Lurigancho in east Lima) due to the availability of low cost lands.

Regarding its historical development, table 5.2 shows that this is the only zone that has actually increased its share of establishments. On the time periods before 2007, this area had an average share of around 13% of establishments. For firms inscribed since 2007 this share climbed to 24.8%, a large increase considering that growing zones are hard to represent by this method (As explained on point 4.1.4).

By the year 2000 (Table 4.5), the only district that appears on this list is Chorrillos with 4.1% of firms. This number is still fairly equal by 2012 weighted and unweighted numbers (4.8%). The district of Lurín has, by 2012, around 5% of establishments, while in 2000 it did not appear on this table (it only had 0.4%). This district mostly explains the recent surge in establishments for this zone. As a zone (Table 5.6), south Lima has

certainly increased its share of firms and establishments. By 2000, this zone represented only 6.3% (last place) of firms, compared to around 14% of firms on 2012, being the third most important zone.

## **5.8. Analysis of hypotheses**

The previous section of this paper has described all the different industrial characteristics of each one of the 6 identified zones of Lima. In this section we will further try to assess the hypotheses provided, considering the factors of age, size, sector and global trade connections.

### **5.8.1. Hypothesis 1:**

***Printing and publishing as well as sectors related to fashion tend to locate in central areas. All other sectors seem to be capable of moving out.***

As stated in point 5.1.3, most of the manufacturing activity for the textile and apparel sectors concentrated along old and east Lima. This evidence seems fairly conclusive, however we must take into consideration the special characteristics of east Lima as it includes both central and outskirt zones. Further disaggregation of this zone, shown on table 5.7 demonstrates that the district of Ate, closer to the central areas of Lima has a major preponderance in these two sectors; 60.7% of establishments in the manufacture of textiles sector for the zone, as well as 49.4% of establishments in the manufacture of general apparel. On the other hand, table 5.7 also shows that the district of San Juan de Lurigancho has 20.2% and 30.4% of the establishments in these sectors. As shown on figure 1.2, the industrial areas of this district are located to the south of the district, just north of the area in between old and east Lima. These results suggest that indeed, the apparel and textile sectors do locate mostly in central areas. The fact that the apparel sector also has some representation in Modern Lima is also conclusive of this, since modern Lima is located in the centre of the economic activity of the city, representing mostly smaller, locally oriented firms.

**Table 5.7. Number of establishments in the printing, apparel and textiles sectors for districts in the east Lima zone**

**DISTRITOFISCAL \* Bigsector Crosstabulation**

		MANUFACTURE OF TEXTILES	MANUFACTURE OF GENERAL APPAREL	PUBLISHING, PRINTING AND REPRODUCTION OF MEDIA	ALL SECTORS	
DISTRITOFISCAL	ATE	Count	54	39	18	367
		% within Bigsector	60.7%	49.4%	72.0%	50.7%
CHACLACAYO		Count	0	0	1	11
		% within Bigsector	0.0%	0.0%	4.0%	1.5%
ELAGUSTINO		Count	2	1	1	28
		% within Bigsector	2.2%	1.3%	4.0%	3.9%
LURIGANCHO		Count	5	10	3	117
		% within Bigsector	5.6%	12.7%	12.0%	16.2%
SAN JUAN DE LURIGANCHO		Count	18	24	0	112
		% within Bigsector	20.2%	30.4%	0.0%	15.5%
SANTAANITA		Count	9	5	2	76
		% within Bigsector	10.1%	6.3%	8.0%	10.5%
ALL OTHER DISTRICTS		Count	0	0	0	13
		% within Bigsector	0.0%	0.0%	0.0%	1.8%
Total		Count	89	79	25	724
		% within Bigsector	100.0%	100.0%	100.0%	100.0%

The publishing, printing and reproduction of media sector shows a fairly similar spatial distribution. Table 5.7 shows that most of this sector's activity in east Lima is located in the district of Ate (72.0%). The only significant difference is that these activities are not concentrated in old Lima (at least not on medium and large firms) but rather in south Lima (Table 5.1). Since these results seemed contrary to the theories described, we disaggregated the results for the districts of such zone (Table 5.8) and found that 85.7% of the establishments related to this sector were located in the district of Chorrillos. As seen on figure 1.2, Chorrillos is the northernmost district of south Lima and as such it is adjacent to modern Lima, a zone that is overrepresented by this sector. It seems like the district of Chorrillos is almost an extension of modern Lima in this particular case and therefore could be considered a central location, thus confirming our hypothesis.

**Table 5.8. Number of establishments in the publishing, printing and reproduction of media sector for districts in the south Lima zone.**

**DISTRITOFISCAL \* Bigsector Crosstabulation**

			PUBLISHING, PRINTING AND REPRODUCTION OF MEDIA	ALL SECTORS
DISTRITO FISCAL	CHORRILLOS	Count	12	87
		% within Bigsector	85.7%	26.0%
	LURIN	Count	2	109
		% within Bigsector	14.3%	32.6%
	ALL OTHER DISTRICTS	Count	0.00	138
		% within Bigsector	0.0%	41.3%
Total		Count	14	334
		% within Bigsector	100.0%	100.0%

### 5.8.2. Hypothesis 2:

***The distribution of the logistics and distribution activities sector are changing over time, as logistic activities tend to move from the city centres to the outskirts.***

As cities grow and industries seek bigger, more affordable lands, logistic sectors tend to follow them. Guerra (Personal communication, January 13<sup>th</sup>, 2014) states that the typical locations for logistic activities were old and eastern Lima as well as the Callao province. Today these locations have shifted and now most new logistic services are concentrating in southern Lima (particularly Lurín) which is the only zone that can be considered truly on the outskirts.

Table 5.9 shows the logistic sector locations based on the 3 time periods. It is clear that, as with most manufacturing sectors, east Lima holds most logistic activities, along with the Callao province and old Lima. As expected, logistic activities have grown in southern Lima, as industry is moving towards this zone. They have also grown in modern Lima, likely representing the growing importance of the whole logistics sector. Flores Estrada (Personal communication, December 30<sup>th</sup>, 2013) explained that with today's industry moving to the outskirts, logistic firms are now providing warehouses and distribution points in central areas of the city where products can be assembled and sent to their final consumer destinations, probably explaining this surge in logistic firms in the area. On the other hand, old Lima shows a strange increase in the number of

establishments in the 1995-2006 period, followed by a strong decrease on the 2007-2012 period. Gonzales de Olarte (2006) mentions that in this zone many manufacturing firms have changed to importers. Guerra (Personal communication, January 14<sup>th</sup>, 2014) explained that back in the mid 1990's, in the core period of urban decline, several logistic firms bought lands in the area taking advantage of the central location and low prices, prices not present anymore in the 2007-2012 period. Finally, the decline in logistic activities in the port area of Callao probably relates to the also decreasing manufacturing activity in the zone shown originally on table 5.2.

**Table 5.9. Logistic services inscription years per zone**

**ZONA \* Inscriptionyear Crosstabulation**

			Inscriptionyear			Total
			1928-1994	1995-2006	2007-2012	
ZONA	North Lima	Count	14	32	5	51
		% within Inscriptionyear	11.5%	15.6%	8.9%	13.3%
	Old Lima	Count	11	52	6	69
		% within Inscriptionyear	9.0%	25.4%	10.7%	18.0%
	East lima	Count	32	54	16	102
		% within Inscriptionyear	26.2%	26.3%	28.6%	26.6%
	Modern Lima	Count	16	26	11	53
		% within Inscriptionyear	13.1%	12.7%	19.6%	13.8%
	South Lima	Count	14	18	14	46
		% within Inscriptionyear	11.5%	8.8%	25.0%	12.0%
	Callao Province	Count	35	23	4	62
		% within Inscriptionyear	28.7%	11.2%	7.1%	16.2%
Total		Count	122	205	56	383
		% within Inscriptionyear	100.0%	100.0%	100.0%	100.0%

### 5.8.3. Hypothesis 3:

***Small firms tend to locate in central areas while larger firms tend to move production to low cost locations.***

In order to understand this hypothesis we first needed to determine which were the outskirts and low cost locations. As was previously described, small firms tend to concentrate in central areas where high land costs are compensated by the accessibility of local inputs and external economies. Larger firms tend to locate on low cost lands since they are not as reliant on external economies as smaller firms, and require larger sites. Table 5.10 shows the approximate prices for the different locations we have

previously mentioned. As can be seen, central areas like old or east Lima (with the exception of Lurigancho) are considered expensive places and under pressure to be converted to other uses. Callao, even though is an old industrial zone has some areas to its north being more affordable (on the \$300 per m<sup>2</sup> range). Overall, the most affordable available lands are located on the eastern districts of Lurigancho (\$80-150 per m<sup>2</sup>) and in Chilca (\$60-100 per m<sup>2</sup>).

**Table 5.10. Approximate land prices of industrial lands in Lima – Per square meter (Values represented in 2012-2013 US\$)**

Zone	District	Price Range
Old Lima	Lima	\$800-1000
East Lima	Ate	\$700-1200
East Lima	Lurigancho	\$80-300
South Lima	Lurin	\$200-300
South Lima	Chilca	\$60-100
Callao Province	Callao & Ventanilla	\$300-700

Notes:

No data available for Modern/North Lima

Source: Own based on information provided by Niezen (2013) and Florez Estrada (2012)

In order to examine this hypothesis, we separated the 4 sector size categories from table 5.3 and created only 2 categories. This meant that all the small-scale medium firms would be in one group and all others (big concentrated, multi-site and large multi-site) would be in the second group (Table 5.11 - Totals). For this analysis we only considered manufacturing and warehousing establishments. We did not consider fiscal locations or headquarters as these were mostly located on non-industrial lands and would show a skewed tendency in modern Lima<sup>2</sup>.

<sup>2</sup> We also tried to compare firms based only on their number of establishments. Firms with a single establishment were compared with firms with 2 or more establishments. Even though numbers varied a little, the same overall results were found.



Small-scale medium firms had a tendency to locate in modern Lima and less in the Callao province than their larger counterparts. Larger firms had a strong tendency to locate in Callao but comparatively less likely to locate in modern Lima. We expected smaller firms to locate in central areas where external economies can be present. This may be the case for modern Lima but we would have expected these firms to locate also in old and east Lima, even in the central areas of Callao.

**Table 5.11. Small-scale medium firms vs. larger firms<sup>3</sup>**

				smallestablishments * ZONA * NewOldFirms Crosstabulation						
				ZONA						
NewOldFirms				North Lima	Old Lima	East Lima	Modern Lima	South Lima	Callao Province	Total
1928-1994	smallestablishments	small	Count	42	82	102	17	40	38	321
			% within ZONA	42.0%	38.9%	37.8%	48.6%	37.0%	23.5%	36.2%
		others	Count	58	129	168	18	68	124	565
			% within ZONA	58.0%	61.1%	62.2%	51.4%	63.0%	76.5%	63.8%
	Total		Count	100	211	270	35	108	162	886
			% within ZONA	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
1995-2012	smallestablishments	small	Count	78	79	157	39	94	43	490
			% within ZONA	66.7%	46.7%	49.2%	84.8%	55.3%	26.4%	49.8%
		others	Count	39	90	162	7	76	120	494
			% within ZONA	33.3%	53.3%	50.8%	15.2%	44.7%	73.6%	50.2%
	Total		Count	117	169	319	46	170	163	984
			% within ZONA	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Total	smallestablishments	small	Count	120	161	259	56	134	81	811
			% within ZONA	55.3%	42.4%	44.0%	69.1%	48.2%	24.9%	43.4%
		others	Count	97	219	330	25	144	244	1059
			% within ZONA	44.7%	57.6%	56.0%	30.9%	51.8%	75.1%	56.6%
	Total		Count	217	380	589	81	278	325	1870
			% within ZONA	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 5.11 also shows the inscription years of the firms analyzed in order to compare the different age groups of all firms. With this we noticed that overall small firms have had an increasing tendency to locate in modern Lima. Finally we also noticed that in the later time period there has been a tendency for small firms to locate in northern Lima. In order to understand this we followed Maggi's comments (2011) on the growth of northern Lima. He states that over 40% of Lima's economic activity concentrates in this area, with most of this growth concentrating in the past 10 years. Of all the growing zones of Lima (north, east and south), north Lima is by far the fastest growing economy of the city, representing the second highest income per capita (after what Maggi considers the equivalent to our Modern Lima). This implies that these new small-scale

<sup>3</sup> Since we had a small number of establishments on the third period (2007-2012), the analysis of the 3 historical stages was not possible due to cell count issues. Hence we combined the 1995-2006 and 2007-2012 periods, creating a single 1995-2012 period for this analysis.

medium manufacturing firms would be catering mostly to local markets, a statement that will be further elaborated by the next hypothesis.

#### **5.8.4. Hypothesis 4:**

***Firms with global trade connections locate in the outskirts and/or close to the port/airport, locations which would provide them with greater connectivity. Firms without global trade connections would tend to locate in the city centres since they are focused on local markets.***

From the previous analysis we have seen that larger firms are effectively locating in Callao while medium sized ones are locating in northern and modern Lima. We would expect therefore that these areas would have different global trade connections. As we described previously, giving the example of Bogota (Mohan, 1994), smaller firms tend to produce for local markets while larger firms tend to have more global trade connections. In order to examine this, we looked at the percentage of firms in each zone that had global trade connections (importing, exporting or both). Overall we found that 67.5% of firms in our database had these characteristics. The only zones that had less than this average were north (64.6%) and modern Lima (64.3%). These zones, with a higher tendency to have small firms, also seem to have less global trade connections. On the other hand, 75.8% of the firms that had an establishment in Callao had some sort of global trade connections, the highest average.

Table 5.12 shows the mean number of establishments a firm with/without global trade connections would have in each zone, as well as an independent sample T-Test in order to see if these differences were statistically significant. From this test we found that even though firms without connections seemed to have more establishments in northern and modern Lima than firms that do, these differences were not statistically significant. Therefore, even though our data does imply that these zones tend to attract locally oriented firms, we cannot confirm this part of the hypothesis. Looking at the globally connected firms, we do find different trends. These firms, able to locate in any of the 6 zones are significantly more likely to locate on east and old Lima, but more specifically in the Callao province, where this difference is greater. This is consistent with our hypothesis that states that globally connected firms locate near the port. However it is harder to explain why an area like old Lima also shows this trend being a central

location, while south Lima, far in the outskirts, does not. The case of old Lima could be related to its importance in the industrial tradition of the city, as well as its proximity to the railways that move products to and from the port, the industrial districts to the east and the mining towns in the Andes. The case of south Lima, not significant enough to confirm the hypothesis, is harder to explain. Being located on the outskirts, this zone should attract globally connected firms. Maybe there is a case for the Lurin district being close enough to local markets (modern Lima) while at the same time too far from the port and airport, however we have not been able to gather any particular information to support this interpretation. Exploring the next hypothesis may provide us with further understanding of this issue.

**Table 5.12. Mean number of establishments in each Zone of firms with and without global trade connections**

Group Statistics					
extrel_d	N	Mean	Std. Deviation	Std. Error Mean	
North Lima	No relation	407	.2310	.57939	.02872
	with relation	844	.2263	.60227	.02073
Old Lima	No relation	407	.3096	.61786	.03063
	with relation	844	.4254	.78863	.02715
East lima	No relation	407	.4717	.73516	.03644
	with relation	844	.6327	1.01947	.03509
Modern Lima	No relation	407	.2162	.42972	.02130
	with relation	844	.1931	.42396	.01459
South Lima	No relation	407	.2260	.56847	.02818
	with relation	844	.2867	.65223	.02245
Callao Province	No relation	407	.1966	.55769	.02764
	with relation	844	.3673	.90611	.03119

Independent Samples Test										
		Equality of		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	of the Difference	
									Lower	Upper
North Lima	Equal variances assumed	.006	.936	.130	1249	.897	.00465	.03590	-.06578	.07509
	Equal variances not assumed			.131	830.710	.895	.00465	.03542	-.06487	.07418
Old Lima	Equal variances assumed	17.652	.000	-2.601	1249	.009	-.11577	.04450	-.20309	-.02846
	Equal variances not assumed			-2.829	997.888	.005	-.11577	.04093	-.19608	-.03546
East lima	Equal variances assumed	20.184	.000	-2.848	1249	.004	-.16096	.05652	-.27184	-.05007
	Equal variances not assumed			-3.182	1066.451	.002	-.16096	.05059	-.26022	-.06169
Modern Lima	Equal variances assumed	2.433	.119	.898	1249	.369	.02309	.02570	-.02733	.07351
	Equal variances not assumed			.894	792.489	.371	.02309	.02582	-.02760	.07377
South Lima	Equal variances assumed	7.015	.008	-1.606	1249	.109	-.06069	.03779	-.13483	.01346
	Equal variances not assumed			-1.684	908.697	.092	-.06069	.03603	-.13139	.01002
Callao Province	Equal variances assumed	39.851	.000	-3.495	1249	.000	-.17074	.04885	-.26658	-.07490
	Equal variances not assumed			-4.097	1178.121	.000	-.17074	.04168	-.25251	-.08897

### 5.8.5. Hypothesis 5:

***New smaller firms will still look for central locations. New, large multi-establishment firms will look for outskirts locations taking advantage of greater connectivity and more affordable land prices. Old big concentrated firms would locate in central areas.***

It is strange, from all the tables shown above, that there is no particular distinction between medium and multi-establishment firms in the expanding zones of Lima. It may be that current policy initiatives to promote zoning changes for housing initiatives in central areas of Lima, along with the skyrocketing land prices in these (Table 5.10) is affecting medium firms. From the information already shown, these firms appear to be locating on the outskirts as much as larger firms. In order to further explore this, we analyzed all our original firm sizes. Just as we did when analyzing global trade connections, we compared the means of the number of establishments firms of each size had in each of the 6 zones. Table 5.13 shows the average number of establishments per zone for each firm size with the addition of normalized data in order to provide further clarity. From this table we can see once again that small-scale medium firms are mostly concentrated on north and modern Lima. The difference is that now we can separate the larger firms. We can see that the big concentrated firms are most commonly found in old Lima and Callao. These two zones are part of the first industrial corridor of the city. Following what we previously explained, old concentrated firms tend to locate near their clients and transportation corridors, in this case, the port and old industrial centres, thus confirming this part of the hypothesis. Since they are located on central areas where external economies are present, perhaps some dependency on these economies is also present. Multi-site firms are located mostly on northern and eastern Lima and finally, we can see once again that large multi-site firms have a strong tendency to locate in Callao. Remembering that Callao mostly has warehousing facilities, it can be understood that these firms have warehouses in this zone.

**Table 5.13. Average number of establishments per zone for all years (With normalized data)**

SECTORSIZE		Norhtern Lima	Old Lima	East Lima	Modern Lima	South Lima	Callao	Number of establishments
SMALL SCALE MEDIUM FIRM	Mean	.1825	.2664	.3978	.1861	.1910	.1302	1.35
	Std. Deviation	.46120	.50654	.59322	.40177	.43171	.39650	.499
BIG CONCENTRATED FIRM	Mean	.1026	.3385	.3949	.1487	.2051	.2974	1.49
	Std. Deviation	.36573	.59923	.60323	.35673	.45291	.54085	.521
MULTISITE FIRM	Mean	.5364	.7364	1.2091	.2455	.4182	.6727	3.82
	Std. Deviation	1.08092	1.07240	1.46579	.47287	.85006	1.12608	1.308
LARGE MULTISITE FIRM	Mean	.4516	.9597	1.5242	.3387	.7339	1.2177	5.21
	Std. Deviation	.86818	1.30912	1.61529	.58278	1.22381	1.70871	3.178
Total	Mean	.2278	.3877	.5803	.2006	.2670	.3118	1.97
	Std. Deviation	.59469	.73917	.93922	.42581	.62663	.81310	1.727

Normalized Data

	Norhtern Lima	Old Lima	East Lima	Modern Lima	South Lima	Callao
SMALL SCALE MEDIUM FIRM	0.14	0.20	0.30	0.14	0.14	0.10
BIG CONCENTRATED FIRM	0.07	0.23	0.27	0.10	0.14	0.20
MULTISITE FIRM	0.14	0.19	0.32	0.06	0.11	0.18
LARGE MULTISITE FIRM	0.09	0.18	0.29	0.07	0.14	0.23
<b>TOTAL</b>	<b>0.12</b>	<b>0.20</b>	<b>0.29</b>	<b>0.10</b>	<b>0.14</b>	<b>0.16</b>

Note: The normalized data is calculated by dividing the mean number of establishments of the sector size by the overall average number of establishments of the same sector size

However since we still could not find any relevant result for the growing zones in south and east Lima we decided to repeat this analysis by looking only at firms from 1995 onwards (Table 5.14). Once again, small-scale medium firms are more present in north and modern Lima while big concentrated firms are now mostly present in old Lima but not anymore in Callao. The trend in southern Lima is not very conclusive. Large multi-site firms, along with Callao, could be starting to become more established in this area, even though smaller multi-site firms are not. This relationship however, does not appear to be very strong. In east Lima, we still cannot see new trends.

**Table 5.14. Average number of establishments per zone for the years 1995-2012 (With normalized data)**

SECTORSIZE		Northern Lima	Old Lima	East Lima	Modern Lima	South Lima	Callao	Number of establishments
SMALL SCALE MEDIUM FIRM	Mean	.1864	.2408	.4078	.2019	.2214	.1126	1.36
	Std. Deviation	.46283	.49145	.61494	.41141	.45576	.37288	.497
BIG CONCENTRATED FIRM	Mean	.1087	.3913	.3913	.1522	.2391	.2174	1.50
	Std. Deviation	.40482	.64547	.55384	.36116	.47739	.46471	.545
MULTISITE FIRM	Mean	.4706	.6912	1.2206	.2500	.4265	.8088	3.87
	Std. Deviation	1.12596	1.01124	1.64676	.50000	.83427	1.28432	1.315
LARGE MULTISITE FIRM	Mean	.5000	.7885	1.5385	.3077	.8846	1.0769	5.08
	Std. Deviation	.95998	1.31859	1.56508	.57866	1.32330	1.61908	2.383
Total	Mean	.2256	.3411	.5626	.2077	.2902	.2600	1.88
	Std. Deviation	.60644	.68775	.92628	.42904	.62738	.74400	1.443

Normalized data

	Northern Lima	Old Lima	East Lima	Modern Lima	South Lima	Callao
SMALL SCALE MEDIUM FIRM	0.14	0.18	0.30	0.15	0.16	0.08
BIG CONCENTRATED FIRM	0.07	0.26	0.26	0.10	0.16	0.14
MULTISITE FIRM	0.12	0.18	0.32	0.06	0.11	0.21
LARGE MULTISITE FIRM	0.10	0.16	0.30	0.06	0.17	0.21
TOTAL	0.12	0.18	0.30	0.11	0.15	0.14

Note: The normalized data is calculated by dividing the mean number of establishments of the sector size by the overall average number of establishments of the same sector size

The previous tables do not seem to tell the story of what is going on in the southern and eastern zones of Lima. As was shown in table 5.6, the southern district of Lurín as well as the eastern district of Lurigancho, are the fastest growing industrial centres of the city. However, we have barely drawn any conclusions about these two areas. We will therefore further analyze these two districts in order to determine if mostly new multi-establishment firms are locating in these areas, as theory would predict.

In the case of Lurín, a district in south Lima, we tried to cross tabulate the different firm sizes with the older and newer firms (1928-1994 and 1995-2012) category. Even though this analysis showed that there did not seem to be more multi-establishment firms, due to cell count issues on SPSS, the analysis was not statistically

significant. To further analyze this, table 5.15 shows the distribution of newer firms (1995-2012) in Lurín compared to the overall distribution of firms in Lima. Unfortunately, the chi-square analysis shows no significant difference between Lurín and other districts. The table shows all sizes of firms having fairly similar distributions, suggesting that the expected hypothesis of having more multi-site firms locating in this area over smaller firms does not apply in this zone.

**Table 5.15. Newer firms (1995-2012) in Lurín compared to newer firms in all Metropolitan Lima by firm scale**

**LURIN \* SECTORSIZE Crosstabulation**

			SECTORSIZE				Total
			SMALL SCALE MEDIUM FIRM	BIG CONCENTRATED FIRM	MULTISITE FIRM	LARGE MULTISITE FIRM	
LURIN	Other districts	Count	666	130	252	252	1300
		% within LURIN	51.2%	10.0%	19.4%	19.4%	100.0%
LURIN	in Lurín	Count	35	8	11	16	70
		% within LURIN	50.0%	11.4%	15.7%	22.9%	100.0%
Total		Count	701	138	263	268	1370
		% within LURIN	51.2%	10.1%	19.2%	19.6%	100.0%

**Chi-Square Tests**

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.661 <sup>a</sup>	3	.447
Likelihood Ratio	2.525	3	.471
Linear-by-Linear Association	.011	1	.917
N of Valid Cases	1093		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.22.

It was interesting to notice from this table though, that multi-site firms do seem to be less represented in Lurín compared to the rest of Lima, this is probably related to what was described by Barkley & McNamara (1994) and Holl (2003) who stated that when looking at new establishments, smaller firms restrict their search to geographically limited areas since such searches are costly. Small new establishments are more likely to locate close to where firms reside or previously worked rather than go to the outskirts. Since Lurín is a new industrial area, it would make sense that smaller multi-establishment firms would tend to locate fewer establishments in this district.

The district of Lurigancho shows some of the same statistical challenges as with the case of Lurín. Again we tried to crosstabulate the different firm sizes with the older and newer firms (1928-1994 and 1995-2012) and found no statistical relationship between the variables. We also tried to compare the distribution of new firm scales in Lurigancho with the same distribution for the rest of Lima (Table 5.16) but again we were not able to find a relationship between the variables. Still, we can see that Lurigancho seems to have less representation of small firms while having more large multi-site firms. Unlike the case of Lurín, this finding could support the hypothesis of large multi-site firms locating in the outskirts.

**Table 5.16. Old and new firms distributions according to firms scale for Lurigancho**

**LURIGANCHO \* SECTORSIZE Crosstabulation**

			SECTORSIZE				Total
			SMALL SCALE MEDIUM FIRM	BIG CONCENTRATED FIRM	MULTISITE FIRM	LARGE MULTISITE FIRM	
LURIGANCHO	Other districts	Count	668	131	250	249	1298
		% within LURIGANCHO	51.5%	10.1%	19.3%	19.2%	100.0%
	In Lurigancho	Count	33	7	13	19	72
		% within LURIGANCHO	45.8%	9.7%	18.1%	26.4%	100.0%
Total		Count	701	138	263	268	1370
		% within LURIGANCHO	51.2%	10.1%	19.2%	19.6%	100.0%

**Chi-Square Tests**

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.294 <sup>a</sup>	3	.514
Likelihood Ratio	2.140	3	.544
Linear-by-Linear Association	1.633	1	.201
N of Valid Cases	1370		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.25.

It seems fairly conclusive that new emerging areas in the outskirts of the city, with their large extensions and lower land prices, are not necessarily attracting only new large multi-site firms but also smaller scaled firms, a pattern not previously described and worth further analysis.



## 5.9. Summary of Results

In this chapter we have described and analyzed the main characteristics of the 6 zones of Lima. North Lima appears as a relatively small industrial zone as it is home to few specific sectors of industry except for the “manufacture of transport equipment” sector. It also concentrates mostly small-scale medium firms. Old Lima is the original Marshalian type of district that features mostly smaller and concentrated firms with larger reliance on external economies. This district represents also one of the largest declines of industrial activity in the city. East Lima today has the largest concentration of industrial activities, following the increase of Lurigancho as an industrial centre. Modern Lima, with no industrial tradition whatsoever, represents mostly a growing smaller scale manufacturing sector that serves the local population. South Lima is the largest growing industrial zone of the city, with the district of Lurín as its main industrial core. As an area of affordable lands, this zone also presents overrepresentation of warehousing establishments in many sectors. Finally, the Callao province shows the same decline as old Lima but mostly concentrated on manufacturing activities. This zone is mostly overrepresented by large multi-site firms and warehousing facilities, showing the basic characteristics of a port district.

As expected we found that the textile, apparel, and publishing & printing sectors, although with relatively different locational patterns, concentrated in central areas, while the logistics and distribution sector moved away from the centres into mostly southern Lima. On the other hand we found that smaller firms do tend to locate in central areas, as modern and northern Lima. Larger firms concentrated in Callao, but not in outskirt areas such as east or south Lima, as we would have expected. We were not able to find conclusive results regarding global trade connections, since results were not statistically significant for locally oriented firms, and since only the port area of Callao demonstrated a strong representation for externally oriented firms; something we were not able to find on outskirt locations. Finally we were not able to support the hypothesis that new smaller firms would tend to locate in central areas, a result that may be explained by the fact that our database does not truly represent small firms but rather medium sized ones that share some locational patterns with larger types of firms. Related to this, we found instead that in outskirt locations, both medium scale and large firms would have the

same general locational patterns. In the next chapter we will further describe and analyse the implications of the results just described and provide both policy recommendations and future research possibilities.

## **Chapter 6.**

### **Findings and implications**

In the previous chapter we have identified the main industrial characteristics of the different zones of Lima. We have also provided analysis on the main hypotheses concerning sector, size, age, and global trade connections, finding mostly that our hypotheses concerning smaller firms and their supposed central locational patterns did not apply. In this chapter we will conclude by answering the main research question and hypotheses as well as the implications of such findings. Additionally, recommendations will be made incorporating both the findings of the thesis as well as extra information gathered from interviews. Thoughts on future trends will also be provided as well as recommendations for future research. Finally, concluding remarks on this work will be discussed.

To return to the goals set out at the beginning of this thesis, we need to first address the primary research question.

- What are the locational patterns of manufacturing industries in the city of Lima, Peru?

In order to answer and analyze this question several methods were used. One of the great strengths of mixed methods in research is having the ability to triangulate results in order to add value to findings of both quantitative and qualitative findings. We first created a firm and establishment database on locational patterns of manufacturing industries in the city of Lima. The database included the sector, size, age and global trade connection patterns of firms. We also compared the information gathered from our database and compared it to a previous research provided to us by the Metropolitan Institute of Planning (IMP-GENIVAR, 2000). This comparison proved to be very useful towards understanding the growing and declining industrial districts of the city. Finally we conducted several interviews on the topic earlier in 2014, many of which provide further

understanding to this discussion, as they add further insight on the issues our quantitative methods did not describe. The findings discussed in this section will not only address locations factors or patterns specifically but also larger themes that have been identified though the interview portions of this study. We will also look at the general implications of the described industrial problematic of Lima.

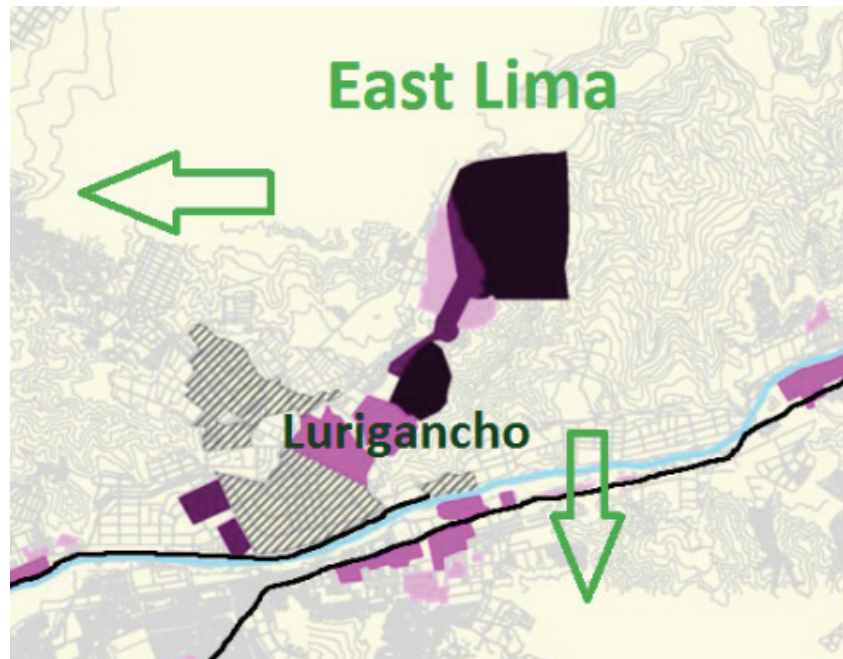
## **6.1. Historical patterns and future locational trends**

From our research and locational database we identified that the growing industrial areas of Lima are those located in south Lima and in the eastern district of Lurigancho. Even though these areas have shown great growth over the past decade, this does not mean these districts necessarily represent the future of Lima's industrial development.

The Industrial areas in the district of Lurín are already too expensive for industrial development (Flores Estrada, 2012). Purchasing lands at \$200-300 per square meter is too much for most firms in Lima and it is almost impossible to find affordable lands in this area. Rey de Castro (cited by Chaparro, 2012) states that at \$200 per square meter, industrialists are already paying 5 times more than in Santiago, Chile or Bogotá. In figure 5.2 we showed the current and proposed industrial lands for Lurín. Current lands are located near the urban centre of Lurín and in close proximity to the Pan-American Freeway. The proposed development is far from the freeway and as it is also located at higher altitude than the later one. Guerra (Personal communication, January 13<sup>th</sup>, 2014) states that this area has a major issue: Since it is located at higher elevation, digging wells in order to get access to water will be a major problem. Pumping water from the nearby Lurín River would also be a complex issue since local farmers already oppose their industrial neighbours, yet alone will they allow them taking their limited water supply. Flores Estrada (Personal communication, December 30<sup>th</sup>, 2013) also mentions that the current industrial area lacks adequate roads and if the zone were to be expanded, large trucks would destroy the existing ones, as they would be used as primary roads, something they were never designed for. The PLAM 2012-2035 (2014) does consider that a major consideration towards creating this new zone is the construction of the proposed peri-urban freeway, shown on figure 5.2. We have not been

able to gather information on when this freeway will be built or if it has even been approved. It seems unlikely that Lurín's district authorities will have the capability to expand this district's potential, considering the conditions just mentioned. If these issues were to be resolved, we could picture Lurín mostly as a warehousing district, considering how many different manufacturing sectors, plus logistic firms are locating in this zone.

The district of Lurigancho shows a different reality. Even though this district does have some established industrial areas that seem to be already at higher price levels, further developments are being created on the farthest parts of the district. The industrial project Parque Industrial Huachipa Este (East Huachipa Industrial Park) is the largest private industrial park promoted in Lima. Figure 6.1 shows this park with over 600 hectares, as it will provide firms with adequate roads, access to electricity, water, natural gas and other amenities such as commercial zones, banks, restaurants or green areas. Finally, this area has industrial zoning up to I4 which means that virtually all types of industry may locate in this area. An interesting fact is that even though this park is located in the district of Lurigancho, over half of its grounds are actually located on the Huachipa district in the province of Huarochiri, not being part of the city of Lima at all. Figure 6.1 shows the dark area as the one located in Huachipa, while the adjacent lighter colors are located in the Lurigancho district, with stricter zoning regulations. This park is located between hills and because of this it is considered a safe area where security is guaranteed and absolutely no squatters will invade the area (Álvarez, Personal communication, January 15<sup>th</sup>, 2014).



**Figure 6.1. Location of the private industrial park of Huachipa**  
Note: The Park is the large dark zone located at the northeast of the Map.

This is a fairly new development and since our interview with Mrs. Álvarez (January 15<sup>th</sup>, 2014), many firms bought land even though the access roads had not been built. Even though it is too early to determine the success or failure of this project, further consideration of the implications of private industrial parks will be considered.

Also, the southern district of Chilca, located 62km south of Lima on the province of Cañete, is also one of the most suitable zones for industrial development. This area has not been analyzed as such on our database, since by 2012 only a few establishments had located in this area. Guerra (Personal communication, January 13<sup>th</sup>, 2014), states that the largest challenge concerning this area is the invasion of lands by squatters, as he states the municipal district has been too soft when dealing with them. He also mentions that Chilca, as well as the whole Cañete province, has been lacking funds and capacity to regulate its lands. Just as the cases described on Bogota (Mohan, 1994) and Jakarta (Firman & Dharmapatni (1995), industries have arrived in this area to provide some sort of order to the district, which does not even have a zoning plan. This is particularly true with the “manufacture & distribution of electricity and fuels” sector, which is represented by large thermoelectric power plants. Even though the municipal

district is eager to give industrial zoning permits to firms asking for them, they are as eager to give zoning permits for other commercial or residential uses, as has already happened. This shows a rather “entrepreneurial behaviour” of its authorities, who seem to have a need to negotiate and sell zoning permits, rather than a sense of creating an urban plan. Guerra (Personal communication, January 13<sup>th</sup>, 2014), states that in Chilca there are at least 3 large private industrial parks being developed with sizes ranging from 230 to 540 hectares, and these could provide the zoning and amenities needed for industrial parks. Still, Dávila (Personal communication, January 7<sup>th</sup>, 2014) states that besides these problems, the distance from the city is one of the major factors affecting this zone. Public transit is virtually non-existent and the only efficient way to get to this area is by private car, which could still imply a 40-minute drive each way. With all these problems, Chilca still seems to attract investors willing to move there. How successful this area will be as an industrial pole is yet to be determined.

Finally, the southern district of Pisco, located on the province of Ica, appears as a possible hub for manufacturing industries. Valdivia (2012) states that Pisco could be the most suitable area for new industrial parks due to the fact that it has the nearest port and airport from Lima (244km from Lima) as well as over 20 thousand hectares of developable lands, plus water and electricity. Its distance to Lima would be a major drawback if a rapid transit system is not provided.

## **6.2. Research implications**

Through this research we found that some of our hypotheses were confirmed while other proved harder to understand. We tried to understand the relative importance that factors such as age, size, sector and global trade connections played on the locational patterns of manufacturing activities in Lima. The hypotheses that were confirmed were those related to the specific sectors we thought would tend to locate in the urban centres versus the ones that would have a tendency to move to the outskirts. We found that the logistics sector is growing mostly in south Lima, the zone that is considered the farthest from the industrial and market centres. We also found that the textile and apparel sectors had a relatively similar locational pattern, locating most of their establishments in old and east Lima. The publishing and printing sector located

also in east Lima but also in the modern and the northern part of southern Lima, providing a different, but still central agglomeration. These areas are the ones with the highest pressure to convert industrial lands into other uses, so the question of how these sectors will try to survive or expand in such a hostile environment is of major importance.

Relating to these sectors mostly locating in the industrial centres, it is important to reconsider why several cities have decided to, under the pressure of rising land prices, protect central industrial lands. As we stated before, PDR type districts, which include sectors related to textiles and publishing & printing (among others), provide goods and services that the city needs on a daily basis, plus are capable of locating on multilevel buildings. These sectors require lower land prices and rents as well as flexible space and external economies to be economically viable. The lack of protection of these types of districts means that in the long run firms in these sectors will not be able to expand, or they may do so informally. We mention this because, in the case of the printing and publishing sector, and since the year 2010, over 100 informal firms in this sector have established in Old Lima (El Comercio, 2014b). These small firms locate on old rundown residential buildings near the historical centre of the city, where rent prices are very low and their operations can go mostly unnoticed. In recent reports (El Comercio, 2014b) the Metropolitan Municipality of Lima has offered alternative lands for the development of their activities in north Lima, a zone that based on the location quotients we previously found (Table 5.1) is the least appropriate area for this relocation. It is understandable that the workers of these informal firms are not accepting their relocation. The question arises; will this problem increase considering there are no affordable options in the city centre for this sector? Is going informal the solution to the lack of zoning in these central areas?

Several other PDR type sectors need special attention, as is the example of the food and beverage sector. This is a sector that due to its increasing weight gaining ratio has traditionally located close to its consumers. Gonzales de Oliarte (2006) stated that the sectors that have grown the most in Peru are those favoured by their high transportation costs. He refers mostly to the manufactures of different types of beverages, whose transportation costs are so high, importing them is virtually impossible. Flores Estrada (Personal Communication, December 30<sup>th</sup>, 2013) gave the



example of a major beverage firm that is moving its main manufacturing facilities from old Lima to the Chilca region. He stated that since these products are expensive to import, their prices could eventually go up due to these higher transportation costs, therefore, in the long run, increasing the overall inflation of the country. The expected growth in sales volumes as well as new, efficient and modern manufacturing processes may offset these rising transportation costs. Still, having large firms like these on the outskirts of the city would increase both worker and freight traffic to and from the city.

On the other hand, the most puzzling hypothesis we were not able to confirm regarded the supposed location of new smaller firms in central areas where external economies were present. We found that in the newer areas of Lurín and Lurigancho small-scale medium firms seemed to be as common to find as on the overall rest of the city. Older areas like old Lima and Callao (and according to interviews the district of Ate in recent years) have shown a declining pattern in the number of new establishments. This goes against the hypothesis that smaller firms tend to stay in the urban centres where they can gain from external economies. Even though our database sample does not actually represent small firms, the question arises: To what extent do new smaller firms lack the conditions needed to locate near the centre of industrial activity and the opportunities these may offer? On the other hand, can it be assumed that these industrial zones, where space is limited and competition for lands is great, will stop working as centres for industrial incubation? While these questions deserve being taken care of on entirely separate and dedicated projects, where information on establishment births, closures, small firms and informal industrial activities are available, some insight on the implications of these issues can be suggested.

We need to reconsider the characteristics and importance of the Marshallian type of industrial districts we were able to identify in old Lima and parts of east Lima and Callao. As stated before, these districts have a large number of small firms that serve as the external economy to the medium and large firms we have analyzed. However these small firms have a great disadvantage compared to their larger counterparts: the size of their lot. As Flores Estrada described (Personal Communication, December 30<sup>th</sup>, 2013), large firms have the capability to sell their large lots and buy and build new facilities in the outskirts while reaping a (huge) profit. These lands are sold to residential or

commercial investors who pay large sums of money to build large projects. Small, single-establishment firms do not have this capacity. Since their lots are small and the amount of money they can get is limited, their moving costs would be higher than the money they would receive from selling. Also, investors are not as interested in their small lots. The question then is, if the small firms cannot sell their lands in order to relocate and their role as “the external economy” is disappearing now that the big firms have left, what will happen to their businesses? While it is impossible to answer this question without further research, two options come to mind. They can either go out of business and sell their lots, or dedicate to other business activities. Gonzales de Olarte (2006) provides an interesting take on this last option as he states that in the old Lima areas, many manufacturing firms have converted to importers of the same goods they used to produce, using their old establishments for such endeavours.

This phenomenon follows another inquiry: if medium and large firms are finding a profit by moving out, where will they obtain their supplies from? While in the urban centres they counted with these externalities, we believe now their economies will become more inflexible, as they will be more reliant on external supply chains, particularly imports. Gonzales de Olarte mentioned back in 2006 that Peru’s economy seemed to be becoming more dependent on imported inputs and technologies, weakening the structure of smaller industry sectors in Lima and the rest of the provinces. This sprawled city structure not only discourages new investments from firms that require being close to external economies and services, but also has implications for the city as a whole. Industrial sprawl increases the demand for new and adequate roads, as the proposed peri-urban freeway demonstrates; increases travel time from residential centres to workplaces, increases both traffic congestion and pollution and makes public services and infrastructure more costly and ineffective.

### **6.3. Proposed solutions**

Having all these issues been discussed, we now need to discuss the topic of how these problems should be addressed and what types of solutions are actually being promoted. We know that the central industrial areas in Lima are being displaced by residential and commercial developments where prices have skyrocketed. If this has

happened in the central areas, what can be done to try to save these lands? And what guarantees that this will not happen in future developments like those in Lurigancho or Chilca? We will call for both land and non-land based policies in order to address these issues.

Relating to the first question, how to save central industrial lands, trying to create protected industrial land zones, as the PMDs created in Chicago, would be a very interesting option. This would be difficult to achieve though, considering both current land prices and the disorganized way industry is currently laid out, with no clear distinction from the residential or commercial neighbours. Instead we would need to look at both short term and long term policies. Following Chapple's (1999) description of the struggling apparel industry in San Francisco, we can determine that the best ways to promote and protect sectors located in the central areas, is by taking the supply side and endogenous policy approaches. Supply side relates to those quick response policies such as job training, rent subsidies, land intensification or low-cost loans, that can help reduce costs. Endogenous approaches would mean intervention at the industry level to help pursue new market opportunities or niches. These endogenous policies can only work when the supply side policies have been successful and tend to be fruitless without them.

Related to the question of how to avoid this same problem happening 20 years from now in current outer zones, like Lurín, Lurigancho or beyond, we were able to ask this question to our interviewees. Most respondents (4 out of the 6) mentioned the need to create fixed industrial lands where zoning cannot be changed in the future. However, 3 respondents mentioned that since district authorities' do not have the capability (or willingness) to promote or protect industrial zones in their districts, private industrial parks are the best and only way to go. From the information we gathered on current private park developments, we can agree on the fact that these can offer large extensions of exclusively industrial lands with the amenities that no governmental plan or authority has ever offered before. It seems then that considering the lack of commitment on this topic by government, municipal or district agencies, these parks are the best option towards the future industrial development of Peru.

In our opinion, industrial parks should be constituted as an instrument of strategic planning that should help organize overall industrial activities. These should ideally articulate the industry needs along with the requirements of other economic and social activities as well as land uses. Since external economy type of zones are being lost in the city centre, it would seem appropriate that these parks should promote the development of new relations and agglomerations between firms either spontaneously, or preferably, planned.

Looking deeper into the characteristics of industrial parks, and following a similar reality in the case of the Greater Buenos Aires Area in Argentina, Briano, Fritzsche & Vio (2003) compared 3 different industrial parks in the outskirts of the city. These parks had different locational patterns as well as were built on different time periods. On the other hand, these parks were private, semiprivate and state-owned respectively, describing three very different realities.

They found that on the private industrial park, considered successful in terms of occupancy, the strategies were mostly focused on the real estate business, showing no interest in promoting industrial activities. Both the state-owned and semiprivate parks showed, with different degrees of success, an actual interest on promoting relationships among firms, trying to limit real estate speculation. In the specific case of the semi-private park it was found that unlike the other two, there was a large number of small firms and that the relationships between them were induced rather than spontaneous. They also found that this park created better relationships with the surrounding economies.

From this research (Briano, Fritzsche & Vio, 2003) it is fairly conclusive that the best way to develop industrial parks is by promoting Public Private Partnerships involving private sectors, local and provincial municipalities, universities, research institutions, local associations and unions, among others. On the other hand, if industrial parks are the solution to the lack of industrial land and planning policies, their indiscriminate creation on Lima's lands, without distinctions between them, could promote unhealthy competition for the same markets between different parks. If planned, different parks could cater for specific sectors or activities, thus reducing the competition

between them and promoting better clustering and interfirm relationships. These parks need also to be created under a general national policy that focuses on capitalising on existing regional GVCs, a policy that is still non-existent and urgent to develop.

## **6.4. Concluding remarks**

The city of Lima is undergoing many changes and challenges. Its increasing population along with the lack of planning in its most basic urban aspects have made of this a sprawling metropolis caught between the Pacific Ocean and the Andean Mountains. In this sense, industrial expansion leads the way into what in territorial terms would be considered a new type of mega city. The megacity presents a polycentric spatial expansion of urban centres and sub-centres that sprawl along major highways and/or railroad lines. This concept, used to describe Mexico City's suburbanization (Aguilar & Ward, 2002), relates to Lima's reality. In this pattern, mixed land uses are created and expanded in the region, where traditional agriculture is found side by side with new industrial developments, housing projects, recreational sites and all sorts of suburban developments. This is not necessarily a new concept. Mohan (1994) considers this to be consistent with the worldwide trend observed in all large cities in both developed and developing countries. Hesse (2008) notes that the outward spread of factories and manufacturing districts has been a decisive factor of North American urbanization since the mid-19th century. He also argues that logistic and industrial firms are pioneers of outward urban expansion, as they stimulate subsequent commercial developments due to the advantages of location and accessibility; major contributors to sub urbanization and poly-centralization. Following this argumentation, the new industrial developments in Lima will contribute to outward expansion and considering the limited transportation corridors the city has, and the unexisting rail system to the outskirts, current roads will most probably be condemned to congestion in the following years, making commute times for workers unbearable.

If central and intermediate incubator zones were to be protected and intensified in order to avoid industrial expansion, several steps would need to be taken. Short-term supply side decisions would have to be made providing mostly cost stability policies. These are needed to preserve the still existing economies of scale that promoted the

growth of these areas in the first place and that provide substantial contributions to the local economy in the form of jobs and tax revenues. Once such policies are in place and working, long term policies targeting structural changes into the global supply market can be enhanced and promoted.

On the other hand, if industrial parks are the preferred way to promote industrialization in the outskirts, and knowing that most industries have the capability of locating in most places so long as they are connected to the main transportation and logistical corridors, policies towards promoting best practices are needed. Industrial parks cannot be real estate businesses alone, and relationships between firms and with the local economies have to be promoted in order to create new and competitive economies of scale.

We believe the regional planning of industrial activity must be closely linked with the planning of the overall industrial structure. This can be achieved with the intervention of all the stakeholders on industrial and land development, both at the local and regional scales. This includes all different levels of government, private entrepreneurs, unions, universities and technological centres, commerce chambers and many other local associations. These would need to consider their actions and plans looking at the region as a whole, rather than their particular interests.

To conclude, we need to emphasize that this project is just a small and first step towards the construction of a consolidated industrial map of Lima. With the inclusion of variables such as small firms, population densities, transportation infrastructures, public services, firm and establishment births and closures, or historical land prices, to name a few, we would be able to link the spatial evolution of the economic activity of the region with the management of public policies. Such a project would help open the debate on the redesign of the city's urban landscape.

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## Appendix A.

### Interview Sample

**Project:** Understanding the locational patterns of manufacturing industries in the city of Lima, Peru.

- 1- Understanding the history of industry in Lima**
  - a. Which were the first industrial areas in Lima?
  - b. Where have manufacturing firms located historically?
  - c. When did the deficit of industrial lands start?
  
- 2- What are the challenges and requirements in order to develop industrial areas?**
  - a. Why is it so hard to designate industrial areas in Lima?
  
- 3- What are the advantages and disadvantages of firms that relocate?**
  - a. What are the types of taxes that need to be paid in order to sell old manufacturing establishments?
  
- 4- Which are the industrial sectors that require staying within the city?**
  - a. What are the problems faced by firms that cannot relocate to the outskirts of the city?
  
- 5- Future trends**
  - a. Where are medium and large manufacturing firms moving to?
  - b. Where are small firms going?
  - c. What are the policies or initiatives towards creating new industrial areas/parks?
  - d. What are the policies towards protecting or improving existing central industrial locations? Do these exist?
  - e. Is Lima following the example of any other city/model when deciding to push industries to the outskirts?
  - f. Considering how manufacturing establishments have historically been pushed out of the city due to population growth issues, what is being done to prevent this from happening in the next 20 years in the new manufacturing areas?
  - g. Are private firms doing the work that municipalities should do by creating and promoting new industrial parks? What are the implications of this?

## Appendix B.

### Survey Sample SNI

Encuesta de Localización Industrial de Lima	
<p>La encuesta está destinada a comprender los problemas y las necesidades de locación de las industrias de Lima que representan cerca del 70% de las empresas manufactureras del país. Su participación en la encuesta es de gran importancia por lo que agradeceremos tomar unos minutos de su tiempo.</p> <p>Agradecemos de antemano su cordial participación</p>	
<b>1. Nombre de la Empresa</b>	
<input type="text"/>	
<b>2. Actividad principal de la empresa</b>	
<input type="text"/>	
<b>3. Indique la dimensión de la empresa.</b>	
<input type="radio"/> 1 - 49 Trabajadores	
<input type="radio"/> 50 - 99 Trabajadores	
<input type="radio"/> 100 - 499 Trabajadores	
<input type="radio"/> 500 a más Trabajadores	
INFORMACION DEL ESTABLECIMIENTO PRINCIPAL MANUFACTURERO	
<p>Por favor proceda a completar la encuesta de factores localizacionales considerando como referencia UNICAMENTE A SU ESTABLECIMIENTO PRINCIPAL MANUFACTURERO</p>	
<b>4. Distrito donde se encuentra este establecimiento</b>	
<input type="text"/>	
<b>5. Desde hace cuanto tiempo el establecimiento se encuentra operando en esta Locación?</b>	
<input type="radio"/> 0 - 5 años	
<input type="radio"/> 6 - 10 años	
<input type="radio"/> 11 - 20 años	
<input type="radio"/> 20 + años	
<b>6. Cual es el metraje aproximado de este establecimiento (m2)?</b>	
<input type="text"/>	

## Encuesta de Localización Industrial de Lima

### 7. En que tipo de zonificación se encuentra este establecimiento?

- Zonificación Agrícola
- Zonificación Residencial
- Zonificación Comercial
- Zonificación I1 - Industria Elemental y Complementaria
- Zonificación I2 - Industria Liviana
- Zonificación I3 - Gran Industria
- Zonificación I4 - Industria Pesada Básica

### Factores de localización de su establecimiento

### 8. Indique la **IMPORTANCIA** de los siguientes factores de locacion para su negocio/industria

	Baja	Media	Alta
Cercanía a clientes / mercado	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cercanía a proveedores / materia prima	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Acceso a terrenos con precios competitivos	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Disponibilidad de mano de obra calificada	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Acceso adecuado a energía, agua, alcantarillado	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Acceso Adecuado a líneas de gas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Presencia de municipios eficientes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Incentivos tributarios para la re-localización	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seguridad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cercanía al aeropuerto	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cercanía al puerto	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cercanía a vía férreas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Acceso a vías principales / avenidas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Acceso a transporte público	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



## Encuesta de Localización Industrial de Lima

### 9.Cuál es su nivel de satisfacción con estos factores en su locación actual?

	Baja	Media	Alta
Cercanía a clientes / mercado	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cercanía a proveedores / materia prima	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Acceso a terrenos con precios competitivos	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Disponibilidad de mano de obra calificada	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Acceso adecuado a energía, agua, alcantarillado	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Acceso Adecuado a líneas de gas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Presencia de municipios eficientes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Incentivos tributarios para la re-localización	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seguridad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cercanía al aeropuerto	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cercanía al puerto	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cercanía a vía férreas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Acceso a vías principales / avenidas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Acceso a transporte público	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 10. De los factores antes señalados, cuales son para usted los tres (3) más importantes para tomar una decisión de no reubicarse o re-localizarse?

- |   |   |
|---|---|
| <input type="checkbox"/> Cercanía a clientes / mercado                                    | <input type="checkbox"/> Incentivos tributarios para la re-localización |
| <input type="checkbox"/> Cercanía a proveedores / materia prima                           | <input type="checkbox"/> Seguridad                                      |
| <input type="checkbox"/> Acceso a terrenos con precios competitivos                       | <input type="checkbox"/> Cercanía al aeropuerto                         |
| <input type="checkbox"/> Disponibilidad de mano de obra calificada                        | <input type="checkbox"/> Cercanía al puerto                             |
| <input type="checkbox"/> Acceso adecuado a energía, agua, alcantarillado                  | <input type="checkbox"/> Cercanía a vía férreas                         |
| <input type="checkbox"/> Acceso Adecuado a líneas de gas                                  | <input type="checkbox"/> Acceso a vías principales / avenidas           |
| <input type="checkbox"/> Presencia de institucionalidades locales (municipios eficientes) | <input type="checkbox"/> Acceso a transporte público                    |

### 11. Actualmente tiene alguna necesidad de re-localizar este establecimiento?

- SI  
 NO

## Consideraciones Finales

Agradecemos su participación en la encuesta. Por favor, cualquier consulta comunicarse al [REDACTED] (Oficina de estudios económicos de la S.N.I.) o al correo electrónico [REDACTED].

## **Appendix C.**

### **Survey characteristics**

Our original intention was to distribute a survey on locational factors in collaboration with the SNI, who kindly offered to send it to their manufacturing associates. The SNI is an institution that coordinates the private businesses of Peru, since its primary function is the development of manufacturing industry. It was founded in 1896 to protect the interests of private businesses and has worked accordingly ever since. Today the SNI represents over 1,000 of the most important manufacturing companies that overall contribute to over 90% of Peruvian manufacturing GDP. It only represents medium and large manufacturing firms.

The agreement with the SNI had two major characteristics. On one hand, we provided them with the already mentioned survey on locational challenges for them to distribute. They would have used their resources to distribute the survey to an approximate 600 of their associates, and would have collected the responses. The survey would have been sent to managers, CEOs or owners of manufacturing firms. This survey intended to understand those locational factors that were the most important for respondents. It would have also determined how satisfied they were with the mentioned factors. Therefore, unlike the current study, a detailed analysis on the factors that influence locational choices would have been provided.

This study would have provided relevant and updated information on the issues mentioned, rather than the current database information from the years 2011-2012. This 3-4 year difference could have been very important, as we believe the rising prices in the central industrial areas of Lima have plateaued. In the outskirts areas, these prices are still increasing which could mean that firms who have not already bought lands for future development may be unable to do so today (Guerra, personal communication, January 13th, 2014). Having this newer survey data, with the opinions of industry experts and owners, along with the SNIs support, would have also been a powerful tool towards the promotion of further studies and the implementation of the policy strategies we have outlined on our conclusions.

On the other hand, and even though submitting this survey would have had many positive outcomes, it is important to also consider the positive attributes that came from our own research. First of all, our study used a sample of all medium and large manufacturing and logistic firms in Lima (over 1,200 firms). Although based on 2011-2012 firm's information, this number is more representative than the unknown number of respondents the SNI survey would have delivered (less than 600). Related to this, the SNI survey would have asked the respondents to fill in the locational factors of their main manufacturing establishments, rather than the information we were able to gather from all of each firms' establishments.