



MASTER'S PROGRAMME IN URBAN MANAGEMENT AND DEVELOPMENT

(October 2009 – September 2010)

Influence of land value in the profitability of low-income housing projects in periphery of Lima

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UMD 6 Report number:

Rotterdam, September 2010

Executive Summary

In the previous decade the real estate sector in Peru has grown significantly, especially in Lima and in housing projects. In this effort the Peruvian government has been a key stakeholder implementing two important housing programs: *Mivivienda* which is targeted to middle class and *Techo Propio* which is for low-income people. *Mivivienda* has been one of the most successful programs from the government because not only the demand but also the supply of new dwellings have greatly increased; however, for *Techo Propio* there is still a great imbalance: the housing demand is the greatest and continues growing but there are few housing projects for poor people in spite of the great subsidy to finance the construction to developers who prefer to develop *Mivivienda* projects. Only in Lima the effective demand for low-income housing is more than a quarter of million dwellings in contrast to the supply that is about the hundredth. The first step to solve this mystery is to understand that the problem is not about subsidy; there are some empirical evidences that it could be the scarcity of serviced land in Lima and other economic and social factors.

The approach of this research is financial analysis from the point of view of the supply side. This research investigates the influence of land in the total profit obtained by developers from social housing projects that are subsidized by government. This research is quantitative and exploratory, with case studies (eight projects) about *Techo Propio* Peruvian social housing program. The context of this thesis is the peripheral area of Lima and the period of time covered in the study is the decade from 2001 to 2010. The research question asks if the profit because of the land strategy (to buy a plot and wait time until the price increase without doing anything else) is greater than the profit because of the project itself (the cash flow obtained for the effort to sell and build dwellings).

The methodology consists mainly in the use of discounted cash flow analysis as a financial tool to explore the profitability of each project. The raw data was obtained mainly through interviews from developers and from the files of the public institution which promotes the program. At the end, it has been proposed the use of some key performance indicators such as the unitary net present value (NPV per square meter of plot invested) and the return on investment (ROI: NPV per dollar invested) to compare the results among all projects. The methodology is complemented with some qualitative and sensitivity analysis.

Using the selected indicators, the findings show that only three projects out of eight have greater unitary net present value because of land than because of the project itself. In three projects the total profit is negative and in two of them the profit because of land is negative. Using the return on investment, five projects of eight have greater profitability because of land than because of the project itself. In general, the return on investment qualifies better the benefits generated from land strategy than the net present value per square meter.

Regarding the conclusions, after the comparison among projects using the key performance indicators, simple descriptive statistics and the sensitivity analysis for a typical *Techo Propio* project, there are opposite results among projects. For

that situation it is not possible to conclude in a positive or negative response to the research question. Nevertheless, this research have proved in some way, based mainly on the results of indicators and on some qualitative information, that *Techo Propio* has many problems to be profitable for private developers and is at least much less successful than *Mivivienda*. A land strategy based only on buying a plot and waiting time to increase its price it is not possible, not any more in Lima. Land strategy needs some partners, private developers, banks, landowners and central and local government to use some modalities of plot acquisition such as real estate investment trust. For developers land strategy also can include an optimum floor area ratio and mix uses, and for the government the design of some instruments for land value capture.

Finally, this research contributes to understand better *Techo Propio* as a social housing program especially from the point of view of the private developers; why there are few projects and dwellings built of this type in Lima, why the profitability is very small or even negative, and why in some cases land contributed significantly to the total profit. Although the results of the quantitative analysis are not very conclusive it is possible to say that *Techo Propio* is not enough profitable for developers and in order to increase their profits it has been necessary actions such as some additional helps from the government, mix uses, construction strategies, and others.

Keywords: Land value, profitability, profit because of land strategy, profit because of project itself, subsidy, low-income housing, *Techo Propio* (TP), *Mivivienda* (MV).

Acknowledgements

This research has been possible with the contribution of NFP for the fellowship; *Fondo Mivivienda* and Ministry of Housing, Peruvian public institutions which provides me information; Peruvian private developers who collaborates with the interviews; my supervisor in IHS Carlos Morales to give me very good feedback during all the elaboration of the thesis; my classmates and friends from IHS who made my stay easier in Rotterdam during all the studies of the master; and finally to Luisa, my mother who support me during all my life.

Abbreviations

CAPECO:	<i>Cámara Peruana de la Construcción</i> (Peruvian Chamber of Construction)
FAR:	Floor Area Ratio
FMV:	<i>Fondo Mivivienda</i> (institution of the Ministry of Housing)
GDP:	Gross Domestic Product
INEI:	<i>Instituto Nacional de Estadística e Informática</i> (National Institute of Statistic and Informatic)
IRR:	Internal rate of return
K:	Discount rate
KPI:	Key performance indicator
LV:	Land value
MV:	<i>Mivivienda</i>
NPV:	Net present value
NPV _L :	Net present value because of land strategy
NPV _P :	Net present value because of the project
PBP:	<i>Premio al Buen Pagador</i> (indirect subsidy to MV)
ROI:	Return on investment
TP:	<i>Techo Propio</i>
€	Euro
S/.	Sol (Peruvian currency)
US\$:	American dollar
m ² :	square meter
π:	inflation rate

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Chapter 1: Introduction

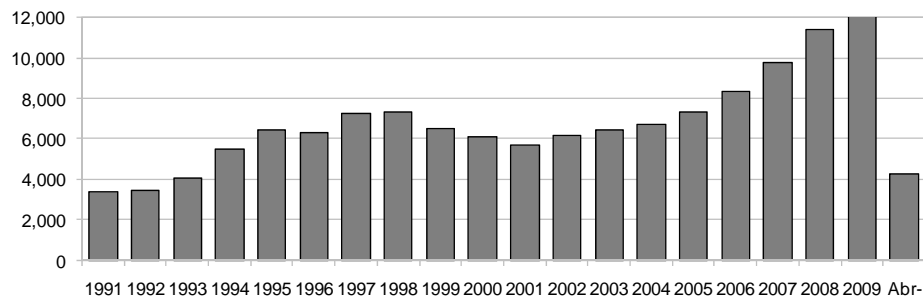
1.1 Background/rationale

Since Lima has been the capital of Peru during Spanish domination until nowadays, the land value in the city continue being the greatest of all the country. Regarding the Latin America region, today Lima is the fifth in population with almost 9 million and it is the seventh metropolitan area with the large GDP about US\$ 109 billion in 2008 (PricewaterhouseCoopers 2009). Especially in the second half of the twentieth century the city experienced a big urban sprawl with a very low average urban density about 2,847.17 inhabitants per square kilometre (INEI Census 2007) in contrast to other Latin American cities.

Special historic, geographical, economic, social, and political factors have influenced in the urban growth of Lima. Historical and political reasons such as centralism concentrated power and development of infrastructure in the capital and in the main coastlines cities because of their proximity to ports. Due to segregation and social exclusion of other Peruvian regions such as highland and jungle, large migration occurred from the interior of the country especially to Lima city during twentieth century in order to find better job's opportunities. Regarding the geography, it is important to highlight that Lima is the second largest city in the world located in a desert (after Cairo, Egypt); today the metropolitan area extends over three valleys formed by the rivers Chillón, Rímac and Lurín. Thus, all these factors contributed to determine the current urban shape: a consolidated central metropolitan area and three peripheral areas known as “*conos*”: north, east and south *conos* which are located in the most desert areas but which show the most rapid urban growth specially for low-income population.

After the economic turbulence in 1980s and the political dictatorship in 1990s, during the first decade of twenty-first century, Peru has a period of democracy and improved significantly in terms of the macroeconomic indicators, especially GDP and exports. One of the sectors with the greatest performance has been construction and housing sector (CAPECO 2010). Peruvian government created two housing programs: *Mivivienda* which is addressed to middle class and *Techo Propio* which is addressed exclusively to poor people. The former has a low conditioned subsidy and the latter has a large subsidy. Now, with low inflation and low interest rate, liquidity in the bank system, and clear legal environment with these housing programs the real estate industry grew substantially.

Chart 1: Evolution of construction real GDP in Perú (million of soles). Source: CAPECO



During the previous decade, it is clear that not only real estate and construction activity have increased significantly especially in Lima, but also the land value. Due to *Techo Propio* is designed to poor people, houses of this kind of projects are located in the periphery of Lima, where it is possible to find the cheaper land, but at the same time the farther from the central business, and it is the less urbanized area with less urban services: water, sewage, electricity, and roads. Previous generation of migrants invaded these peripheral areas or “*conos*” informally as an alternative to get a piece of land since it was impossible to get in the formal market.

In spite of the increase of real estate activity in Lima, there have been few *Techo Propio* projects in the capital city. In contrast, there are a lot of *Mivivienda* projects in almost all the metropolitan area of Lima and less of these are located in peripheral areas. Moreover, few companies have developed big projects in the periphery.

This research attempts to investigate the influence of land value in the profitability of housing projects in the periphery of Lima during the previous decade. This research aims to find how profitable those projects were for private companies. Essentially, the research will use financial tools and methods that will be explained later.

1.2 Definition of problem / question

1.2.1. Characteristics of the periphery of Lima¹

It is said that Lima grows like an “oil drop” because of the shape of its territory. This territory is essentially a dessert and slopes softly from the shores of Pacific Ocean until small mountains slopes located at 500 meters above the level of the sea. Metropolitan Lima extends within the valley of Chillón, Rímac and Lurín rivers and covers a total area of 2,672.28 km², of which 825.88 km² (31%) comprise the urban area and 1,846.40 km² (69%) the periphery. From north to south the urban area extends around 60 km and around 30 km from west to east.

Lima Metropolitan Area comprises the two provinces of Lima and Callao and 49 districts in total. There are several criteria to divide the city in areas or zones. Usually the official reference to do that has been the *Plan de Desarrollo Metropolitano* (Metropolitan Development Plan) but unfortunately Lima does not have an updated Plan. The last one *Plan de Desarrollo Metropolitano* was published in 1992 and it established guidelines for the urban development from 1990 to 2010. In this document Lima Metropolitan Area is divided in 4 areas: the Central Metropolitan Area and the peripheral areas or “*Conos*” which extend in all directions north, east and south: *Cono Norte*, *Cono Este* and *Cono Sur*. Some authors consider Callao like another particular area in the west of the city. *Conos* comprise the following districts:

¹ All figures quoted here have been taken from INEI

- *Cono Norte*: Ancón, Carabayllo, Comas, Independencia, Los Olivos, Puente Piedra, San Juan de Lurigancho, San Martín de Porres, Santa Rosa
- *Cono Este*: Ate, Cieneguilla, Chaclacayo, El Agustino, Lurigancho, San Luis, Santa Anita
- *Cono Sur*: Chorrillos, Lurín, Pachacamac, Pucusana, Punta Hermosa, Punta Negra, San Bartolo, San Juan de Miraflores, Santa María del Mar, Villa el Salvador, Villa María del Triunfo.

The *Cono Norte* is the most populated of all the peripheral areas with 25% of the metropolitan population, *Cono Este* has 12%, *Cono Sur* 20%, and the central metropolitan area formed by the residential and business districts, historic center and the province of Callao with 43%.

The Peruvian institution of market research APEIM (*Asociación de Empresas de Investigación de Mercados*, by its Spanish acronym, 2010) classifies the districts of Lima in 10 zones based on criteria of geographic proximity, socio-cultural and economic characteristics, and life style. This institution classifies socioeconomic group in A (rich people), B (middle class), C (lower middle class), D (poor) and E (extreme poor). In 2010 according to this study, the three peripheral areas have 70.8% of the total poor population and 78.6% of the total extreme poor population. Shaded cells represent the highest concentration in table 1.

Table 1: Distribution of zones by socio-economic levels. Lima, 2010. Source: APEIM

Zone	Districts	Area	A	B	C	D	E
Zone 1	Puente de Piedra, Comas, Carabayllo	North	2.8%	7.7%	10.7%	15.6%	16.7%
Zone 2	Independencia, Los Olivos, San Martín	North	1.4%	10.1%	16.1%	12.8%	9.9%
Zone 3	San Juan de Lurigancho	East	2.8%	4.3%	11.0%	12.2%	17.0%
Zone 4	Cercado, Rimac, Breña, La Victoria	Center	4.9%	11.4%	11.8%	9.0%	5.5%
Zone 5	Ate, Chaclacayo, Lurigancho, Santa Anita, San Luis, El Agustino	East	4.2%	5.9%	10.6%	14.6%	19.6%
Zone 6	Jesús María, Lince, Pueblo Libre, Magdalena, San Miguel	Center	18.1%	10.8%	4.6%	1.5%	0.3%
Zone 7	Miraflores, San Isidro, San Borja, Surco, La Molina	Center	54.9%	23.5%	6.4%	2.1%	1.8%
Zone 8	Surquillo, Barranco, Chorrillos, San Juan de Miraflores	Center	9.0%	14.6%	9.1%	8.2%	6.0%
Zone 9	Villa El Salvador, Villa María del Triunfo, Lurín, Pachacamac	South	0.0%	3.4%	9.8%	15.6%	15.4%
Zone 10	Callao, Bellavista, La Perla, La Punta, Carmen de la Legua, Ventanilla	West	2.1%	8.3%	9.9%	8.2%	7.8%
TOTAL LIMA - CALLAO			100%	100%	100%	100%	100%

Note: Shaded cells represent the highest concentration in the table.

Chart 2: Map of Lima Metropolitan Area. Source: INEI, Peru.



1.2.2. Housing programs promoted by Peruvian government²

The Peruvian government promotes housing programs by two institutions belonging to the Ministry of Housing: *Fondo Mivivienda* and *Banco de Materiales*. *Banco de Materiales* promotes *Vivienda Banmat* which is only for very low-income population. Since the beginning of twenty-first century Peruvian government has been promoting two housing programs by *Fondo Mivivienda*: *Mivivienda* which is addressed for middle class and *Techo Propio* which is for low-income population.

This research only will take into account the most recent programs promoted by *Fondo Mivivienda*, focusing in detail in *Techo Propio* program and in a macro perspective in *Mivivienda* program as a reference for some broad comparison. Currently, Peruvian government does not build any house, only promotes, facilitate and contribute to fund the housing program, coordinating with all the stakeholders: private real estate developers, banks, municipalities, etc.

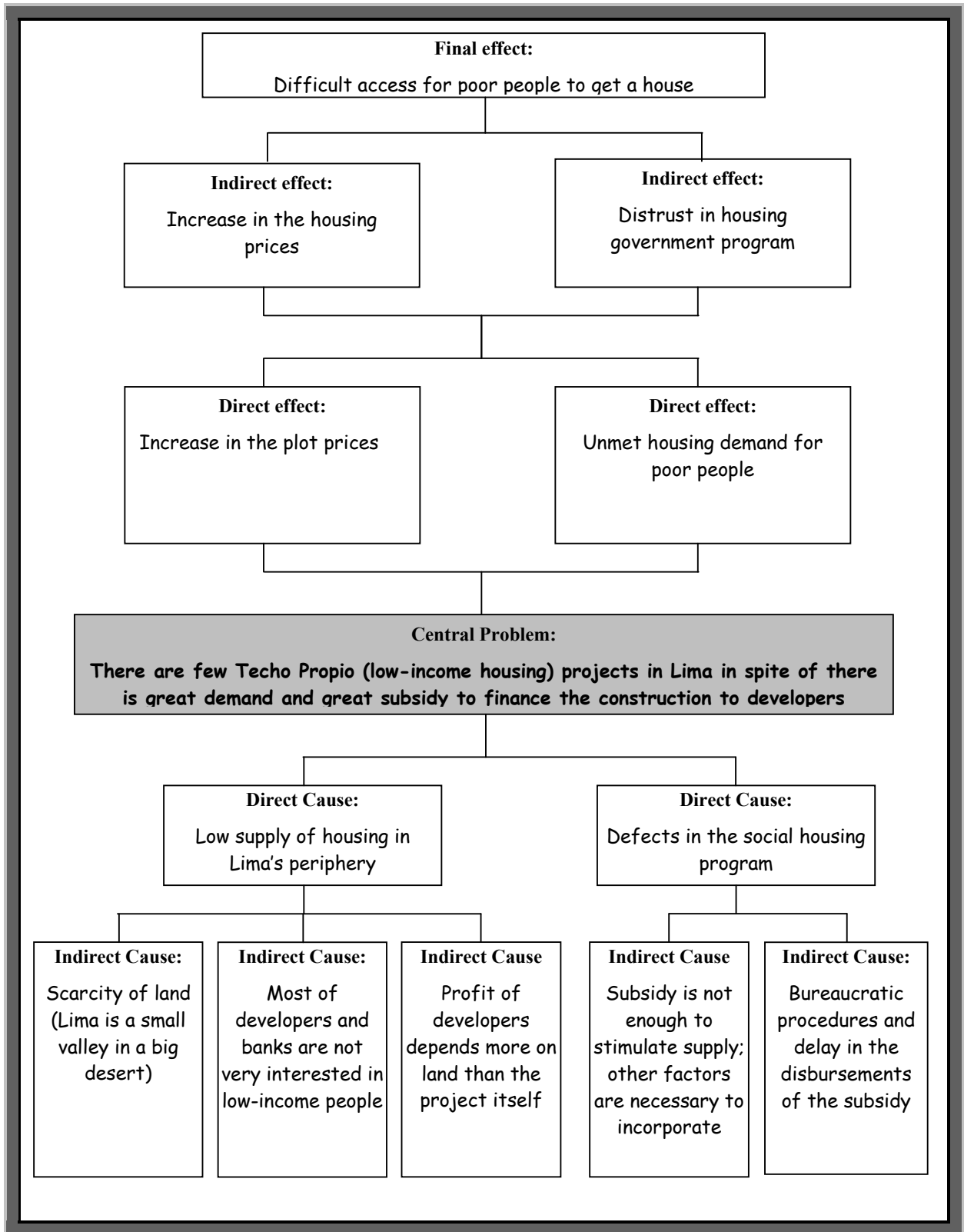
- *Mivivienda*: the program is offered through many financial institutions in the local market. It funds houses between US\$ 18,000 and US\$ 64,000. The funding period is between 10 and 20 years and if the buyers are punctual in their monthly payments they will receive a prize *Premio del Buen Pagador* (PBP) of US\$ 4,500 (conditioned subsidy in order to reduce default). *Mivivienda* is funding through two components which are a percentage of the price of the house: savings (10%) and bank credit (90%). Because of the PBP subsidy the bank credit might be reduced in between 7% and 25%.
- *Techo Propio* is a program to provide housing financing for Peruvian families with fewer resources, giving them access to a home that has electricity, water and drainage, and adequate conditions of habitability. Only poor people with a monthly income no greater than US\$ 570 can access to this program. *Techo Propio* is funding through three components which are a percentage of the price of the house: savings (10%), subsidy (45%), and bank credit (45%).

1.2.3. Problem tree

Regarding the point of view of society the central problem in this study is defined as: **There are few *Techo Propio* (low-income housing) projects in Lima despite there is a great demand and great subsidy to finance the construction for developers.** This problem has two roots or groups of causes: from one side an explanation could be in the supply itself: scarcity of serviced land, lack of interest from developers in social housing projects, small or even negative profit that depends more on land than project itself. On the other hand, the other group of causes of the problem could be in some defects in the social housing program designed by the government. The effects of the problem are more obvious: increase of the price of properties (land and dwellings in general) and unsatisfied housing demand who complain to the government.

² In this point all the information was obtained from *Fondo Mivivienda*.

Figure 1: Problem Tree Diagram



1.3 Aim / objectives

To explain the significance of this research to knowledge it will be answered the following questions:

- Why is this research so important?
 - To search the influence and contribution of land value in the profitability of real estate projects in Lima's periphery for low-income housing projects in contrast to other residential levels in other parts of the city.
 - To provide suggestion to the Peruvian government to improve the social housing programs.
 - To discover strengths and weaknesses of the housing programs.

- What could be a possible heading in the newspaper?
 - From this research: "land value margin is a key to a successful residential real estate project in Lima's periphery"

1.4 Scope

This research is quantitative and exploratory, with case studies (eight projects) of *Techo Propio* housing program. It is exploratory because it provides valuable means of finding out what is happening with land value in Lima periphery.

This study focuses only in the peripheral area of Lima and the period of time covered in the study is the decade from 2001 to 2010. Regarding the social housing projects promoted by government, during this decade in Lima there have been eight projects of *Techo Propio* program. Actually this sample is at the same time the universe: only eight TP projects were done in Lima's periphery in a modality of "new house" that include the acquisition of plot.

1.5 Description of the research area

The research area of this study is land value. Because it studies the relationship between profitability and land value, not only urban land economics knowledge but also real estate financial tools are required. Land value implies knowledge about valuation theory and the methods to appraisal property. Also it is important to know the business, social, legal and political environment in Lima's periphery.

1.6 Research questions and hypotheses

The research objective of this study is to analyze the influence of land value in the profitability of residential projects subsidized by government in the periphery of Lima during the decade 2001 – 2010. The profit has two components: the first one due to the project itself (incomes and expenses generated by sales and construction of the project) and the other due to the increment of the land value for speculation when the developer buy the plot at certain time and decides to start the project after several years when the value of the plot increases without doing anything else.

Box 1: Research Question**Research Question:**

Regarding housing programs subsidized by Peruvian government and executed by private real estate developers in Lima's periphery, is the profit because of the land strategy greater than the profit because of the project itself?

In order to respond the research question, it is necessary to define the concept of profit; in this study a dynamic model will be used, that means, a discounted cash flow, so the unitary net present value (NPV per square meter of plot invested) will be the indicator for profit. Also, what is the profit because of the land speculation and the profit because of the project itself will be explained in detail later, in the research methodology. Other indicator is the return on investment (ROI as the NPV per dollar invested); it is especially useful to make a comparison among all projects.

Moreover, to analyze the profit of the projects it is necessary to take into account or isolate other factors which influence in the profit of a real estate project. For instance, the subsidies of the programs might introduce another speculation effect, so to avoid this (to consider only the land speculation effect due to the growth of the city) it will be considered only projects whose plots were bought before the beginning of the new subsidized housing programs. Other important factor is the technology which might influence in costs; but it is known that for these housing projects developers in Lima use almost the same technology, reinforced concrete slabs, especially for projects that have a large number of houses. Regarding access to capital to fund the project, the only difference is due to the bank requirements but all of banks in the Peruvian market offer almost the same conditions for project which are financed by *Mivivienda* and *Techo Propio* programs. Finally, important macroeconomic effects such as interest rate and inflation have remained almost the same during the previous decade, but it will be considered readjustments to correct these effects because different projects have been executed in different times.

Box 2: Hypothesis**Hypotheses:**

H1: The profit because of the land strategy is greater than the profit because of the project itself.

1.7 Research methods

In order to answer the research question and prove the hypotheses it has been used the income approach to appraisal properties in the all *Techo Propio* projects in Lima. Discounted cash flow analysis is the main tool to find the profitability of the projects and at the same time the net present value (NPV) provides the

residual land value. If the plot of the project was bought some years before the beginning of the project, the NPV has two components: the profit because of the project itself and the profit because of the increase of price of the plot since the date of the purchase of the plot until the date of the beginning of the project. The comparison between these two components will answer the question. Finally, simple statistical tools will be used to draw conclusions about the comparison among different projects *Techo Propio*.

To get the data of the projects to elaborate the cash flow, surveys to developers of each project have been done. Because some of the data like prices of plot, costs of projects, and so on are private information, to get that data has been depended on the willingness of the developers to provide them. Alternatively, it has been used secondary sources such as files from *Fondo Mivivienda* and Ministry of Housing, newspapers, documents of the national office of property registration, and documents of Peruvian Chamber of Construction and The Technical Appraisal of Peru. The last two institutions provide information about prices of land in different parts of Metropolitan Lima.

1.8 Thesis structure

The research is divided in five chapters; this first one is the introduction. Chapter two looks into the literature about land value, property appraisal, and financial analysis of real estate projects. Because the context of the research is in a peripheral area in Lima some literature about experiences in housing programs and land value in suburban areas in Latin American cities are reviewed. After that, concepts about profit, profitability, land value, and subsidy are explained.

Chapter three describes the research methodology in detail. It shows all the tools and techniques that are used to the research. In general, this chapter presents the approach to answer the research question, the data collection and data analysis, and finally the strategy for interpreting results. Specifically, the income approach is applied to appraisal properties along with land residual method, so financial real estate analysis and cash flow are useful tools. Surveys to developers of the selected projects, and secondary sources are techniques to get the data.

Chapter four presents the research results of the fieldwork and its analysis. Many of the results are presented in statistics, tables, graphs, figures, etc. The interpretations of the key performance indicators per each project (unitary NPV and ROI) are presented. Detailed cash flow is presented in annexes.

Chapter five discusses conclusions and recommendations. It presents the meaning of the results of the previous section, and restates the hypothesis about the land value speculation to the total profitability in a subsidized housing project in Lima's periphery. The recommendations point out suggestions to the government to improve social housing program, the limitations of the research and the lessons learned for future studies.

Chapter 2: Literature review / theory

This chapter presents the concepts about land value, profitability and low-income housing according to the available literature. It explains mainly the definitions of these and other concepts related with them. It contains the previous research, the body of the literature reviewed and the research question in the context.

2.1 Previous research

For the purpose of this research all the literature can be classified in two groups: literature for concepts and definitions and literature for the methodology.

Regarding literature for concepts and definitions, it will be reviewed concepts like profit, return, profitability, land value, residual value, and subsidies. The most important literature which includes these concepts is:

- Brian & Sabatini (2006)
- Evans (2004)
- Brealey & Myers (2002).
- Geltner & Miller (2001)
- Pasquale & Wheaton (1996)
- Alonso (1964)

Regarding literature for the methodology, it will be reviewed the methodologies for property appraisal, land valuation, financial real estate analysis and cash flow. The most important literature which includes these methodologies is:

- Geltner & Miller (2001)
- Eckert, Joseph (1990)

There is almost no specific literature about land value in Lima city. Some Peruvian institutions that did little in this field are:

- CAPECO (Peruvian Chamber of Construction), which is focused more in construction values, since 1996 they publish a market research study of construction annually, and since 2002 this study contains very general information about prices of plots in Lima.
- CTTP (Appraisal Institution of Peru), which only does valuations according to the requests. There are some individual studies that contain values of land in different parts of Lima and in different years, but they are elaborated individually by independent appraisers.

The closest case studies about land prices and subsidies can be found in the region of Latin America, especially in Chile. Braian, I. & Sabatini, F. (2006) '*Los precios del suelo en alza carcomen el subsidio habitacional*' in *Prourbana*, did a quantitative and qualitative analysis about how land prices in Santiago de Chile have been affected (increase drastically) due to subsidy housing policy. The results in Santiago have not been the desired: less number of houses built, smaller plot, less construction quality, more expensive houses because of land prices increase and poor location of social housing: far away from the city center, segregation and the formation of urban ghettos. Chile is maybe the Latin American country with the strongest housing policy and due to is very close to Peru not only geographically but also in some social aspects, it can be a valuable reference as experience in order to understand a similar situation in Lima.

Introduction

General topic

This thesis is about land value, and pretends to investigate if a low-income housing program is attractive for private land developers because of the advantages of the housing program or because of the opportunities provides by the margin of land. The context of this research will be the periphery of Lima where low-income housing projects usually are located.

Overall trends

Some studies such as Braian, I. & Sabatini (2006), especially in Latin American cities have proven that, contrary to the conventional politician's beliefs, subsidies, which are usually used in low-income housing program, cause an increase of property's prices and of land price. Lima is not the exception, property and land prices have significantly increased in the last years, so now is more difficult for poor people to purchase a dwelling. On the other hand, in the supply side, land developers find harder to develop housing projects for low-income households because of the low profit, and presumably few of them decide to continue to invest in this kind of projects because of the opportunities in the land margin when a plot is bought at a low price and sold at a high price. Moreover, according to the Peruvian sociologist Julio Calderón (2006) the public policies in Latin America and Peru have a lack of integral management to face the growth of cities, thus the land market, the distribution and property of urban land, the valuation and the legal frame are disconnected processes.

Writer's reason

There are almost no studies nor about land prices in Lima neither about the attractiveness of the private investment in social housing projects like other cities in Latin America like Bogota and Santiago. The main reason of this research is to investigate if low-income housing projects are profitable for private real estate companies and how land profit influence in the attractiveness of the business. This would be very useful to public sector in order to make some improvements to the

low-income housing program and to get more land developers, that means increase the supply of housing for poor people.

Organization

The literature review starts with a review of key concepts: profitability, risk of the investment, periphery of city (Lima's case), low-income housing, land value, subsidy. After that, this chapter reviews methodologies about assessment of the project's profitability and risk, sensibility analysis, calculation of land value: residual value.

2.2 Group literature

2.2.1. Preliminary work on the topic

I used to work in the *Fondo Mivivienda*, the institution belonging to the Peruvian Ministry of Housing which promotes housing programs. There I supported and gave advice to *Techo Propio* projects, some of them in Lima. Therefore, this experience in the field can contribute to the investigation.

Point of view

Techo Propio is a low-income housing program promoted by Peruvian government and in Lima those projects are usually located in the periphery of the city. The program has important component of subsidies like many other programs of social housing. In the last years is very noticeable that prices of land have increased in Lima and there is not so many houses built by *Techo Propio*, few projects and few investors in Lima. A possible explanation for this situation is that *Techo Propio* has little profit, if any, and the few land developers who continue in the system do that because they can obtain profits due to land margin.

Mivivienda, on the other hand, is a housing program promoted also by Peruvian government but addressed to middle class; it has a small component of subsidy. In spite of there are more need and demand for low-income houses (*Techo Propio*), there are more *Mivivienda* houses in Lima, even in the periphery of Lima. Presumably, this is because the success of projects of this programs depends more on the market and business skills than on the subsidy or land speculation.

2.2.2. Body: literature for concepts

- **Profit:** we use the concept of economic profit which is different from accounting profit. The economic profit is the difference between the total incomes and the total expenses including the opportunity costs. In a dynamic model, when time is incorporated because incomes and expenses are generated in different periods, a measure of the profit is the net present value (NPV). According to Brealey and Myers (2002) the present value can be understood through the first fundamental financial principle which states that a dollar today is worth more than a dollar tomorrow. NPV is determined subtracting the required investment. The NPV is the sum of all the profits generated in

each period brought to the present through the discount rate. In other words the NPV is a surplus of profit, or is the profit that the project or the investment generates after recovering all the costs including the opportunity cost given by the discount rate. In investment evaluation, the project will be accepted if the NPV is not negative. Mathematically, the NPV is defined by the equation:

$$NPV = \sum_{i=0}^n \frac{F_i}{(1+k)^i} = F_0 + \frac{F_1}{1+k} + \frac{F_2}{(1+k)^2} + \dots + \frac{F_n}{(1+k)^n} \dots (1)$$

F_i : is the cash flow in the period “i”
 K : is the discount rate
 n : is the number of periods (months, years, etc.).

The discount rate k is a measure of the risk of the project. According to Brealey and Myers (2007) “ k ” is the profitability rate or the reward that the investor demands for the project. This profitability rate is also known as discount rate, minimum rate or opportunity cost of capital. It is called opportunity cost because is the return on the foregone by investing in the project instead of investing in securities.

- **Return:** according to Geltner and Miller (2001), returns are the fundamental measure of investment performance in the micro and macro-level. Return is a way to measure profit in an investment. Essentially, return on an investment is *what you get, minus what you started out with, expressed as a percentage of what you started out with*. The most common used multi-period return measure is the internal rate of return (IRR). Mathematically, the IRR is the discount rate in a cash flow when the net present value (NPV) is zero. In investment evaluation, the project will be accepted if the IRR is greater than the discount rate. Solving the following equation is possible to find the IRR.

$$NPV = \sum_{i=0}^n \frac{F_i}{(1+IRR)^i} = 0 \dots (2)$$

- **Profitability:** this research uses the Return on Investment (ROI) which is defined, according to Phillips and Pullman (2001) as the benefits between the total costs (or investment). It is a ratio that measures the efficiency of an investment. If the investment is composed by different costs in different times it is necessary to calculate the present value of the total cost.

$$ROI = \frac{NPV}{I} \dots (3)$$

- **Land value:** According to Eckert (1990) the general model for a land value is:

$$LV = \frac{PGI - C}{R} \dots (4)$$

Where LV is land value, PGI is the project gross income, C is the cost and R is a capitalization rate. This is a very similar formula to NPV, but this case is a static model. Thus, we can say that in a dynamic model for a real estate project, when incomes and cost are generated in many periods of times the land value is equal to the NPV of the investment. Eckert explains that land values are affected by four types of factors: economic (demand variables: employment rate, wage rate, income levels, interest rate, transaction costs, etc; supply variables: amount of available land, development & construction costs, taxes, etc.); social (age distributions, education, crime rates, pride of ownership, etc.); legal, government and political (taxation, zoning, land use control, fiscal and monetary policies, quality of local government services, etc.); and physical, environmental, and locational factors (site: size, topography, quality of soil; situation: distance to central business district, proximity to natural or man-made amenities, etc.).

According to DiPasquale and Wheaton (1996) an economic model for land value can be built following the Ricardian rent theory. Essentially, among other factors, land value increase according to the growth of the city (b_t). This conclusion is very important because it means that landowner expectations about the city growth can increase the value of land just waiting time. Mathematically, these ideas are in the following equations:

Residual price of land at a developed site (within the urban area):

$$p_t(d) = \frac{r_a}{i} + \frac{k(b_t - d)}{qi} + \frac{kb_t g}{qi(i - g)}, \quad d \leq b_t \dots (5)$$

Agricultural value
Current location value
Future growth in location value

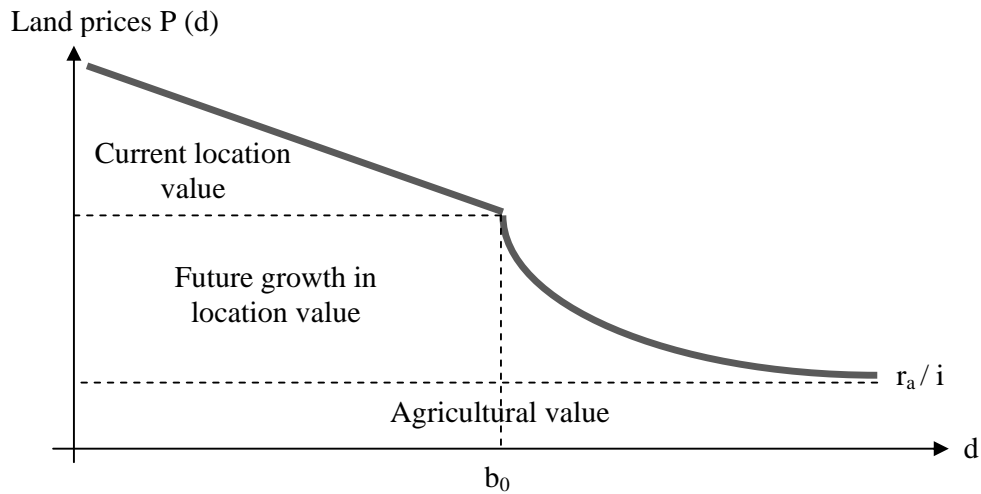
Price of vacant land (beyond the urban border):

$$p_0(d) = \frac{r_a}{i} + e^{-iT} \frac{kb_T g}{qi(i - g)}, \quad d > b_0 \dots (6)$$

Agricultural value
Future growth in location value, discounted

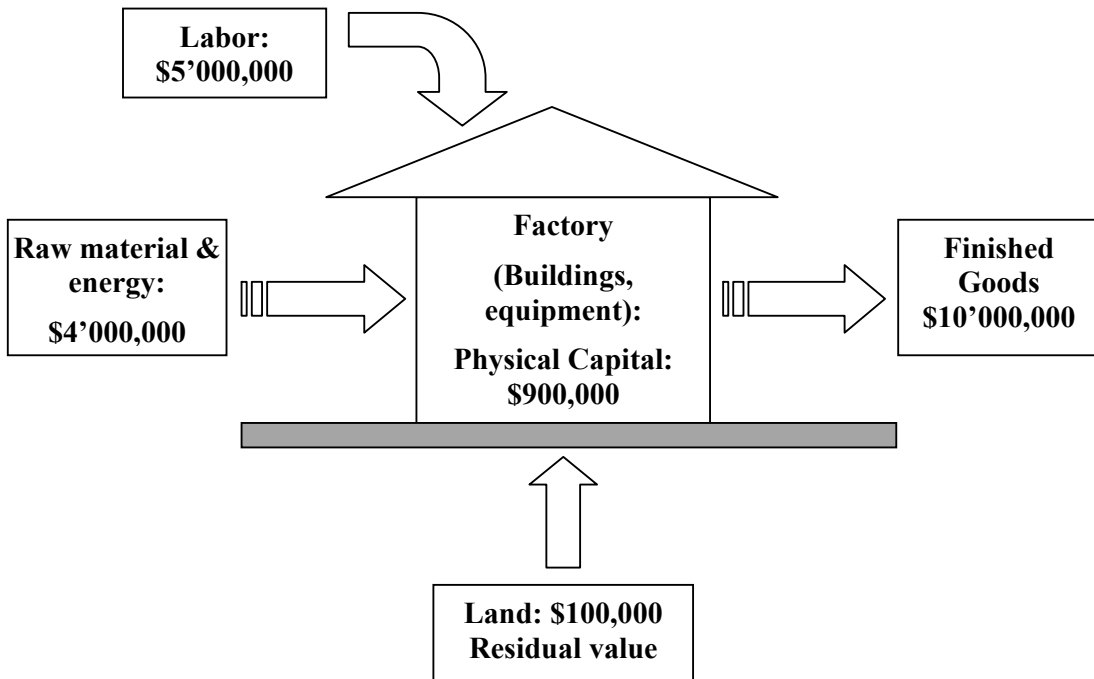
- $p_t(d)$: price of land at the distance d
 r_a : agricultural value per area
 i : interest or discount rate
 k : cost of commuting annually per distance
 b_t : border of the city as a function of time
 d : linear distance from the center of the city
 q : area of land per unit of housing. Residential density: $1/q$
 g : constant growth rate of the border
 T : time at which the border will reach a particular distance $T(d)$
 n : number of households
 v : land supply from 0 to 1

Figure 2: Variation of Land Value with distance.³



- **Residual value:** many authors have written about the residual theory of land value. Geltner and Miller (2001) explain that in every production process four production factors are used: land, labor, capital and raw materials (including energy). All these factors must be paid to get the finished product. However, the mobile factors (labor, capital, raw materials) must be paid first. Thus, the incomes generated in the production process minus the cost of the three mobile factors will determine the profit available for the land owner that is the land value.

Figure 3: Illustration of the Residual Theory of Land Value



³ Source: DiPasquale & Wheaton (1996)

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- **Highest and best use:** Eckert (1990) explains this principle means that the market value of property depends mainly on potential use instead of current use alone. Vacant land is the clearest example of this concept. This principle applies also to land value.
 - **Subsidies:** it is defined as a financial assistance paid to an economic or social sector. Usually subsidies are given by the government to low-income families or to strategic industries to prevent their declination. Subsidies to social housing have three trends: government do not participate directly in the construction, now is the private sector who do that; assistance for homeownership is increasing; and the greater use of housing allowances to assist low-income families renting accommodation in the private or non-profit sectors.

According to the American Congress 1969: “a subsidy is an incentive provided by government to enable and persuade a certain class of producers or consumers to do something they would not otherwise do, by lowering the opportunity cost or otherwise increasing the potential benefit of doing so”.

- **Social housing:** The Economic Commission for Europe and United Nations (2006) defines social housing as social rental housing. This document makes a clear difference between “social housing” and “social housing policies”: the former is only one of the instruments for implementing the latter.
- **Low-income housing:** According to the US Department of Housing and Urban Development, low-income housing is targeted at people without enough income to provide adequate housing for their families. These families are unable to buy a home because they cannot qualify for a mortgage. Most people choose to rent based on their income and family situation. Therefore, this definition depends on how it is defined low-income people. In Peru, particularly Lima, formal low-income housing is considered *Techo Propio* and to qualify to this program people have to earn a monthly income no greater than US\$ 570.

Regarding quantitative literature, a classical literature about land value is Alonso (1964) in *Location and land use: toward a general theory of land rent*, provides the general background of urban economics and land value theory. The book of Evans (2004), *Economics, Real Estate and the Supply of Land*, and Pasquale and Wheaton (1996), *Urban economics and real estate markets*, provide the concepts and tools to understand the real estate economics and the supply of land. There are some evidences that land prices have increased significantly in the last years in Lima, and presumably the subsidy's housing policy in *Techo Propio* has one of the factors which have contributes to this situation.

Regarding qualitative literature, it will be very useful to review some similar cases in the region of Latin America and due to the strong relationship between social housing and informality as an alternative, understand informality is also important. Smolka (2002) in *Regularizing urban land tenure: the solution which*

is part of the problem and the problem that is part of the solution explains that informality is not a consequence of poverty but the cause and he cites numerous examples in several cities in Latin America. Peru has a large tradition in regularization, so another possible explanation why there are not so many projects and investors in Lima is perhaps because informal land owners and poor households see more attractive the informality and regularization programs.

Finally, Julio Calderón (1999), a Peruvian sociologist, in *Land market in periurban agricultural areas of Lima* provides an explanation about how agricultural land is converted in urban land in Lima's periphery. The strength of this study is that describes local reality and is one of the few literature about this in Lima; unfortunately, this study is since 1999, so the data and conclusions should be taken carefully or updated. This study can provide some light about how are the transactions to buy and sell land in Lima's periphery in order to develop a *Techo Propio* project and how much could be the margin obtained.

2.2.3. Body: literature for methodology

An important contemporary author in quantitative literature who will be considered in this thesis is Geltner (2001), who in *Commercial Real Estate: Analysis and investments* provides a framework to do a financial analysis in a private real estate project, which is crucial to find if *Techo Propio* project is attractive for Peruvian land developers in Lima's periphery. In this thesis it will be considered the most important outcomes to assess the attractiveness of the investment the profitability (NPV) and the risk (sensitivity analysis and probabilistic analysis). All the real estate inputs will be considered to build a financial cash flow model using a calculation sheet. This literature provides the methodology for the elaboration of cash flow analysis for real estate projects.

Eckert (1900) in *Property appraisal and assessment administration*, provides the methodology for property and land valuation. In fact, from the three methods to assess a property, the income approach is selected as the most convenient because of the available information. The income approach suggests using a cash flow analysis. The residual theory of land value shows the land value is the profit generated for a real estate project.

2.3 The research question(s) in the context

How these theories and concepts can explain why there are few low-income housing projects in Lima's periphery? Speculation, subsidies, land value evolution, landowner and developers behavior, expectations about profitability, scarcity of land in Lima's periphery, are all factors than can explain this.

On the other hand, there are other questions that might be made in the context of this study. Is it necessary to make some changes in the housing programs promoted by government? How can increase supply, the interest of developers to construct more low-income housing projects without the need using land speculation? What is the weight of land in the total project profit? Is it land so important to determine the success of a low-income housing project?

Conclusion

- Low-income housing projects like *Techo Propio* are alternatives against informality and regularization for poor people who usually live in the periphery of cities. Something that is not very clear is if the market of *Techo Propio* program is bigger or not than the informal market for housing.
- There are evidences that subsidy housing policies in some countries in Latin America have contributed to increase the value of land, even in the periphery where projects of social housing program are usually located. *Techo Propio* housing program in Lima's periphery presumably follow the same pattern.
- The increase in land value produces increase in properties, a reduction in the demand for social housing and a reduction in the supply of *Techo Propio*. There are few real estate developers and few social housing projects in the periphery of Lima, perhaps the projects are not profitable.
- Hypothesis: The profit of *Techo Propio* project because of land strategy is greater than the profit of the project itself.

Research question:

Regarding housing programs subsidized by government and executed by private real estate developers in Lima's periphery, is the profit because of the land strategy greater than the profit because of the project itself?

2.4 Literature Summary Table

Table 2: Literature Summary Table

Author/ date	Questions/ concerns	Material/ evidence	Arguments	Concepts/ Form of analysis
Evans (2004)	Land use planning can influence the use and the price of land	Theoretical paper	<ul style="list-style-type: none"> ▪ Demand for housing depends on incomes, interest rate, etc. ▪ Supply of land will be affected by the willingness and the ability of land owners to sell their land for some other use. ▪ The behavior of land owners influences on the price of land: hold a land rather than sell it. ▪ Planning constraint can cause land prices to be higher 	<ul style="list-style-type: none"> ▪ Demand curve for land ▪ Supply curve for land ▪ Ricardian rent model ▪ Neoclassical view
Geltern & Miller (2001)	<ul style="list-style-type: none"> ▪ Discounted cash flow to evaluate real estate projects 	Theoretical paper	<ul style="list-style-type: none"> ▪ Dynamic model using discounted cash flow and NPV as an indicator of the performance of the project 	<ul style="list-style-type: none"> ▪ NPV, IRR ▪ Profit ▪ Profitability
Eckert (1990)	<ul style="list-style-type: none"> ▪ How to appraisal a property and which is the best method according to the situation? 	Theoretical paper	<ul style="list-style-type: none"> ▪ Property appraisal best method depends on the situation, the available data 	<ul style="list-style-type: none"> ▪ Sales approach ▪ Cost approach ▪ Income approach ▪ Highest and best use
Braian & Sabatini (2006)	<ul style="list-style-type: none"> ▪ What proportion of the social housing value is absorbed by the land price? ▪ In what way the higher price of land affect the size and location of housing? 	Case study in Santiago	<ul style="list-style-type: none"> ▪ The deployment of modern real estate projects and the expectation of land rents for all the periphery have produced that the main increases of land prices are in the areas of low-income people. ▪ The subsidies were for covering the land prices in great proportion. ▪ The size and quality of social housing have decreased ▪ Social housing are located far away from the city center: urban segregation 	<ul style="list-style-type: none"> ▪ Social housing ▪ Urban border ▪ Land prices ▪ "Urban Ghettos"
Calderón (1999)	<ul style="list-style-type: none"> ▪ Paradox: conflict between the needs of the city and the way in which agents drawn together around the land issue are seeking out their own interests. 	Working paper in Lima	<ul style="list-style-type: none"> ▪ Urban expansion is located on agricultural land rather than wasteland. ▪ Agents' profits exceed the payment given to farmers, with minimal development. 	<ul style="list-style-type: none"> ▪ periurban agricultural area

Chapter 3: Research methodology

Chapter three presents the research methods that are used to answer the research question. This includes the general scheme of the research methodology, how to approach to answer the question, the data collection methods, the data analysis tools and techniques, and the strategy for interpreting the results. Recall that this research is a quantitative exploratory with cases of studies about *Techo Propio* program.

3.1 Approach to answering the question

3.1.1. Scheme of the research methodology

Recalling the research question: *Are housing programs subsidized by government profitable for private real estate developers in Lima's periphery because of the program itself or because of the land strategy?* To answer this, it has followed some steps.

First of all, it was gotten the database of *Techo Propio* (TP) projects from *Fondo Mivivienda* (FMV), the government institution which promotes this housing program. When private developers want to start a TP project they have to submit some documents to FMV such as registration document of the plot, registration documents about the company, cash flow and schedule of the project, design plans, and so on.

Secondly, it was chosen the TP projects with the following criteria: only projects located in the periphery of Lima and only projects in the modality of “new house” a TP modality which includes the acquisition of the plot. It is necessary to divide the projects in two groups: projects whose plots were bought before and after the beginning of the social housing program. When the government announces the housing programs at the beginning of twenty-first century it could create expectations in land owners so they might have increase the price of plots. Because of the preliminary information shows that there are few projects of TP (eight) in the area of study, the sample of the study (number of projects) will be the universe.

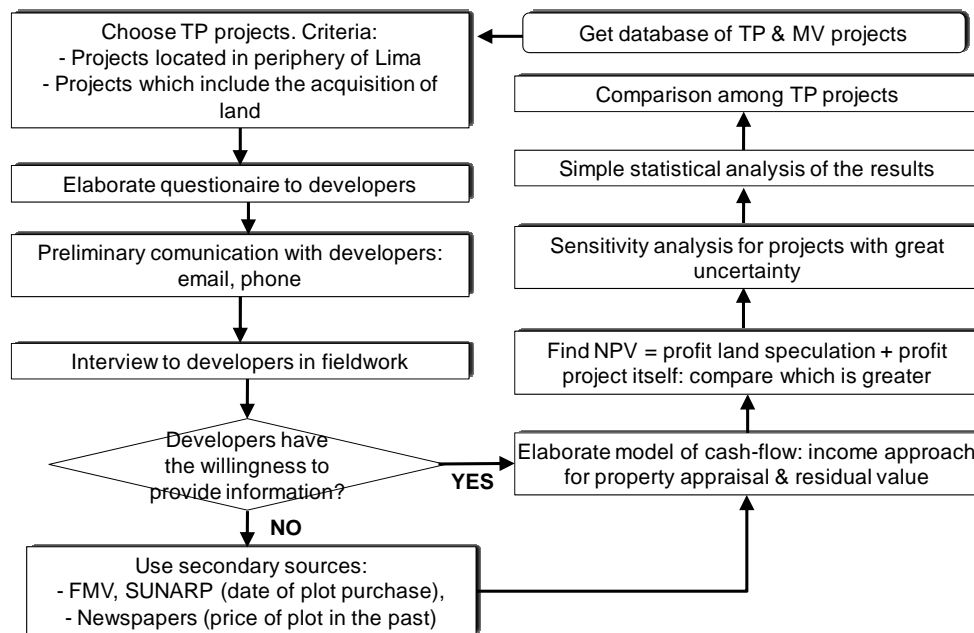
After that, the questionnaire for developers will be elaborated. This includes questions about financial and economic issues; time information is crucial because a dynamic model will be used: the cash flow of the project. Also, letters of presentations from Institute of Housing and Urban Development Studies are elaborated for each real estate company that will be visited for the questionnaire. In addition, a preliminary communication with developers by email and telephone will take place in order to book appointment during the fieldwork, also the questionnaire will be sent by email to developers.

During the fieldwork three big tasks will be done. First, visits to FMV to extract information from the file store, documents submitted by developers for building a TP project such as registration file of the plot, cash flow and schedule of the project, design plans, technical information of the project (areas, location), and so on. Secondly, interviews to developers in order to extract technical and financial

information of the projects through the questionnaire. This task includes two types of visits: to the company office and to the work project site. Third, visits to the newspaper archive of “*El Comercio*” a very well-known prestigious Peruvian newspaper with a section about sales and purchases advertising. In this newspaper archive it will be searching advertising about plots with similar location and in the same purchase-sale time. Secondary sources such as FMV and *El Comercio* and others will be necessary because a real problem is the willingness of developers to provide financial information about their projects.

After the fieldwork, to analyze the data it will be used a dynamic model, so cash flow will be elaborated for each project. Finally, to obtain results and draw conclusions about TP projects it will be used descriptive statistics. The flowchart of the scheme of research methodology is presented in the following graph.

Figure 4: Scheme of the research methodology



The main limitation of the study is the willingness of the private developers to provide financial information about their projects. Secondary sources are good alternative but the scarcity of information, limited time, constraints in accessibility and the assumptions to choose similar locations and similar dates for plots (in case it cannot be found the actual information) can vary the results in some way.

3.1.2. Measuring instruments as operational definitions

The followings instruments and tools will be used:

- Questionnaire and interview scheme

- Income approach for property appraisal: Discounted Cash Flow and Residual value for land value
- Sensitivity analysis for projects with uncertainty in some variables
- Descriptive statistics to compare results among projects.

The dependent variable is the profit, and the independent variables are the financial (incomes and expenses) and technical data related with the cash flow of the project. The following table summarizes the operational definitions of variables.

Table 3: Key Performance Indicators to measure the results

		profit	How to measure
Dynamic model	Project Indicator	Unitary profit	NPV / built area
		Profitability (ROI)	NPV / total cost discounted
	Land Indicator	Gross Unitary land value	NPV / plot gross area
		Net Unitary land value	NPV / plot net area
		% Δ land value	NPV / plot cost

Table 3 shows the five key performance indicators (KPI) that can be used for the research purpose. First of all, in this research a dynamic model will be used, that means, a model which consider the time as a variable; therefore, cash flow analysis is necessary to evaluate the contribution of incomes and expenses that are generated in different times.

The first two KPIs are more related with the project. The unitary profit calculated as the net present value between the built area measures the efficiency in the construction process: how much profit the developer obtains per each square meter of built area. The profitability calculated as the net present value between the total costs (discounted) measures the return on investment: how much profit the developer obtains per each dollar invested; the ROI is a ratio which measures better the efficiency of the investment.

The other KPIs are more related with land. The gross unitary land value calculated as the net present value between the plot gross area measures how much profit the developer obtains per each square meter of plot invested. The net unitary land value is quite similar to the previous but instead of using the plot gross area it uses the plot net area⁴: it measures how much profit the developer obtains per each meter of serviced land. The last KPI, the percentage of increment in land value calculated as the net present value between the plot cost measures the percentage change in the land value inasmuch as according to the theory of residual value the NPV is equal to the difference between the current and the initial value of land.

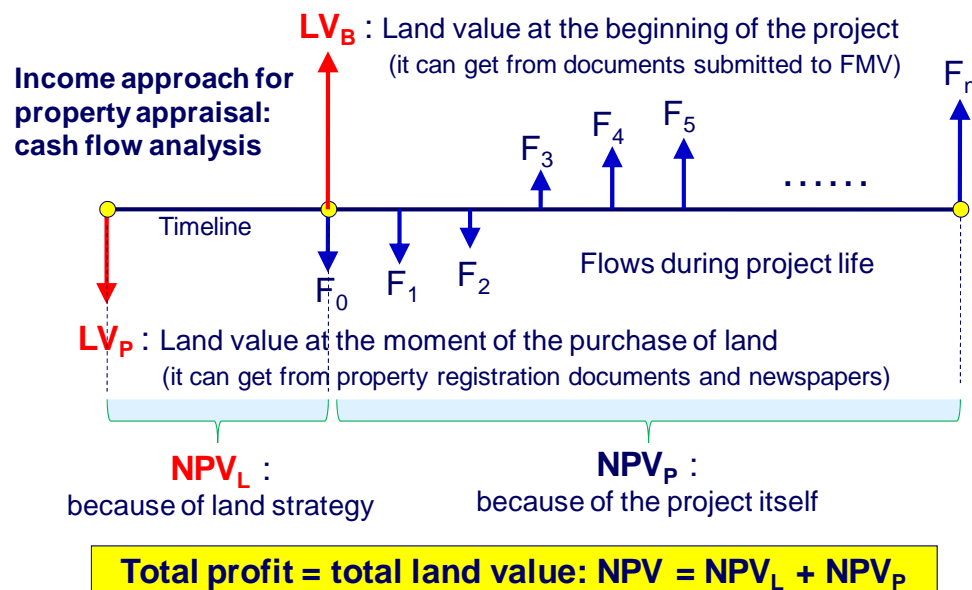
⁴ In Perú, the plot net area is between 50% to 60% of the plot gross area because when the developer buy a piece of raw land according to the Peruvian law the developer have to donate some part of the plot to roads, school and green areas.

Two KPIs have been chosen to be considered the most appropriate to prove the hypothesis. One KPI is related with land, the gross unitary land value or unitary NPV is more appropriate to compare the contribution of each component (comparison within each project), land and project to the total NPV, because NPV has the additive property ($\text{total NPV} = \text{NPV}_{\text{land}} + \text{NPV}_{\text{project}}$). The other KPI is related more with the business of the project, the return of investment (ROI) is more appropriate to a comparison among projects. It should be highlight the use of NPV in the five indicators, so the estimation of NPV and hence the development of cash flows for each project is essential. Remember in equation (1) the NPV depends on sales incomes, costs (serviced land, construction, legal fees, marketing, taxes, overhead, etc.), the discount rate, and on the period when each flow is generated during the project life.

3.1.3. How to answer the research question

Essentially to answer the research question is necessary first to define profit and after that to distinguish and to compare two components of the profit. This research will use a dynamic model, so the NPV of the cash flow will be an indicator of the profit for a private developer. If the developer bought the plot at a certain time in LV_P (land value at the moment of the purchase of land) and decides to wait until other date to start the project when the land value increase without doing anything in LV_B (land value at the beginning of the project), this situation generates the first component of the profit: NPV_L because of the speculation (inertial growth), it will be the difference between the two previous values. The project generates itself another profit: NPV_P because of the incomes and expenses generated during the project life. Because NPV has the additive property, the total profit o total NPV is the sum of the two components. The comparison between these two components will answer the research question.

Chart 3: Components of the total profits: NPV of land and NPV of project (cash flow)



3.2 Data Collection

3.2.1. Field site description

Lima is a big city with almost 9 million inhabitants; for the purpose of this research has been chosen periphery of Lima. In this area live about the 75% of the poor and extreme poor population of the city. It is the area with the last possibility of expansion but at the same time is located in a dessert area, so there is a scarcity of serviced land and it is very expensive to provide infrastructure: pipelines, roads, and other services. The most remote areas from peripheral areas or “Conos” are more than an hour from the Center of Lima in a rush hour.

3.2.2. Description of the tasks in the fieldwork

In the fieldwork, to collect the data three main tasks should be done: visits to FMV, visits to projects, visits to newspaper archive.

- Visits to *Fondo Mivivienda* (FMV): the institution which promotes MV and TP programs. The file storage contains technical and financial information especially about TP projects submitted by developers. As a former official from FMV I know what kind of information there is and I have the help of some friends who continue to work there. Important information: cash flow of the project, registration file of the plot (data and price of the purchase), design plans and technical information of the projects.
- Visits to projects: the purpose of this task is to extract information directly from developers. The instruments will be a questionnaire and interviews to developers. The number of projects is 8 TP projects. Main problem: willingness of developers to provide information. Important sub-tasks are:
 - Ask support to FMV in order to contact developers
 - Get database and location map of the company’s offices and site work of the projects.
 - Communication by email and phone with developers and to send questionnaire. Search contact person in office and in work site. Booking an appointment.
 - Taking pictures to the projects.
 - Visit two projects per day: office of the company and work site. Make interview to receive answer of the questionnaire.
- Visits to newspaper archive: *El Comercio* is the most reliable Peruvian newspaper to extract information about property prices. This task is in the critical path, so it is necessary to hire a person to search the information in the advertising section about the sale – purchase of the plot of the projects or to search plots in similar location and time.

Other secondary sources: National Office of Property Registration (SUNARP), Peruvian Chamber of Construction (CAPECO), Valuation Institution of Peru (CTTP), among others.

3.2.3. Content of the questionnaire

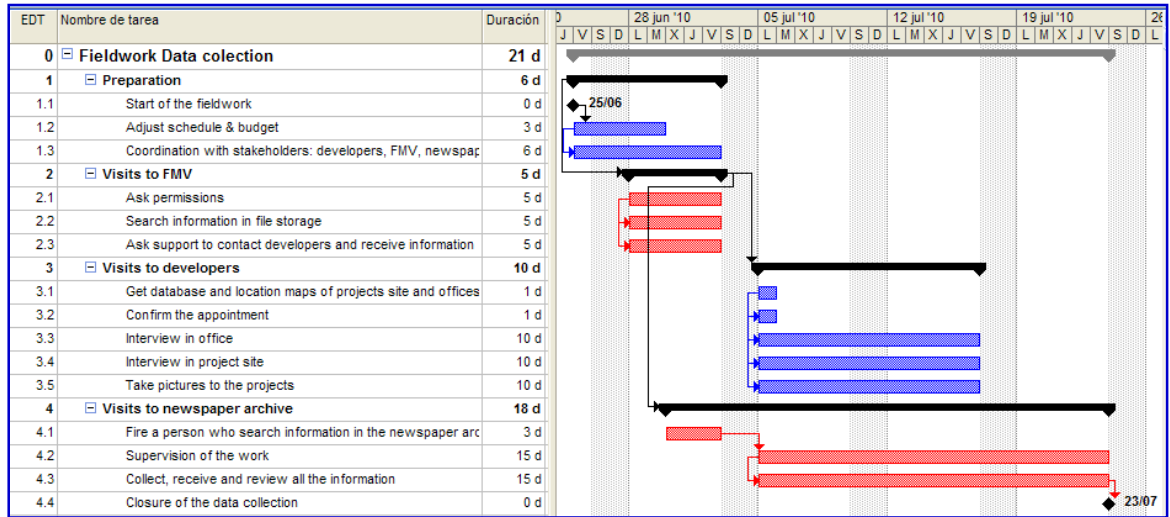
The questionnaire is one of the most useful instruments to extract information from developers. Because of all the data required is quantitative the questions are precise and there is no problem with the consistency. All the questions are focused to get financial and technical data to elaborate the cash flow of each project. The same questions will be in the questionnaire for the eight *Techo Propio* projects.

1. Date and cost of the purchase of the plot
2. Date of the first apartment sale
3. Date of the last apartment sale
4. Average sales rate per month
5. Date of beginning of construction
6. Date of end of construction
7. Date of end of the project
8. Cost of the plot at the moment of the purchase
9. Estimated value of the land at the beginning of the project
10. Plot area
11. The plot bought was raw land or serviced land? Yes or not
12. Cost per m² of the urbanization of the plot (in case it was raw land)
13. Cost per m² of the build
14. Total built area
15. Price, area and number of unit per each type of apartment
16. Registration, municipality, and notarial costs
17. Overhead
18. Additional comments about the project (only financial and technical aspects)

3.2.4. Planning of the data collection in the fieldwork

- Schedule: All the fieldwork period will last 21 business days. It starts at 25th and the closure will be at 23th July. The critical path is determined by the tasks of visits of FMV and visits of newspaper archive. The four important phases or stages during the field work are: preparation, visit to FMV, visit to developers, and visits to newspaper archive.

Chart 4: Gantt Chart of the fieldwork data collection



- **Budget:** the budget should cover flight to Lima round trip, local transportation, to hire people for searching information in newspaper archive, photocopies of documents, pictures, etc.

Table 4: Budget for the fieldwork

BUDGET	
Item	Cost (euros)
flight to Lima round trip	1,000
local transportation	€7 x 21 days = 141
hire to search for information in newspaper archive	300
photocopies of documents, pictures, etc.	50
Total	≈ € 1,500

3.3 Data Analysis

For each project will be elaborated a cash flow with all the data collected in the fieldwork. As it was explained before, the indicator of profit is the net present value (NPV) which is at the same time the land value according to the residual value theory. Also, the NPV has two components, the NPV_L because of the speculation (without subsidies) and the NPV_P because of the project. The difference between both NPV will answer the research question and can prove or reject the hypotheses. It is expected that the NPV_L because of the increase of the land value only for land strategy will be greater than the NPV_P because of the project for TP projects. In order to analyze the variability of the results sensitivity analysis will be used as a tool to deepen the analysis.

Because of there are several projects with different results is better to use a unitary value of the profit for comparison. Since NPV is equal to land value according to residual theory, the unitary profit or unitary land value will be NPV between the

plot area (e.g. unitary NPV = 10 \$/m²) which measures how much profit is obtained per each square meter of land or the unitary land value after the end of the project. However, due to different projects are executed in different times it is necessary to make two corrections: first, correction for inflation rate, after that adjustment for exchange rate (it is possible that not all information is in the same currency), and bring all project to the present value (we choose July 2010). Finally, with all these adjustments all the differences in unitary NPV (NPV_L – NPV_P) can be compared and analyzed statistically. To draw conclusions about the set of the TP projects, it will be used the mean and the standard deviation of the data.

Tables that summaries all the data analysis will be elaborated to compare all TP projects. The table will look like the following:

Table 5: Summary Table to compare results

Project	NPV _L	NPV _P	NPV _T	$\Delta = NPV_L - NPV_P$
A	8.50 \$/m ²	6.50 \$/m ²	15.00 \$/m ²	2.00 \$/m ²
B				
C				
D				
...				
H				
Mean				
st. dv.				

3.4 Strategy for interpreting results

To prove the hypotheses, based on the statistical analysis and using the mean of the results as indicator, the conclusions can be obtained from the following conditions ($\Delta = NPV_L - NPV_P$):

- If mean of $\Delta > 0$ en TP \implies Hypothesis H1 is proved

Thus, if the hypothesis is proved that means that for *Techo Propio* (TP) projects the profit obtained by land strategy (to buy a plot and wait until the price increase without doing anything else) is greater than the profit obtained by the project itself (sales and construction of the project). An important conclusion would be that housing projects for poor people depend more on the speculation and inertial growth of land value in Lima's periphery and this could be an explanation why there are few TP projects in this area of the city. The normal situation (the profit depends more of the projects itself rather than land speculation) would be for MV projects that are for middle class.

Chapter 4: Research results and analysis

4.1 Problems and difficulties found in the fieldwork

During the fieldwork many different things than expected were found.

- Private developers were very reluctant to provide financial information, most of them considered that information as confidential. A lot of time is needed to gather information since the interviews were done to companies instead of individuals; schedule an appointment with the general manager or the responsible of the project took in average three trials.
- At the beginning the purpose of the research was to investigate in detail *Mivivienda* (MV) and *Techo Propio* (TP) projects; however, it was too difficult to access to information especially in MV projects. In the case of TP projects, because they are social housing projects, it was very useful to find a lot of information recorder in public institutions as *Fondo Mivivienda* and Ministry of Housing, so now the thesis only focus in TP projects. The size of the research has been reduced from 25 to 8 projects.
- The total number of *Techo Propio* project built in Lima have been fourteen, but two of them were built by Central Government and one by Municipality, and three of them were built in a modality “*Postulación Colectiva*” which does not include the acquisition of the plot (actually this modality has been a failure). Therefore, focus only on TP projects built in Lima’s periphery by private institutions (to isolate or minimize the effect of public intervention) and considering only the modality of “new house” which include the acquisition of plots, there are a total of eight TP projects. The sample, despite is the universe, is very small: only 8 TP in the past decade (2001 – 2010). With a size of 8 projects is difficult to draw conclusions if a statistical analysis is elaborated.
- Some projects (three) mixed different programs in the same project: MV & TP, so it could distort the results of the investigation. Managers gave different reasons to do that, but in general the perception was that because of TP is not profitable they include MV to compensate their profits.
- It was found different situations for plots in each project: charges, special purchases (real estate investment trust, acquisition through warranties), etc.
- In five projects plots were bought after the beginning of the social housing program around year 2001 (contrary to what it was supposed to prove the hypothesis), so it is not possible to isolate the effect of subsidy speculation from land strategy for these projects because the subsidy can influenced the decision of making a profit (when the government announced the program this could create a subsidy speculation in developers and landowners).
- Plan A (interviews to private developers) and B (searching information in the newspaper archive) were not enough. Particularly, newspaper archive has limited information about property and plots announcements and advertising, most of the information only provides phone numbers outdated or incomplete information. Thus, it was necessary a plan C.

4.2 Adjustment in the methodology

Since there were many problems and surprises during the fieldwork it was necessary to adjust the methodology of the research.

- Only focus in *Techo Propio* (TP) projects, because of the access to information.
- Not only analyze the north area but also all the periphery of Lima: north, east, and south.
- Complement the quantitative analysis with a qualitative analysis, because the first one, due to the small sample (actually the universe) in addition to the cash flow analysis can only include a simple descriptive statistical analysis. The sample is the universe: 8 projects.
- Only choose projects in the modality of “new house”, that means the development include the construction of a new house and the plot.
- Divide the study in two groups: plots bought before and after the beginning of social housing program *Techo Propio*. Projects in group “before” can respond the research question.
- Plan C was used as a complement. As a former consultant in *Fondo Mivivienda* and *Ministry of Housing* I had the advantage to know senior directors and officials, so I got some of the data through friends, relationships, and consultants.
- Eliminate hypothesis 2 about *Mivivienda*, because this type of project will not be analyzed in detail, only use MV to make macro comparisons.

Assumptions and considerations

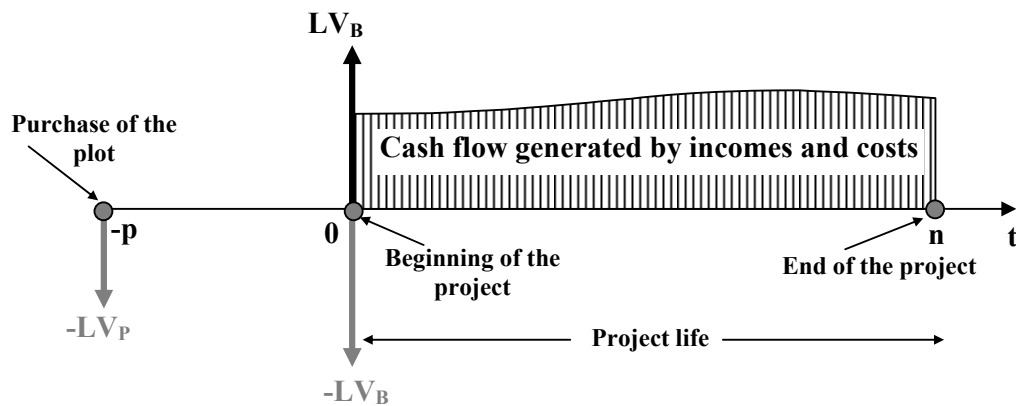
Because of the problem found during the fieldwork and not all information for the cash flow were gotten some assumptions and additional definitions were made.

- Beginning of the *Techo Propio* program: date when the government announces to implement this social housing program with the new administration in the second half of 2001.
- “Projects before”: projects whose plots were bought before the beginning of *Techo Propio* program.
- “Projects after”: projects whose plots were bought after the beginning of *Techo Propio* program.
- Ratio TP/total: In projects which combines TP & MV houses most of the information about costs consider all project. In order to elaborate the cash flow regarding only TP projects, it was distributed all the costs and plot area proportionally applying the ratio: number of TP houses / total number of houses.
- Land strategy: For the group of “projects before” the land strategy is only to wait time from the date of purchase to the beginning of the project without doing anything. For the group of “projects after” the land strategy can include the effect of subsidy combined with the speculation to wait time until the land

increase its value without doing anything. For both groups of projects other things that can be part of land strategy: to buy a plot and wait until government built infrastructure (pipelines, electricity, roads), mix land uses (TP & MV), etc., but this research does not consider the mix of uses inasmuch as this effect is corrected by the ratio TP/total.

- Date of purchase: date when the plot was acquired according to Peruvian National Office of Property Registration.
- Beginning of the project: date when the first dwelling was sold according to the information provided by the developer during the interview.
- End of the project: date when the developer finishes the registration of each unit of housing in the National Office of Property Registration, after the end of construction works.
- LV_P : land value at the date of purchase
- LV_B : land value at the beginning of the project
- LV_V : land value at the date of valuation (certain date of the information provided), usually after the beginning of the project.
- NPV_L : Net present value because of land strategy. It is essentially the profit that the developer obtains without doing anything, only buying the plot and waiting time. NPV_L is the difference between the values of land at different times corrected for inflation and discount rates. NPV is calculated at the beginning of the project.
- NPV_P : Net present value because of the project. It is the profit obtained in the cash flow considering the sales revenues and all the costs of the project. The land value at the beginning of the project (LV_B) or at the date of some valuation (LV_V) is considered as a cost in the cash flow instead of the land value at the date of purchase (LV_P).
- NPV_T : total net present value. It is the total profit obtained considered the project life since the purchase of the plot. It is the sum of the two previous.

Figure 5: Cash flow analysis and the different components of NPV when LV_B is known



To calculate all the NPVs it can use the following formulas ($t = 0$):

$$NPV_L = -LV_P * (1 + K_L)^p + LV_B \dots (7)$$

$$NPV_P = -LV_B + \sum_{i=0}^n \frac{I_i - C_i}{(1 + K_P)^i} \dots (8)$$

$$NPV_T = -LV_P * (1 + K_L)^p + \sum_{i=0}^n \frac{I_i - C_i}{(1 + K_P)^i} = NPV_L + NPV_P \dots (9)$$

Where all are real values (corrected by inflation):

p: number of months from the date of plot purchase to the beginning of the project

n: number of months from the beginning to the end of the project

K_P : discount rate for project.

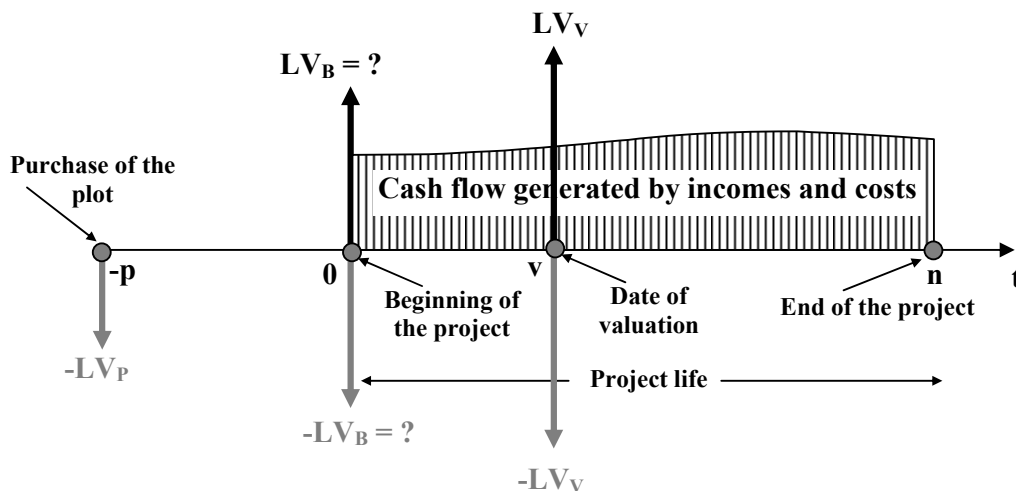
K_L : discount rate for land.

I_i : incomes at month "i"

C_i : costs at month "i"

In some projects it was not possible to get the information about land values at the beginning of the project (LV_B is unknown); instead of this it was got information about the land value in other date that it is called the land value at the date of valuation (LV_V). Using LV_V (discounted) instead of LV_B is an assumption that might create a distortion in the real land value at time zero but since there is no further information, LV_V has been used as an approximation. Thus, the formulas for NPV using this information are ($t = 0$):

Figure 6: Cash flow analysis and the components of NPV when LV_B is unknown: using LV_V



$$NPV_L = -LV_P * (1 + K_L)^p + \frac{LV_V}{(1 + K_L)^v} \dots (10)$$

$$NPV_P = -\frac{LV_V}{(1 + K_L)^v} + \sum_{i=0}^n \frac{I_i - C_i}{(1 + K_P)^i} \dots (11)$$

$$NPV_T = -LV_P * (1 + K_L)^p + \sum_{i=0}^n \frac{I_i - C_i}{(1 + K_P)^i} = NPV_L + NPV_P \dots (12)$$

- Correction for inflation rate: The financial information gathered from different projects is expressed not only in different currencies but also in different times in nominal terms, so it is necessary a correction for inflation rate to convert the nominal in real dollars. Similarly to the exchange rate, all the information is found in statistics of the web site of the Peruvian Central Bank (<http://estadisticas.bcrp.gob.pe/index.asp?sFrecuencia=M>) If P_0 is the nominal price at time = 0, to calculate the real price after “n” periods:

$$P_n = P_0 \times (1 + \pi_0) \times (1 + \pi_1) \dots (1 + \pi_{n-1}) \dots (13)$$

Conversely, if P_n is the nominal price at a certain time, to calculate the real price before “n” periods:

$$P_0 = \frac{P_n}{(1 + \pi_0) \times (1 + \pi_1) \dots (1 + \pi_{n-1})} \dots (14)$$

Because of in the cash flow analysis it was used monthly periods, all the information about exchange and inflation rate used is monthly.

- Correction for exchange rate: in Peru the currency is the sol. Because all historic macroeconomic information is in national currency and the exchange rate is expressed in American dollars, this research presents all the monetary results in that currency instead of euros. All the information is found in statistics of the web site of the Peruvian Central Bank (*Banco Central de Reserva del Perú*: <http://estadisticas.bcrp.gob.pe/index.asp?sFrecuencia=M>). To transform from soles to American dollar it was used:

$$1 \text{ dollar} = 1 \text{ sol} \times \left(\frac{1}{\text{nominal exchange rate}} \right) \dots (15)$$

All the cash flow analysis will be elaborated in local currency (soles) and at the end, for the comparison of the results among all projects, the results will be corrected for exchange rate transforming to US dollars at present moment (at July 2010).

- Correction for discount rate: it was assumed that the discount rate for project is the same as the discount rate for land: $K = K_P = K_L$. Instead of working with all the values of K month per month, this research has used only a value for K , assuming constant over time for all project. That value was assumed as an approximation of the average real interest rate for mortgage credit in Peru during the previous decade, it was around 10% annual. It was assumed that this discount rate reflects the cost of opportunity of the capital for private real estate investors and at the same time the level of risk of the investment. However, it is necessary to enhance that the risk to manage and execute a housing project in Peru is not the same as to the risk of buying a plot and wait time for the increase of its value without doing anything; thus K_L should be lower than K_P . Since it is too difficult to calculate K_L , the research has considered both values equal to 10% annual, although the conclusions will take into account this fact. Cash flow analysis was done considered monthly periods, so to transform the annual discount rate to a monthly discount rate it was used the next formula (monthly $K = 0.797\%$):

$$K_{monthly} = (1 + K_{annual})^{1/12} - 1 \dots (16)$$

- Assumptions in the cash flow: the incomes comes from the sales of dwellings which are received in three parts: 10% when the dwelling is sold (savings of the householder), 45% after two months (the government disburses the subsidy), and the remaining 45% after two more months (a private bank disburses the credit). This time lag of two months between payments is a formal scenario. Actually, there is a lot of uncertainty in this variable; sometimes it takes several months.

Regarding costs, as it was explained, the information comes mainly from the interviews with developers and from the files of *Fondo Mivivienda*, the public institution which promoted *Techo Propio*. In few cases there has been lack of information especially in the price of the plot when it was bought, so other sources from expert appraisers were used. Other detailed costs were assumed for comparison with projects with more complete information. All the cash flows have a monthly periodicity. The structure of costs included in all cash flow is: serviced land, construction, design cost, marketing cost, financial costs, legal fees, overhead, taxes, and profit for the builder. In some projects, some of the costs are combined into a single item.

- Finally, it is necessary to mention that this research will keep the anonymity of the names of the companies whose projects are studied. Companies are very sensitive to provide and publish financial information and government too because its participation in social housing programs is very large. For this reason, it has been encoded all the names of the projects with capital letters.

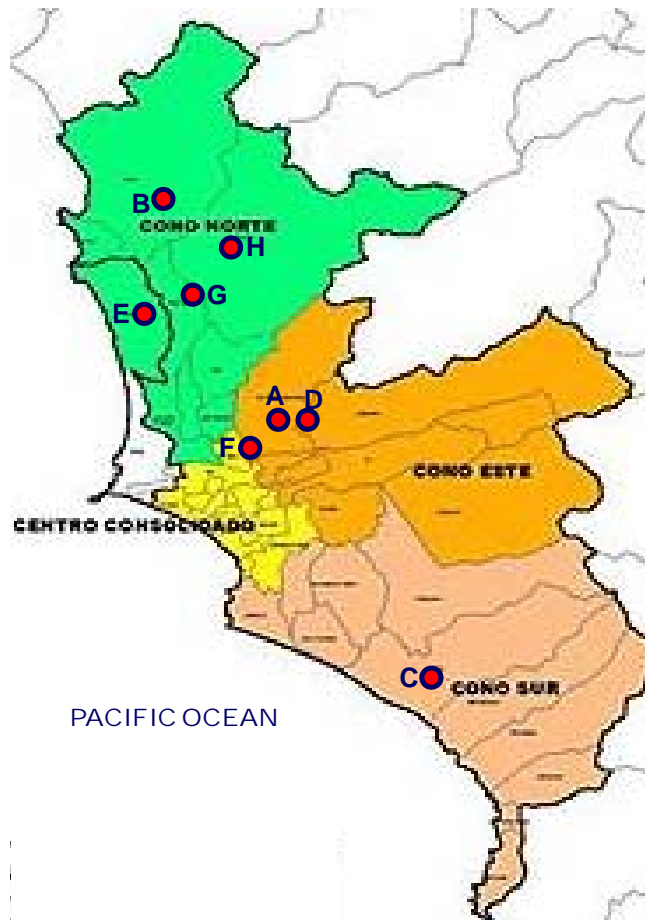
4.3 General characteristics of the sample

As it was explained before, Lima Metropolitan Area is divided in 4 areas: the Central Metropolitan Area and the peripheral areas or “Conos” which extend in all directions. The spatial distribution of 8 TP projects selected for the research (the sample is the universe) is: 4 in the north, 3 in the east, and 1 in the south.

Table 6: Summary of *Techo Propio* projects in Lima’s periphery

Project	Area	N° houses	TP	MV
A	East	1,200	1,200	0
B	North	628	628	0
C	South	478	478	0
D	East	410	328	82
E	North	504	504	0
F	East	3,400	100	3,300
G	North	207	139	68
H	North	1,034	1,034	0
Total		6,827	4,411	3,450

Chart 5: Location of *Techo Propio* projects in Lima’s periphery



As it can be appreciated in Table 6, for a total of 8 projects and 6,827 dwellings which were considered at the beginning to built and sell only as TP houses, at the end around the 65% were sold as TP. The big difference is in project F; the company projected since the beginning only MV and after that they considered include a small proportion of TP houses.

Also it can be appreciated in Table 6 three projects have combined MV (middle class) with TP (poor) houses in order to improve profits: projects D, F, and G. Mixed different types of program in the same project creates a distortion, or a land strategy opportunities. For this reason in this group of projects it was used the ratio TP/total to isolate the effect of MV houses. This correction is reasonable because there are actually few physical differences between houses of MV & TP in the same project (only a backyard or a balcony, or different finished materials) but the prices are very different, MV price is between two and three times TP price as it can be seen in Table 7.

Table 7: Projects which combines TP & MV houses. Differences in prices

Project	TP price	MV price	TP / MV
D	\$ 8,000	\$ 18,885	42.36%
F	\$ 6,615.37	\$ 22,119.09	29.91%
G	\$ 12,360	\$ 20,845	59.29%

Picture 1: Techo Propio and Mivivienda houses in the same project. Source: skyscraperperu.



According to the adjustments in the methodology that were explained, the projects were divided in two groups: “projects before”: B, C and D; and “projects after”: A, E, F, G and H. Recall that the criterion to divide the projects in before and after is the date of the plot was purchased in contrast to the date of the beginning of the implementation of *Techo Propio* program in the half of 2001. This division is important because if land was bought after the announcement of TP then the subsidy influenced the decision of making a profit. “Projects before” isolate the subsidy effect, so with the result of this group of projects the hypothesis can be proved.

Table 8: Groups of projects. The shaded cells are “project before”

Project	date of the plot purchase
A	June 2003
B	June 1997
C	September 1997
D	March 1973
E	June 2002
F	November 2007
G	June 2006
H	March 2006

4.4 Land values variation in plots

Regarding the land value of the project’s plot there are four important dates to define that value: when the plot was purchased, the beginning of the project (first sale), the date of some valuation of the project (depend on the information found), and the end of the project (property registration). To obtain the increment in land value applying a land strategy, that means, the NPV_L (without doing anything), ideally, it is necessary to compare the values at the date of plot purchase (LV_P) and at the date of the beginning of the project (LV_B). However, in some projects the last information is unknown, so this was replaced for the value obtained in a certain date, the date of the valuation of the project (LV_V). Table 9 shows the four dates for each project.

Table 9: Land values: comparison in different dates

Project	date of the plot purchase	date of the beginning of	date of the valuation of	end of the project:
A	June 2003	July 2003	July 2006	December 2007
B	June 1997	August 2003	December 2008	September 2010
C	September 1997	March 2003	May 2003	December 2010
D	March 1973	February 2004	July 2006	January 2009
E	June 2002	January 2008	May 2009	January 2010
F	November 2007	January 2008	August 2008	March 2010
G	June 2006	December 2007	August 2009	March 2010
H	March 2006	July 2007	July 2008	March 2010

Because the raw data mix different currencies and times, it was necessary to correct the data for inflation considering July 2010 (until July 2010 it possible to get this information for Peruvian Central Bank at this moment) and after that for exchange rate. Because the increment in land value was generated in different time intervals for each project, to make a fair comparison it was calculated the increment in land value per area and per time. The third column of Table 10 shows the value of plot per square meter at the date of plot purchase and the fourth column the value of the plot at a certain date of the valuation of the project (in project B is the same of the date of the beginning of the project and in the rest is different). The last column shows the average increment in land value in American dollars per square meter per month. That increment is calculated according to the formula:

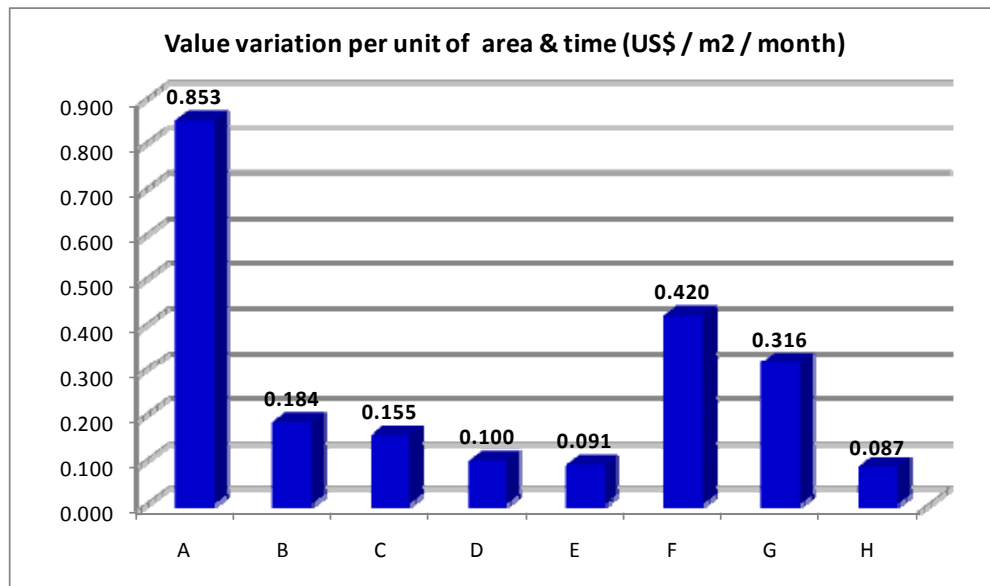
$$\frac{\frac{\Delta LV}{A}}{t} = \frac{LV_B - LV_P}{\Delta t} \dots (17)$$

Table 10: Land values variation per area and per time. Real dollars at July 2010

Project	Area	plot value per m2 (date of plot)	plot value per m2 (date of valuation)	Value variation per unit of time (US\$ / m2 / month)
A	East	\$22.48	\$54.06	0.853
B	North	\$1.37	\$15.01	0.184
C	South	\$7.12	\$17.68	0.155
D	East	\$5.55	\$45.45	0.100
E	North	\$4.60	\$10.78	0.091
F	East	\$17.05	\$20.84	0.420
G	North	\$23.20	\$35.20	0.316
H	North	\$79.99	\$82.41	0.087
Mean				0.28
Median				0.17
Standard Deviation				0.24

Chart 6 is a bar chart which compares the land value variation per unit of time among the eight projects. It shows graphically the results of Table 10.

Chart 6: Land values variation per area and per time: bar chart



Regarding the location of the projects, according to Table 10 and Chart 6 plots in the north area experience an average increment of land value of US\$ 0.170 per m² per month; plots in the east area US\$ 0.458 per m² per month, and the unique plot in the south area US\$ 0.155 per m² per month. The mean for the 8 plots is US\$ 0.28 / m² / month. Although it is not prudent to draw conclusion from a small sample, these results show in a certain way the real tendency in Lima: it is known that nowadays the north and east peripheries of Lima have the greater and faster increment of land values. These results are shown only as a curiosity; they are not relevant to the purpose of the research.

4.5 Qualitative and quantitative analysis per each project

All the eight projects have been encoded, and separated them in two groups: “projects before” and projects after”.

- “Projects before”: B, C, D
- “Projects after”: A, E, F, G, H

4.5.1 Projects before

They are the projects whose plot were acquired before the beginning of the implementation of the *Techo Propio* program in the second half of 2001 with the new administration. In this group are projects B, C, and D, located in the north, south, and east periphery of Lima respectively. In these projects it can be isolated the subsidy effect because of the announcement of the program. With these projects the hypothesis of the research can be strongly proved.

4.5.1.1 Project B

Description of the project

This project has 628 dwellings of 34.00 m² of built area; all of them are TP houses with independent plots (construction of one story with possibility to extend to two stories with a FAR of 0.38) and were sold at the same price of US\$ 8,000. It is located in the north periphery of Lima. The plot was bought in June 1997; the sales started around August 2003 (the beginning of the project) and finished in May 2005. The construction works started in April 2004 and finished at the end of 2006. The end of the property registration is estimated to be around September 2010.

In this project the information gathered was obtained from the file of FMV, interview and emails received from the developer.

Qualitative analysis

In this project the developer applied a land strategy (defined in the terms explained in the methodology). After the announcement of TP housing program in 2001, the developer decided not to wait more time than previously under the hypothesis that he thought that the subsidy of the program given by the government would be more attractive than his land strategy (doing nothing, waiting time for an increase in plot price). In this case, at the beginning of the project there were many problems with the sewage because the main pipeline was located more than seven kilometers from the project. For this reason the project was delayed and the developer (an influential man in the political environment) used his political relationships to get that the public company of water and sewage made the pipelines works as soon as possible.

Analyzing the value of the plot in different dates without doing any rigorous cash flow analysis, it is possible to draw some conclusions easily. The plot was bought in US\$ 1 / m² in June 1997. In August 2003 when the project started (first dwelling was sold) the plot was worth US\$ 10 / m². To compare both values, it is necessary to correct the first one for inflation. According to the historic inflation rate information, the factor to correct from June 1997 to August 2003 is 1.2. Therefore, in real values of August 2003, the land value incremented US\$ 8.80 / m² (without consider discount rate); this is the value that the developer won only waiting time (around 6 years) after buying the plot without doing anything.

Quantitative analysis

After elaborating the cash flow and all the calculation it was obtained the results of the NPV because of project, land and total NPV. All the details can be appreciated in Annex 3. The project earned a total good profit but the profit because of land if even greater than the total. If the plot had been bought at the same date of the beginning of the project (August 2003) instead of June 1997, the project would not have been earned value. In this project the developer earned

much more money because of the land than because of the project itself; this project is according to the hypothesis.

Table 11 shows all the indicators of project B per each component: project, land and the total. The most important indicators for this research are the unitary NPV, that is the NPV per m² of plot gross area and the profitability or ROI (return on investment) defined as the profit earned (NPV) per each unit of cost (at present value corrected by discount rate). The NPV because of land is 7.60 soles more than the total NPV per each square meter of plot invested. On the other hand, it is indisputable the very high profitability obtained because of land in this project; if the developer had only bought the land and waited time without doing anything he would have obtained about 5 soles per each sol invested in the plot, his unique investment (508.39%); however, the developer invested actually in a housing project, so he had to invest in addition to the plot in other costs (construction, legal issues, etc.) and at the end of the project he obtained 16 cents per each sol invested in the housing project (16.48%).

Table 11: Indicators for project B

	<u>TOTAL</u>	<u>PROJECT</u>	<u>LAND</u>
Profit per m2 built: NPV / built area	S/.108.8 /m2	-S/.38.6 /m2	S/.147.4 /m2
Profitability: ROI = NPV / total cost	16.48%	-4.78%	508.39%
Land value per m2: NPV / plot gross area	S/.21.5 /m2	-S/.7.6 /m2	S/.29.1 /m2
Land value per m2: NPV / plot net area	S/.41.1 /m2	-S/.14.6 /m2	S/.55.7 /m2
% increment of land value: %Δ LV = NPV / raw	375.25%	-133.13%	508.39%

4.5.1.2 Project C

Description of the project

This project has 478 dwellings of 33.50 m² of built area; all of them are TP houses with independent plots (construction of one story with possibility to extend to two stories with a FAR of 0.45) and were sold at the same price of US\$ 8,000. It is located in the south periphery of Lima. The plot was bought in September 1997; the sales started around July 2003 (the beginning of the project) and finished in October 2005. The construction works started in May 2003 and finished at the end of 2005. The end of the property registration is estimated to be around the end of 2010.

In this project the information gathered was obtained mainly from the file of FMV and emails and phone calls from one of the project managers. It was impossible to communicate with the owner of the company because it has changed the address, phone numbers, and name's company several times.

Qualitative analysis

In this project the developer applied a land strategy. After the announcement of TP housing program in 2001, the developer decided not to wait more time than previously under the hypothesis that he thought that the subsidy of the program given by the government would be more attractive than his land strategy (doing nothing, waiting time for an increase in plot price).

This project had many problems: tons of claims from householders, defaults to the construction workers, many changes of the project manager, and construction strike which delayed the project significantly. In order to finish the project and because of the social pressure the government gave a lot of help to the project. Before a rigorous quantitative analysis it is possible to draw that the developer got a negative profit unless he received some other benefits from government or other externalities or irregularities.

Analyzing the value of the plot in different dates before doing any rigorous cash flow analysis, it is possible to draw some conclusions easily. The plot was bought in US\$ 5.29 / m² in September 1997. In May 2003 when the project started the plot was worth US\$ 11.85 / m². To compare both values, it is necessary to correct the first one for inflation, so the real value of 5.29 is 6.28. Therefore, in real values of August 2003, the land value incremented US\$ 5.57 / m² (without consider discount rate); this is the value that the developer won only waiting time (around 6 years) after buying the plot without doing anything.

Quantitative analysis

After elaborating the cash flow and all the calculation it was obtained the results of the NPV because of project, land and total NPV. All the details can be appreciated in Annex 4. According to the data and the cash flow analysis the project as a total result lost money but the profit because of land was positive. If the developer had bought the plot continuing with his land strategy after May 2003 without build any project he would have obtain a positive profit (more than 914 mil real soles as a present value). This project is according to the hypothesis.

Table 12 shows all the indicators of project C per each component: project, land and the total. The NPV because of land is S/. 15.10 per m² and is 51.20 soles more than the total NPV per each square meter of plot invested. On the other hand, the profitability obtained because of land is the only positive; if the developer had only bought the land and waited time without doing anything he would have obtained about 59 cents per each sol invested in the plot, his unique investment (59.16%); however, the developer invested actually in a housing project, so he had to invest in addition to the plot in other costs (construction, legal issues, etc.) and at the end of the project he obtained a loss of 16 cents per each sol invested in the housing project (16.48%).

Table 12: Indicators for project C

	TOTAL	PROJECT	LAND
Profit per m2 built: NPV / built area	-S/.136.5 /m2	-S/.193.5 /m2	S/.57.1 /m2
Profitability: ROI = NPV / total cost	-15.51%	-20.66%	59.16%
Land value per m2: NPV / plot gross area	-S/.36.1 /m2	-S/.51.2 /m2	S/.15.1 /m2
Land value per m2: NPV / plot net area	-S/.61.9 /m2	-S/.87.7 /m2	S/.25.9 /m2
% increment of land value: $\% \Delta LV = NPV / raw$	-141.41%	-200.57%	59.16%

4.5.1.3 Project D

Description of the project

This project has 410 apartments of 46.00 m² of built area; it combines houses for middle class and poor people; 328 are TP houses and 82 are MV distributed in blocks of five stories with a FAR of 2.1. A curious situation in this project is that in spite of the apartments for MV and TP have different prices, physically they do not have enough differences, only a backyard in the first floor for MV apartment. It is located in the east periphery of Lima. The plot was bought in March 1973; the sales started in February 2004 and finished in July in this year, so the sales speed is very high in this project. The construction works started in November 2006 and finished at October 2007. The end of the property registration was in January 2009.

In this project the information gathered was obtained mainly from the file of Peruvian Ministry of Housing and interviews with the project manager.

Qualitative analysis

Because of the combination of different types of houses for different socio economic sector, the developer use another variation of his land strategy, the mix of uses, and a difference in price (price of MV is more than twice the price of TP). MV apartments were sold about US\$ 18,885 and TP in US\$ 8,000. At the beginning the project only offered TP apartments but after several months, and under the hypothesis that land increased its value because of the expectation of the subsidy and the public infrastructure executed in the close environment, it was possible to offer MV project also.

Regarding the plot, this project is a special case because it was bought in a time when Peru had other local currency, the “old sol”. The current currency, the “new sol” is equivalent to a million of “old soles”, this is because the very high inflation rate that Peru suffered especially during the 1980’s. For this reason, the instability of the local currency, for this project all the cash flow was elaborated since the beginning in US dollars and in order to obtain real dollars it was used the historical US inflation from some sources such as the Federal Reserve, the Department of the Treasury and the magazine Inflation Data.

The plot was bought at that time because of an agricultural purpose; at that time the company was dedicated not only to real estate business but also to agricultural business. After thirty one years the owner decides to invest in a social housing in this plot.

The plot was bought in US\$ 1.08 / m² in March 1973 and in July 2006 the plot was worth US\$ 41.69 / m². Correcting for inflation and comparing both values at the date of the beginning of the project (February 2004) the land value incremented in $38.15 - 2.88 = \text{US\$ } 35.27 / \text{m}^2$; this is the value that the developer won per square meter only waiting time (around 31 years) after buying the plot without doing anything. This estimation does not consider the discount rate, that if it is included the result is totally different as it is explained in the quantitative analysis.

Quantitative analysis

After elaborating the cash flow and all the calculation it was obtained the results of the NPV because of project, land and total NPV. All the details can be appreciated in Annex 5. According to the data and the cash flow analysis the project as a total result obtain a positive profit. It can have two scenarios: scenario A, considering the plot as a sunk cost because it was bought 31 years ago and with another purpose (agricultural business that generated incomes and costs); and scenario B considering the cost of the plot, correcting by inflation and bring the result to the present value.

The results of scenario A, plot as a sunk cost, can be appreciated in the Table 13. Checking the third line, the NPV / plot gross area, the NPV because of land is US\$. 30.30 per m² and represent a 39% of the total NPV which is US\$ 78.0 per each square meter of plot invested; that means, in this case the project earned more money because of the project itself (cash flow) instead of land strategy. On the other hand, checking the second line of the table, the profitability obtained because of land is in theory infinitum, because of it was assumed that the initial cost of the plot was zero and the total profitability obtained at the end of the project was 33.67%, that means that the developer earned 34 cents per each US dollar invested in the housing project.

Table 13: Indicators for project D: scenario A: consider the plot as a “sunk cost”

	TOTAL	PROJECT	LAND
Profit per m2 (built): NPV / built area	US\$31.9 /m2	US\$19.5 /m2	US\$12.4 /m2
Profitability: ROI = NPV / total cost	33.67%	18.21%	#iDIV/0!
Land value per m2: NPV / plot gross area	US\$78.0 /m2	US\$47.7 /m2	US\$30.3 /m2
Land value per m2: NPV / plot net area	US\$80.1 /m2	US\$49.0 /m2	US\$31.1 /m2
% increment of land value (%Δ LV = NPV / raw	#iDIV/0!	#iDIV/0!	#iDIV/0!

The results of scenario B, plot not as a sunk cost, can be appreciated in the Table 14. Checking the third line, the NPV / plot gross area, the NPV because of land is negative (– US\$ 24.50 / m²). That means, in real terms and considering the cost of opportunity in the time, this plot decreased its value because of the great number of years the discount factor produce in the calculations. On the other hand, checking the second line of the table, the profitability obtained because of land is also negative (– 44.67%) and the total profitability obtained at the end of the project was 8.11%, that means that the developer earned 8 cents per each US dollar invested in the housing project.

In both scenarios this project is opposite to the research hypothesis.

Table 14: Indicators for project D: scenario B: consider the plot not as a “sunk cost”

	TOTAL	PROJECT	LAND
Profit per m2 (built): NPV / built area	US\$9.5 /m2	US\$19.5 /m2	-US\$10.0 /m2
Profitability: ROI = NPV / total cost	8.11%	18.21%	-44.67%
Land value per m2: NPV / plot gross area	US\$23.2 /m2	US\$47.7 /m2	-US\$24.5 /m2
Land value per m2: NPV / plot net area	US\$23.9 /m2	US\$49.0 /m2	-US\$25.1 /m2
% increment of land value (%Δ LV = NPV / raw	42.41%	87.08%	-44.67%

In project D it is important to mention that, in the real case, when it is considered TP and MV dwellings, the project as a whole increase its total NPV in 455%

4.5.2 Projects after

They are the projects whose plot were acquired after the beginning of the implementation of the *Techo Propio* program in the second half of 2001 with the new administration. In this group are projects A, E, F, G, and H. In these projects cannot be isolated the subsidy effect because of the announcement of the program. These projects are not reliable to prove the hypothesis of the research.

4.5.2.1 Project A

Description of the project

This project has 1,200 apartments of 41.27 m² of built area distributed in blocks of five stories with a FAR = 3.55 (the highest FAR of all TP projects in Lima). It is located in the east periphery of Lima, very close to the project D. The plot was bought in June 2003; the sales started almost immediately in July 2003 and finished around the middle of the year 2006. The construction works started in September 2003 and finished at the end of 2006. The end of the property registration was around the end of 2007.

In this project the information gathered was obtained mainly from the file of FMV, there was serious limitation with the information because the developer and the manager were very reluctant to provide data. Fortunately, another TP project,

the project D is almost in the same location and it was executed almost during the same time, so assumptions and approximation were made such as to take some costs as the same.

Qualitative analysis

In this project the developer definitively did not apply a land strategy, he preferred not to wait time under the hypothesis that he thought that the subsidy of the program given by the government would be more attractive than a land strategy. Two important factors determined the success of this project: the high FAR, 3.55, the developer optimized the space building blocks of five stories that share a common plot; other factor was the volume of the project: 1,200 apartments that generated a higher incomes than other projects.

Analyzing the value of the plot in different dates before doing any rigorous cash flow analysis, it is possible to draw some conclusions easily. It was possible to get only raw data about the value of the plot when it was bought. According to some appraisal document serviced land in that location during May 2003 was in US\$ 35 / m². However, the plot of this project was bought as a raw land, so an approximation can be deduct the cost of the urbanization which at that time was around US\$ 20 / m², so the cost of the plot could be US\$ 15 / m² at June 2003. Taking the valuation of land of the project D at July 2006 in US\$ 41.69 / m², it possible to compare both values after inflation correction: $38.71 - 14.98 = \text{US\$ } 23.73 / \text{m}^2$ is the increment in real values at July 2003 (without consider discount rate). In this case the date of the valuation (July 2006) was several months after the beginning of the project, so it is complicated to isolated the effect of the increment of the land value because of the land strategy from the subsidy and construction effect.

Quantitative analysis

After elaborating the cash flow and all the calculation it was obtained the results of the NPV because of project, land and total NPV. All the details can be appreciated in Annex 2. Checking the third line of Table 15, the NPV / plot gross area, the NPV because of land is S/. 23.50 per m² and represent a 48% of the total NPV which is S/. 87.0 per each square meter of plot invested; that means, in this case the project earned slightly more money because of the project itself (cash flow) instead of land strategy. This project is opposite to the hypothesis.

On the other hand, the profitability obtained because of land is the highest, if the developer had only bought the land and waited time without doing anything he would have obtained about 80 cents per each sol invested in the plot, his unique investment; however, the developer invested actually in a housing project, so he had to invest in addition to the plot in other costs (construction, legal issues, etc.) and at the end of the project he obtained 9 cents per each sol invested in the housing project.

Table 15: Indicators for project A

	TOTAL	PROJECT	LAND
Profit per m2 built: NPV / built area	S/.49.0 /m2	S/.25.5 /m2	S/.23.5 /m2
Profitability: ROI = NPV / total cost	9.20%	4.58%	79.57%
Land value per m2: NPV / plot gross area	S/.87.0 /m2	S/.45.2 /m2	S/.41.8 /m2
Land value per m2: NPV / plot net area	S/.174.0 /m2	S/.90.5 /m2	S/.83.6 /m2
% increment of land value: %Δ LV = NPV / raw l	165.66%	86.09%	79.57%

4.5.2.2 Project E

Description of the project

This project has designed to be developed in three stages for a total of 1,700 dwellings; the research focus in the first stage (the only one that finished) that includes 504 dwellings of 36.00 m² of built area, all of them are TP with a FAR of 0.29. It is located in the north periphery of Lima. The plot was bought in January 2002; the sales started in January 2008 and finished in October in that year, but the first 204 houses were bought at a price of S/. 42,250 and after that the price increased in S/. 42,600 for the remaining 300. The construction works started in May 2009 and finished at November in the same year. The end of the property registration was in January 2010.

In this project the information gathered was obtained from the file of FMV and from the interview to the developer.

Qualitative analysis

In this project the developer apply in some way a land strategy, he acquired the 50% of the plot as a warranty and the other 50% was paid. Some important factors determined the relative success of this project: the high price of houses in contrast to other TP projects in Lima (26% more than the second higher price). It perhaps was possible in the last years (this is one of the last projects) because of the general increase of land prices in Lima and the betterment that the peripheral area experience because of some public infrastructure works. Other important factor was the sales strategy, not only the speed of sales (50 houses per month as an average) but also the fact that houses were sold many months before the beginning of the construction.

Analyzing the variation in the land value of the plot, it possible to observe that during January 2002 when the plot was bought the value was US\$ 3.00 / m², and in May 2009 the value was US\$ 10.00 / m². Correcting for inflation at the beginning of the project in January 2008 it possible to compare both values: $9.36 - 3.47 = \text{US\$ } 5.89 / \text{m}^2$ is the increment in real values (without consider discount rate). In this case the date of the valuation (May 2009) was many months after the beginning of the project, so it is fairly complicated to isolated the effect of the increment of the land value because of the land strategy from the subsidy and construction effect.

Quantitative analysis

After elaborating the cash flow and all the calculation it was obtained the results of the NPV because of project, land and total NPV. Something important to explain is that all data collected, especially costs considers all the three stages (1,700); because the research focus only in the first stage (finished stage) in order to make a correction the costs were multiplied by the factor 504/1,700. All the details can be appreciated in Annex 6. Checking the third line of Table 16, the NPV / plot gross area, the NPV because of land is S/. 1.30 per m² and represent only less than 1% of the total NPV which is S/. 161.20 per each square meter of plot invested; that means, in this case the project earned much more money because of the project itself (cash flow) instead of land strategy. This project is opposite to the research hypothesis.

Regarding the profitability, the ROI obtained because of land is 5.46%, if the developer had only bought the land and waited time without doing anything he would have obtained about 5 cents per each sol invested in the plot, his unique investment; however, the developer invested actually in a housing project, so he had to invest in addition to the plot in other costs (construction, legal issues, etc.) and at the end of the project he obtained 17 cents per each sol invested in the housing project.

Table 16: Indicators for project E

	TOTAL	PROJECT	LAND
Profit per m ² (built): NPV / built area	S/.166.0 /m ²	S/.164.7 /m ²	S/.1.3 /m ²
Profitability: ROI = NPV / total cost	16.67%	16.52%	5.46%
Land value per m ² : NPV / plot gross area	S/.161.2 /m ²	S/.159.9 /m ²	S/.1.3 /m ²
Land value per m ² : NPV / plot net area	S/.322.5 /m ²	S/.319.9 /m ²	S/.2.6 /m ²
% increment of land value (%Δ LV = NPV / raw	688.66%	683.20%	5.46%

4.5.2.3 Project F

Description of the project

This project has designed thinking in middle class (MV) but after some negotiation with the government, the project included 100 TP apartments in addition to the 3,300 apartments of MV with a FAR of 1.61. It is located in the east periphery of Lima. The plot was bought in November 2007. There was a special situation with the sales in this project because TP apartments were sold by the municipality of the district in January 2008 (the 100 TP apartments). The construction works did not differentiate between MV and TP, the blocks of apartments contain both types of dwellings without any physical significant difference, only the price: TP was sold in S/. 20,850 and MV in S/. 64,000 (more than 3 time TP's price). As a reference the construction of the blocks to TP started in May 2009 and finished at November in the same year. The end of the property registration was in March 2010.

In this project the information gathered was obtained from the file of FMV and from the interview to the developer.

Qualitative analysis

In this project the developer focus more in a construction strategy rather than in a land strategy. The developer is a well known construction company in Peru with a lot of experience in large projects, so its strategy was to minimize costs and construction time and organize the apartments in block with a certain density (FAR = 1.61). Because of the big size of the project (3,400 apartments) it was possible to achieve some economies of scale. The success of the project was because of MV apartments; TP was only a small proportion of the entire project that was irrelevant to the developer from a economic point of view.

Analyzing the variation in the land value of the plot, it possible to observe that during November 2007 when the plot was bought the value was US\$ 14.67 / m², and in August 2008 the value was US\$ 19.56 / m². Correcting for inflation at the beginning of the project in January 2008 it possible to compare both values: $18.79 - 14.77 = \text{US\$ } 4.02 / \text{m}^2$ is the increment in real values (without consider discount rate). In this case the date of the valuation (August 2008) was few months after the beginning of the project, so it is possible in some way to reduce the effect of the increment of the land value because of the land strategy from the subsidy and construction effect.

Quantitative analysis

All the calculations was done consider only TP projects, so it was used the factor $\text{TP/total} = 100/3,400$ to correct especially costs. This is because the research purpose is to focus only in TP so it is necessary to isolate it from MV. After elaborating the cash flow and all the calculation it was obtained the results of the NPV because of project, land and total NPV, and those results show a high negative profit. It is necessary to clarify that Table 17 do not show the real results, because the real project had a combination of MV and TP apartments and the real profit was very high positive because of MV. All the details can be appreciated in Annex 7. Checking the third line of Table 17, the NPV / plot gross area, the NPV because of land is S/. 6.40 per m² and the total NPV is - S/. 409.0 per each square meter of plot invested; that means, in this case the project would have earned money only because of the land strategy. This project might prove the research hypothesis. However, considering all the apartments MV and TP together, the profit because of the project is higher than the profit because of land.

Regarding the profitability, the ROI obtained because of land is 14.17%, if the developer had only bought the land and waited time without doing anything he would have obtained about 14 cents per each sol invested in the plot, his unique investment; on the other hand, if the developer had invested only in TP apartments (no MV), he would have lost 57 cent per each sol invested in the housing project.

Table 17: Indicators for project F: considering only TP dwellings

	<u>TOTAL</u>	<u>PROJECT</u>	<u>LAND</u>
Profit per m2 (built): NPV / built area	-S/.463 /m2	-S/.470 /m2	S/.7.2 /m2
Profitability: ROI = NPV / total cost	-56.75%	-57.13%	14.17%
Land value per m2: NPV / plot gross area	-S/.409.0 /m2	-S/.415.4 /m2	S/.6.4 /m2
Land value per m2: NPV / plot net area	-S/.743.6 /m2	-S/.755.2 /m2	S/.11.6 /m2
% increment of land value (%Δ LV = NPV / raw	-907.83%	-922.00%	14.17%

Regarding the real case, not only TP (100) but also MV dwellings (3,300), the results are totally different as it was shown in the Table 18. The project as a whole is highly profitable. The total unitary NPV indicates that the project earn 335 soles per each meter of plot invested but the unitary land NPV is 6.40 soles /m², so the contribution of land strategy is insignificant: in this project the most important was the project strategy: optimization of costs and marketing strategy to sell the apartments. The total NPV increases in 2,882 % in contrast to the previous case that consider only TP apartments.

Table 18: Indicators for project F: considering TP and MV dwellings (real case)

	<u>TOTAL</u>	<u>PROJECT</u>	<u>LAND</u>
Profit per m2 (built): NPV / built area	S/.12,880 /m2	S/.12,634 /m2	S/.245.7 /m2
Profitability: ROI = NPV / total cost	56.62%	54.95%	14.17%
Land value per m2: NPV / plot gross area	S/.334.7 /m2	S/.328.3 /m2	S/.6.4 /m2
Land value per m2: NPV / plot net area	S/.608.5 /m2	S/.596.9 /m2	S/.11.6 /m2
% increment of land value (%Δ LV = NPV / raw	742.91%	728.73%	14.17%

4.5.2.4 Project G

Description of the project

This project has designed at the beginning to include only TP dwellings, but in a later stage the project included MV dwellings also. It is possible to divide the project in three stages: the first year selling 84 TP houses at price of S/. 33,500, the second year selling 55 TP houses at price of S/. 42,000 and the last stage selling 68 MV houses. The project as a whole has a FAR of 0.77. It is located in the north periphery of Lima. The plot was bought in June 2006. Regarding only TP houses the sales starts at December 2007 and finishes at December 2009. The construction of the TP houses started in November 2008 and finished at December 2009. The end of the property registration was in March 2010.

In this project the information gathered was obtained from the file of FMV and from the interview to the developer.

Qualitative analysis

In this project the developer applied a land strategy through mix uses, combining TP and MV projects in the same plots. It is very clear that the developer change the price of TP houses in a second stage to compensate the loss and even in a third

stage he decided to increase the revenues selling the remaining houses as MV, with almost the same physical characteristics but with a higher price (MV price is in average 1.6 times the prices of TP price). If the company had not change prices and mixed uses the project would probably has been a failure.

Analyzing the variation in the land value, it possible to observe that in June 2006 when the plot was bought the value was US\$17.80 / m² and in August 2009 the value was US\$ 33.00 / m². Correcting for inflation at the beginning of the project in December 2007 it is possible to compare both values: 30.94 – 18.46 = US\$ 12.48 / m² is the increment in real values (without consider discount rate). In this case the date of the valuation (August 2009) was some months after the beginning of the project, so it is not possible to isolate the effect of the increment of the land value because of the land strategy from the subsidy and construction effect.

Quantitative analysis

All the calculations was done consider only TP projects, so it was used the factor TP/total = 139/207 to correct especially costs. This is because the research purpose is to focus only in TP so it is necessary to isolate it from MV effect. After elaborating the cash flow and all the calculation it was obtained the results of the NPV because of project, land and total NPV. It is necessary to clarify that Table 19 do not show the real results, because the real project had a combination of MV and TP apartments and the real profit was higher because of the higher MV price. All the details can be appreciated in Annex 8. Checking the third line of Table 19, the NPV / plot gross area, the NPV because of land is S/. 8.36 per m2 which represent 27% of the total NPV which is S/. 31.22 per each square meter of plot invested; that means, in this case the project earned more money because of the project itself instead of land strategy. The results of this project are opposite to the research hypothesis. Considering all the apartments MV and TP together, the profit because of the project is even higher than the profit because of land, so the results are still opposite to the research hypothesis.

Regarding the profitability, the ROI obtained because of land is higher than the total, if the developer had only bought the land and waited time without doing anything he would have obtained about 12 cents per each sol invested in the plot, his unique investment; on the other hand, if the developer had invested only in TP apartments (no MV), he would have obtained 8 cent per each sol invested in the housing project.

Table 19: Indicators for project G: considering only TP dwellings

	<u>TOTAL</u>	<u>PROJECT</u>	<u>LAND</u>
Profit per m2 (built): NPV / built area	S/.80.4 /m2	S/.58.9 /m2	S/.21.5 /m2
Profitability: ROI = NPV / total cost	7.53%	5.41%	12.02%
Land value per m2: NPV / plot gross area	S/.31.2 /m2	S/.22.9 /m2	S/.8.4 /m2
Land value per m2: NPV / plot net area	S/.61.9 /m2	S/.45.3 /m2	S/.16.6 /m2
% increment of land value (%Δ LV = NPV / raw	44.90%	32.88%	12.02%

Regarding the real case, not only TP but also MV dwellings, the project is very profitable. The total NPV increases in 2,650% due to incorporate MV dwellings in addition to TP dwellings. The developer obtains 577 soles per square meter of plot invested, but the unitary NPV because of land remains the same. Moreover, regarding the total return on investment, the developer obtains about 1.45 soles per each sol invested in the project. Table 20 shows these results.

Table 20: Indicators for project G: considering TP and MV dwellings (real case)

	<u>TOTAL</u>	<u>PROJECT</u>	<u>LAND</u>
Profit per m2 (built): NPV / built area	S/.2,212.1 /m2	S/.2,180.0 /m2	S/.32.1 /m2
Profitability: ROI = NPV / total cost	145.40%	140.33%	12.02%
Land value per m2: NPV / plot gross area	S/.576.5 /m2	S/.568.1 /m2	S/.8.4 /m2
Land value per m2: NPV / plot net area	S/.1,143.1 /m2	S/.1,126.6 /m2	S/.16.6 /m2
% increment of land value (%Δ LV = NPV / raw	829.03%	817.01%	12.02%

4.5.2.5 Project H

Description of the project

This project has 1,034 dwellings of 31.24 m² of built area; all of them are TP houses with independent plots (construction of one story with possibility to extend to two stories with a FAR of 0.58 for all the project) and were sold at the same price of S/. 33,200. It is located in the north periphery of Lima. The plot was acquired through a real estate investment trust between the company and the Peruvian Navy in March 2006; the sales started around July 2007 (the beginning of the project) and finished in December of the same year. The construction works started in November 2008 and finished at October 2009. The end of the property registration was in March 2010.

In this project the information gathered was obtained from the file of FMV and from the interview to the manager.

Qualitative analysis

In this project there is a special situation with the plot, because it was not bought; it was acquired through a trust with an institution, so the plot was not a real cost for the developer. The developer focuses more in a construction strategy rather than in a land strategy; the plot was given as a serviced land. The developer's strategy was to minimize costs and construction time. Because of the big size of the project (1,034 apartments) it was possible to achieve some economies of scale. Other key factor for the success of the project was the fact that all the demand was assured, because the company and the Peruvian Navy signed out an agreement in which all the houses are assigned to the members of the institution; so marketing effort for the company was zero.

Analyzing the variation in the land value of the plot, it possible to observe that in March 2006 when the plot was acquired the value was US\$ 60.00 / m² and in July

2008 the value was US\$ 78.11 / m². Correcting for inflation at the beginning of the project in July 2007 it is possible to compare both values: 73.83 – 61.13 = US\$ 12.70 / m² is the increment in real values (without consider discount rate). In this case the date of the valuation (July 2008) was some months after the beginning of the project, so it is not possible to isolate completely the effect of the increment of the land value because of the land strategy from the subsidy and construction effect.

Quantitative analysis

All the calculations was done considering the plot as a cost from the developer, as he had bought the plot in order to analyze if the project would be profitable including the plot cost. After elaborating the cash flow and all the calculation it was obtained the results of the NPV because of project, land and total NPV. It is necessary to clarify that Table 21 do not show the real results, because the real project did not have the plot as a cost. All the details can be appreciated in Annex 9. Checking the third line of Table 21, the NPV / plot gross area is negative for all the components, even the NPV because of land is - S/. 40.60 which is opposite to the result obtained in the qualitative analysis because here the discount rate is included. The results of this project are opposite to the research hypothesis. Definitively, in this project the only way to obtain a positive profit was through an agreement with an institution and to receive the plot without any cost. Considering the real costs (deleting the plot cost), the total profit is very high around S/. 188 per square meter of plot invested.

Regarding the profitability, the ROI is negative for the total project and for land and project. The real profitability, not considering the plot cost, is 45.32% (the developer actually obtained 45 cent per each sol invested in all the project). In conclusion, in spite of the project was actually very profitable to the developer, evaluating the project including the effect of the land, it had lost money.

Table 21: Indicators for project H

	TOTAL	PROJECT	LAND
Profit per m2 (built): NPV / built area	-S/.75.1 /m2	-S/.5.3 /m2	-S/.69.8 /m2
Profitability: ROI = NPV / total cost	-6.75%	-0.51%	-17.51%
Land value per m2: NPV / plot gross area	-S/.43.7 /m2	-S/.3.1 /m2	-S/.40.6 /m2
Land value per m2: NPV / plot net area	-S/.43.7 /m2	-S/.3.1 /m2	-S/.40.6 /m2
% increment of land value (%Δ LV = NPV / raw	-18.83%	-1.32%	-17.51%

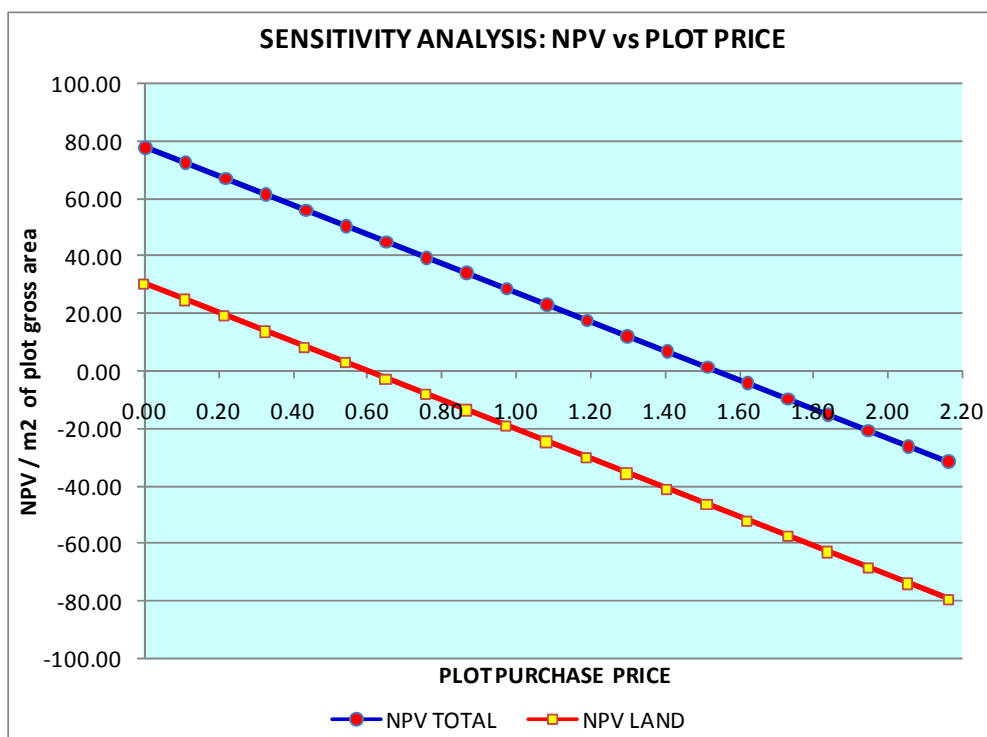
4.6 Sensitivity analysis of project D

Project D is the project with the great uncertainty in the plot price purchase, because of the date when it was bought (March 1973). Many corrections for inflation, exchange rate, change of local currency, and discount rate are necessary to incorporate, so it is worthy to elaborate a sensitivity analysis in this case. The dependent variables are unitary NPV total and the unitary NPV land (in US\$ per

m² of plot gross area) and the unique independent variable is the plot price purchase. It is a *ceteris paribus*⁵ analysis. Remembering the indicators of this project, the total unitary NPV was US\$ 23.20 / m² and the unitary NPV because of land was negative US\$ 24.50 /m². One interesting question is: what is the maximum price at which it had purchased the land for the project is still profitable? In other words, what is the price when NPV is zero.

The plot was actually bought at US\$ 1.08 / m² (according to the data gotten). If the total NPV is considered the maximum price had been 1.54 dollars per m². If the NPV because of land is considered the maximum price had been 60 cents of dollars per m². This last result shows that under the plot purchase price of 60 cents per square meter the developer had obtained positive profit only because of land strategy, but it continues being lower than the profit obtained for the project. Chart 7 shows the variations of both NPV (total and land) according to the plot price purchase. The details of the sensitivity analysis can be seen in Annex 5.

Chart 7: Sensitivity analysis of plot price purchase, project D



4.7 Comparison analysis for all TP projects

After analyzing qualitatively and quantitatively each project, in order to compare the results among them, as it is explained in the methodology, it is necessary to

⁵ With other things the same

make some corrections. First of all, because of the data that was used to elaborate each cash flow is in local currency at the date of the beginning of each project, the first correction is to express all the NPV in real soles at the same time; July 2010 was chosen because it is the last month with available information. Secondly, in order to express the result in a more known currency, the previous results were corrected for exchange rate at July 2010, using the American dollar (US\$). Finally, to take into account the effect of the cost of opportunity the previous results were corrected by discount rate at 10% (real annually). According to the research methodology, there are five important indicators to measure the profit of the projects, but two of them are selected to the comparison and to draw the final conclusions: the unitary NPV (NPV / plot gross area in US\$/m²) and the profitability or ROI (NPV / total cost in percentage).

Table 22 and Chart 8 show the comparison among unitary NPV of the projects. Recalling, the unitary NPV measures the profit obtained per each square meter of plot invested. A very useful property of NPV is the additivity, that means the total NPV = NPV of project + NPV of land, as it can be proved in each project in the table. The greatest total unitary NPV corresponds to the project E (US\$ 78.70 / m²); however, as it was explained, if project F consider all the dwellings not only TP but also MV, the unitary NPV is around thousands of dollars per square meter. Regarding the profit because of land in absolute terms, project A has the higher unitary NPV, perhaps of the higher floor area ratio. In relative terms, project B has the highest contribution of land in the total NPV, about 135% (NPV because of the project is negative).

To prove the hypothesis: *“The profit of Techo Propio project because of land strategy is greater than the profit because of the program itself”* using the NPV criterion, in the Table 20 if the column “land” is greater than column “project” the hypothesis is proved. Only three cases of a total of eight prove the research hypothesis (last column “hypothesis testing” whose cells are “YES”). The shaded cells represent the group of “projects before” (projects B, C, and D) which might prove strongly the hypothesis; the rest are in the group “projects after”.

Table 22 also shows some descriptive statistical indicators such as the mean, median, and standard deviation. Consider the eight projects the average NPV because of land is higher than the NPV because of the project but there is a lot of dispersion because of the standard deviation is very high. It is very hard to draw conclusions from a sample of eight projects and even harder from the group “projects before” with only three projects.

In Chart 8 it can be appreciated better the contribution of the land and the project to the total unitary NPV. In addition, in this chart can be seen the results of three projects (D, F and G) if it is considered also MV dwellings. It is very noticeable the contribution of MV dwellings to the increase in the NPV of the project; that

contribution is indicated in dashed line. However, the unitary NPV because of land remains the same.

Table 22: Comparison among projects: NPV / plot gross area (US\$/m² at July 2010)

Δ LAND VALUE		NPV / plot gross area (US\$ PER M2)			K	10%	0.797%
Project	Location	TOTAL NPV	PROJECT	LAND	NPV _L / NPV (total)	Greater NPV component	Hypothesis testing
A	East	73.1	38.0	35.1	48.03%	PROJECT	NO
B	North	17.9	-6.4	24.2	135.48%	LAND	YES
C	South	-31.4	-44.5	13.1	-41.83%	LAND	YES
D	East	51.4	105.6	-53.7	-104.50%	PROJECT	NO
E	North	78.7	78.1	0.6	0.79%	PROJECT	NO
F	East	-199.6	-202.7	3.1	-1.56%	LAND	YES
G	North	15.4	11.3	4.1	26.78%	PROJECT	NO
H	North	-22.8	-1.6	-21.2	92.98%	PROJECT	NO

Mean	-2.15 \$/m ²	-2.78 \$/m ²	.68 \$/m ²
Median	16.65 \$/m ²	4.84 \$/m ²	3.62 \$/m ²
Standard Deviation	83.70 \$/m ²	87.94 \$/m ²	25.86 \$/m ²

Chart 8: Comparison among projects: NPV / m² (US\$/m² at July 2010): bar chart

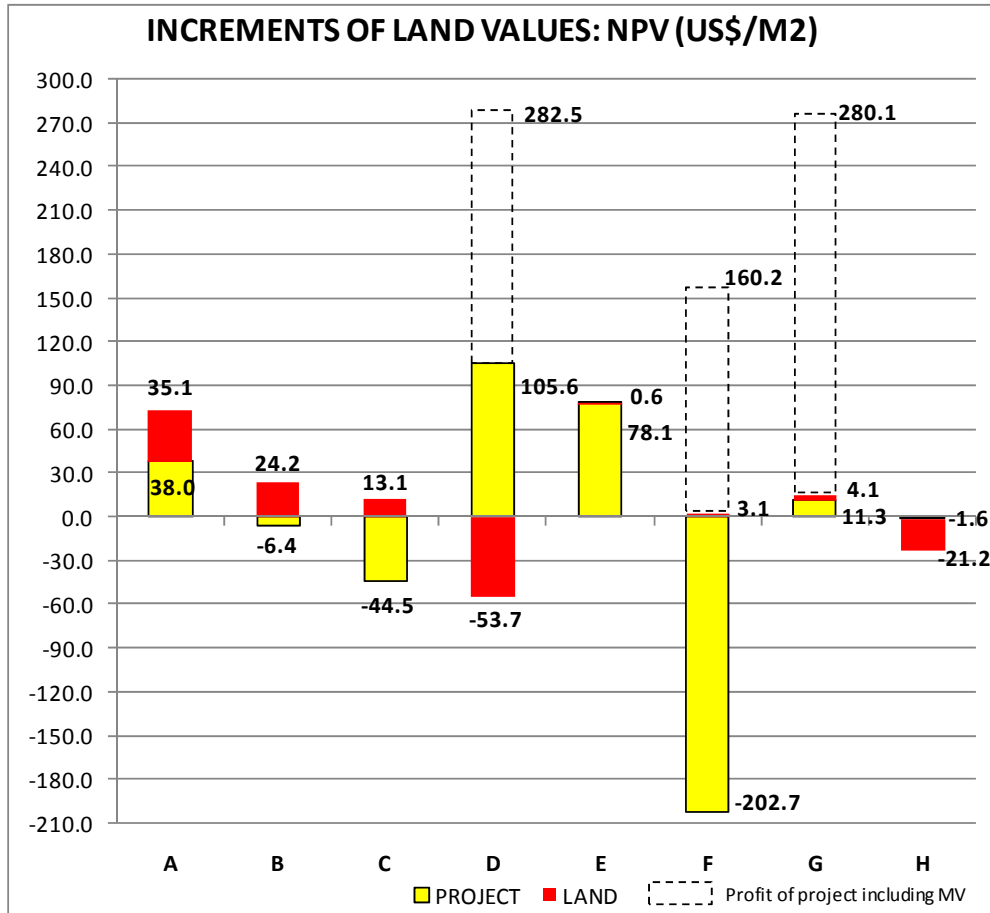


Table 23 and Chart 9 show the comparison among profitability of the projects. Remembering, the profitability or ROI (return on investment) measures the profit obtained per each dollar invested. A very useful property of ROI is that it does not depend on corrections for nor inflation neither for exchange rate. The greatest ROI corresponds to the project E (16.7 %, the developer obtained 16 cent per each dollar invested); however, as it was explained, if project F consider all the dwellings not only TP but also MV, the profitability would be the highest. Regarding the ROI because of land, project B has the higher profitability.

To prove the hypothesis using the ROI criterion, it can compare columns fourth and fifth of the Table 23; if the column “land” is greater than column “project” the hypothesis is proved. Five cases of a total of eight prove the research hypothesis with this second criterion (last column “hypothesis testing” whose cells are “YES”). Again, the shaded cells represent the group of “projects before” (projects B, C, and D) which might prove strongly the hypothesis; the rest are in the group “projects after”.

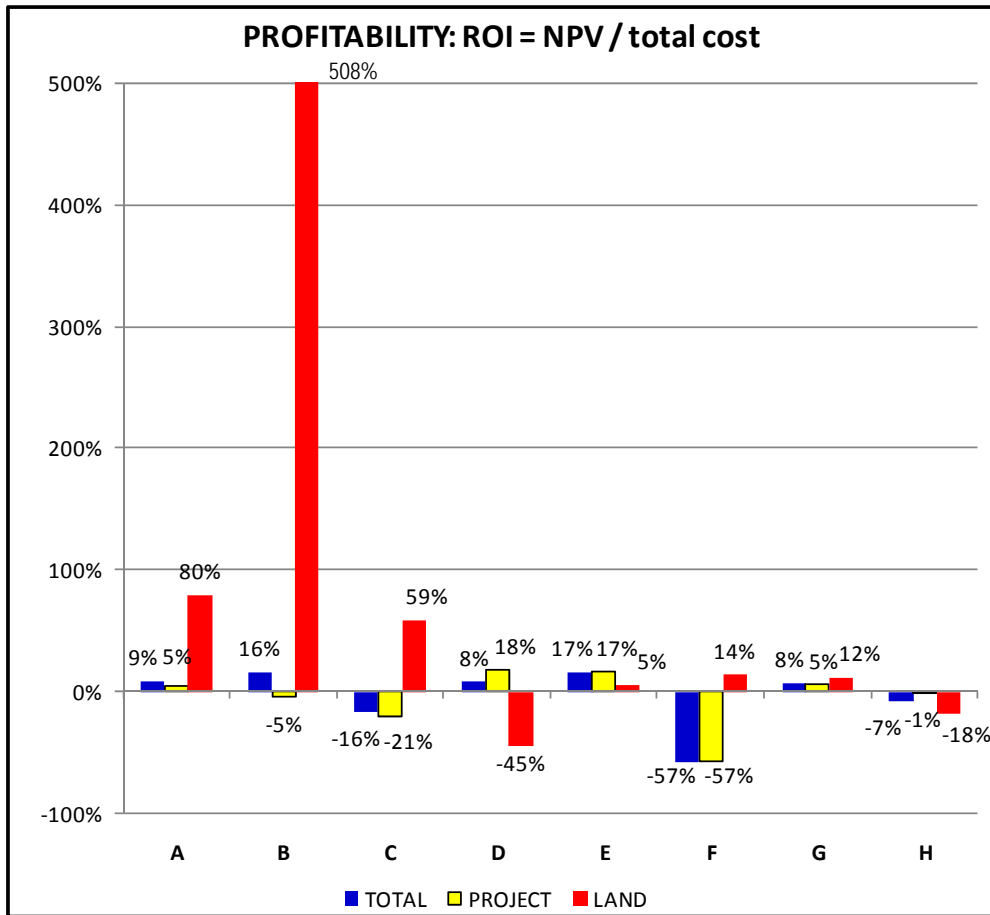
Table 23 also shows the mean, median, and standard deviation. Consider the eight projects the average ROI because of land is much higher than the NPV because of the project but the standard deviation is very high. Similarly to the NVP criterion, it is very hard to draw conclusions from a sample of eight projects and even harder from the group “projects before” with only three projects.

In Chart 9 it can be appreciated better the comparison of ROI because of land, project and total. Go to Annex 10 to see more details about the summary and comparison results.

Table 23: Comparison among projects: Profitability: ROI = NPV / total cost (%)

Δ LAND VALUE		Profitability ROI = NPV / total cost (%)			
Project	Location	TOTAL	PROJECT	LAND	Hypothesis testing
A	East	9%	5%	80%	YES
B	North	16%	-5%	508%	YES
C	South	-16%	-21%	59%	YES
D	East	8%	18%	-45%	NO
E	North	17%	17%	5%	NO
F	East	-57%	-57%	14%	YES
G	North	8%	5%	12%	YES
H	North	-7%	-1%	-18%	NO
Mean		-2.63%	-4.80%	77.07%	
Median		7.82%	2.04%	13.10%	
Standard Deviation		22.93%	22.87%	167.12%	

Chart 9: Comparison among projects: Profitability: ROI = NPV / total cost (%): bar chart



Chapter 5: Conclusions and recommendations

Chapter five presents an overview of the research; some reflections are given on the reliability and validity of the research results. Findings from the research is based mainly on the sub-chapter 4.7 “Comparison analysis for all TP projects” and of course on the sensitivity analysis and in general on the previous chapter. The chapter also includes the conclusions and recommendations for future studies and to improve the social housing programs from the supply side.

5.1. Findings for the research

- Indicators: Unitary NPV (net present value per each square meter of plot invested) and the ROI (net present value per each dollar invested in the project) have been the two key performance indicators (KPI) to make comparisons among different projects and to draw conclusions about the profitability of the social housing project in periphery of Lima, and ultimately to prove the research hypothesis. These KPI were selected because of their simplicity, familiarity and powerful interpretations for the results.

The internal rate of return (IRR) is a more common indicator to evaluate the profitability of the project; however, in the projects analyzed the IRR has indefinite values because of the variability of the cash flow. Therefore, the return on investment (ROI), as the NPV per each unit of present cost invested in the project, has been used to estimate the profitability.

According to the results presented in subchapter 4.7, regarding unitary NPV, only three projects of eight have greater profit because of land than because of the project itself, and for the “projects before” those which can prove strongly the research hypothesis, two projects of three prove it. In three projects the total profit is negative and in two of them the profit because of land is negative, that means in real values and taking into account the cost of opportunity using the discount rate, land in those two project lost value. The mean of the NPV of land (considering the eight projects) is greater than the NPV of project, but the standard deviation is so high to draw definite conclusions.

Regarding ROI, five projects of eight have greater profitability because of land than because of the project itself, and for the “projects before” two of three projects can prove the research hypothesis. The same two projects that have negative NPV of land have negative ROI because of land, so the land value decrease in these two projects; this result sounds strange because according to the empirical evidence all the land value in periphery of Lima is increasing over time. Thus, there should be some questionable raw data provided by developer or from some documents. The mean of ROI of land (considering the eight projects) is much higher than the ROI because of the project. In general, ROI qualifies better the benefits generated from land strategy than NPV per square meter.

Apparently there is not any relationship in the results regarding the location of the projects in north, east or south periphery of Lima. It can be concluded that nor the NPV neither the ROI provides evidence of some pattern according to the location. Of course this is a broad perspective; location here means “macro location” in some of the big peripheral areas or “*conos*” of Lima rather than a specific location.

Regarding the two groups of projects: “projects before” and “projects after”, both the NPV and the ROI do not show certain pattern or differences between these groups.

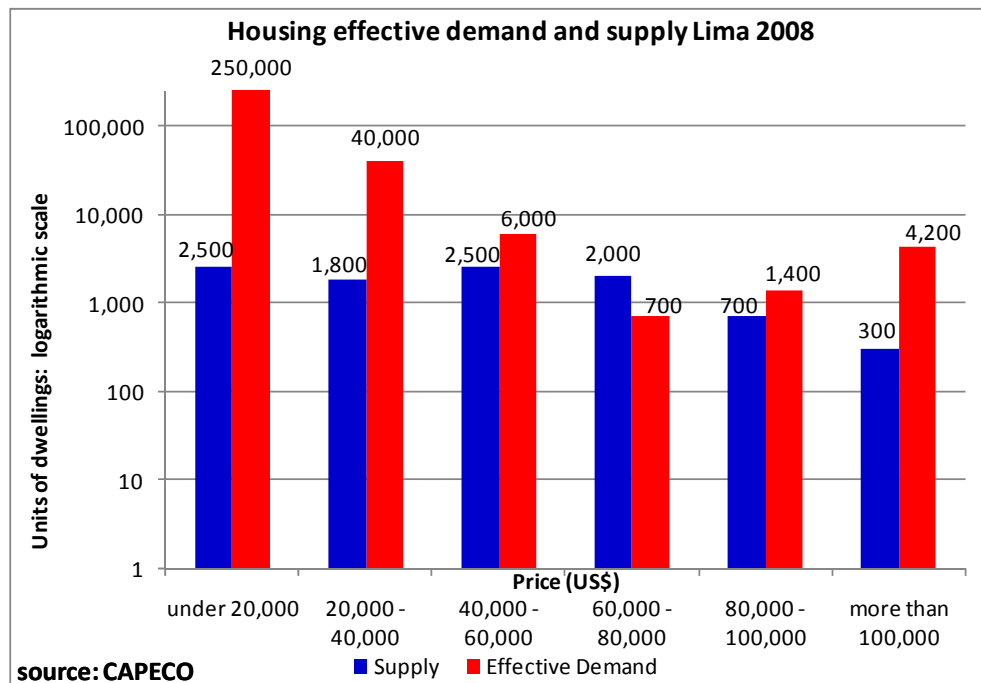
- Sensitivity analysis: in the project D was analyzed the variability of the unitary NPV according to changes in the plot purchase price. A *ceteris paribus* analysis (with other things the same) indicated that below the plot purchase price of 60 cents of dollars project D had earned profit using only a land strategy, but even in this hypothetical case that profit had been lower than that obtained for the project itself. So, the results of the sensitivity analysis for project D do not change the conclusions: this project does not support the research hypothesis.
- Answer to the research question: using the selected KPIs (NPV and ROI), simple descriptive statistics and the sensitivity analysis for a typical TP project should be apparently enough to prove the research hypothesis and answer the research question: “*Regarding housing programs subsidized by Peruvian government and executed by private real estate developers in Lima’s periphery, is the profit because of the land strategy greater than the profit because of the project itself?*”. However, as it was explained, there are opposite results among projects. For that situation it is not possible to conclude in a positive or negative response to the research question: “I do not know” is until now the answer. This is because of not only to the opposite results but also to the limitations of the research. Nevertheless, this research have proved in some way, based mainly on the results of indicators and on some qualitative information, that *Techo Propio* has many problems to be profitable for private developers and is at least much less successful than *Mivivienda*.
- Limitations of the research: it can be summarized in many assumptions, limited information, a small sample (actually, the sample is the universe, a size sample of eight projects), and the fact the *Techo Propio* is more complex than it was expected in contrast to *Mivivienda* projects, for instance. Developers were very reluctant to provide information, the raw data gathered is incomplete so it was necessary to make some assumptions, and unfortunately no many TP projects have been executed in Lima to elaborate a better statistical analysis.

5.2. Conclusions

- Comparison *Techo Propio (TP) – Mivivienda (MV)*: Two TP projects (D and G) which started offering only TP dwellings in the middle of the project life changed to include MV dwellings and one project (F) had the opposite situation (it started offering only MV but later it include a small number of TP dwellings because of some negotiations with the government). In these three cases there is not enough physical differences between TP and MV dwellings but the prices are very different, MV price is between two a three times TP price. An explanation for this situation from the supply side is that TP dwellings did not generate enough profit (in addition construction materials increased their prices rising costs for the developers), so at the end of the project developers increased the TP price or changed to MV; from the demand side, most projects took more than three years to be executed and in this time the close environment to the project experienced some betterment because of the city growth and the extension of public infrastructure (roads, pipelines, etc) increasing the land values and the attractiveness of the area for other higher income levels than poor people (TP).

From a macro perspective, there is a large imbalance between supply and demand in different income levels in Lima. There is a large demand for low-income housing but very little supply for TP; on the contrary the demand and supply for MV is more balanced. According to CAPECO, in Lima during 2008 for a house price under US\$ 20,000 (poor people) the effective demand was more than 250,000 dwellings but the supply for this group was about 2,500. The opposite situation is for upper income group: the supply exceeds several times the demand. Graph 10 shows these rounded figures using a logarithmic scale.

Chart 10: Housing effective demand and supply in Lima 2008. Source: CAPECO



-
- Subsidy: TP has a subsidy about 45% of the price of the dwelling, in contrast MV has only 15% of an indirect subsidy, but developers find more attractive MV projects instead of TP projects, since the supply for MV is much greater than TP as the Chart 8 shows. Therefore, a greater subsidy is not enough to stimulate the supply, only eight TP projects and less than 4,500 TP dwellings have been developed in Lima's periphery during almost 10 years. Middle class demand can access to MV dwellings and there is enough supply, the general perception is that *Mivivienda* is a success; however TP, in spite of there is a great demand nor developers neither private bank are not very interested in. The subsidy is important but to do TP more profitable in Lima there are other factors such as the size of the project (a minimum number of dwellings to achieve economies of scale), optimization of costs, the speed of disbursements from banks and from government, and to get plots at a very low price.
 - Discount rate: The discount rate for land could be much lower than the discount rate for the project. This is because in Peru, especially in this social housing program, the developer faces many risks: the delay of the disbursements (from the government and from private banks), market risk (sales low speed, increase in prices construction materials, increase in the competence), problems and negotiations with the union building, claims from the householders (poor are very sensitive to government actions), image exposure to the press, pressure from the government, and the effort to manage a construction and a real estate projects. On the other hand, buying a plot and wait the price increases over time implies less risks than the alternative to build a housing project. Thus, the results might change in favor of the land strategy because the indicators NPV and ROI would improve and the hypothesis would be proved. Unfortunately, there is little information to determine a precise discount rate for land.
 - Ruled maximum price: Since in *Techo Propio* the maximum price is controlled by Peruvian government, this situation might generate an informal negotiation between developers and householders to increase the price under the table. It is difficult to prove that, but there are some evidence in many letters sent from developer to the Ministry of Housing to ask permission to increase prices, and actually government has been changed price over time, especially in the last years; this could explained why some projects like project E sold dwellings to much higher prices in contrast to other project because it started at the beginning of the year 2008. Limit in the price of TP ruled by government might explain why TP is not profitable.
 - Property taxes: In Peru like other Latin American countries property taxes are very low, so not include them in the cash flow it does not change the results significantly.
 - Land strategy: According to the Peruvian Chamber of Construction, the first difficulty that developers face in Lima is the scarcity of serviced land (especially with water and sewage services) and plots with enough area. The few available plots have high prices that make impossible to develop social housing projects like TP because they would not be profitable.

The best land strategy was for project B, where land contribute to the 135% of the total profit (the profit because of the project is negative); because of land strategy the developer had obtained a return of five dollars per each dollar invested in the plot. Buying the square meter a US\$ 1 and waiting about 6 years to start the housing project when the same square meter worth US\$ 10 was a very good deal. This was possible because that area in the north periphery is very far away from the city center and at that time the developer could get an agricultural price.

Regarding the worst land strategy, project D and H obtained negatives profits because of land, but they are special cases because in the first one, as it was explained in the sensitivity analysis there is a lot of uncertainty and in the second case the plot was not actually part of the cost of the developer. Projects E, F and G had unitary NPV lower than US\$ 5.00 / m²; very low in contrast to the other projects. An explanation for this is that the developer focused more in construction strategy: optimizing costs and time of construction, and implementing a marketing strategy for selling the apartments as soon as possible. Details can be checked in sub-chapters 4.5, 4.6 and 4.7.

5.3. Recommendations

- Subsidy is not enough to have a successful social housing program. Since the scarcity of serviced land in Lima is the main problem for real estate companies, not only developers but also central and local governments have to apply a land strategy. A land strategy based only on buying a plot and wait time to increase its price is not possible any more. Land strategy needs some partners, private developers, banks, landowners and central and local government to use some modalities of plot acquisition such as real estate investment trust (for instance, project H). For developers land strategy also can include an optimum FAR and mix uses, and for the government the design of some instruments for land value capture.
- The challenge for *Techo Propio* or other social housing program is enormous: only in Lima the effective demand is more than a quarter of million dwellings in contrast to the supply that is very small (about a hundredth). To solve this large gap is a step by step process in the long-term, but in the short-term government can simplifying the procedures to disburse the subsidies (actually it takes a lot of time), and integrate urban renewal program (actually, “*Mi Barrio*” is a Peruvian program of this type) with social housing program *Techo Propio*.
- This research contributes to understand better *Techo Propio* as a social housing program especially since the point of view of the private developers; why there are few projects and dwellings built of this type in Lima, why the profitability is very small or even negative, and why in some cases land contributed significantly to the total profit. Although the results of the quantitative analysis are not very conclusive it is possible to say that TP is not profitable enough for developers and in order to increase their profits it has been necessary actions such as some additional helps from the government (for instance, support in the procedures and negotiations with other

stakeholders), mix uses (combine low-income with middle income houses or with commerce), or getting plots at very low prices.

- For future research it would be very interesting to extend the study to *Mivivienda* projects in order to make a better and detailed comparison with *Techo Propio*. There are a lot of MV projects in Lima to choose a big enough sample to elaborate statistical analysis. In addition, this type of projects are less influenced by government (there is no a ruled maximum price and the subsidy is much lower); they depend more on the market. Interesting lessons learned might be taken from MV to apply to TP in order to improve it. New research questions for the future, not only theoretical but also practical could be: *What other variables should be study for Techo Propio in the future? What can it do to get more profitable social housing programs for developers?* One useful recommendation is to elaborate a multiple regression analysis for MV projects, including other variables.

Finally, periphery of Lima city has been growing significantly in the last years, especially for the increase in the housing demand and supply; however there is still a great gap between both. It is still difficult to get attractive profit from low-income housing projects in order to generate more supply and cover more demand for this group. However, the few projects done have been a nice solution that with some improvements in the program and strategies can be extended to the majority of low-income population of Lima.

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Annexes

Annex 1: Interviews data

As it was explained in the methodology (chapter 3), the data was obtained mainly from interviews with developers who built the selected projects and from the files from *Fondo Mivivienda*, the public institution which promotes *Techo Propio* program and save copies of all the documents about projects submitted by developers.

In general developers were reluctant to provide information, especially financial information, but some of them were more collaborative than others, it was the case of projects B, D, E, F, G and H. In all those cases it was the general manager or the project manager who provided the data during the interview.

Projects A and C were the most difficult to get information, in both cases was not possible to have interviews with the developers. In project A most of the information was gotten from *Mivivienda* files and from comparison to project D because both projects are located very close to each other. In project C the data was obtained through a former project manager who participated in the project.

When detailed costs were not given from the developer, some assumptions and approximations were made following the known average in the real estate and construction industry in Peru or following some regulation from the government. For instance, marketing costs is a around 1% of the total income from sales, overhead is 5% of the total construction costs, legal fees and property registration is 2.5% of the total construction costs, profit is about 5% of the total construction costs, and design cost is about US\$ 10 per built square meter. As an approximation to elaborate the cash flow all the flow of incomes and expenses was distributed uniformly in the time.

In addition to the numerical data, during the interview developers expressed their perceptions about their projects and about *Techo Propio* program in general. Especially in projects D, F and G where developers mixed *Techo Propio* and *Mivivienda* dwellings, they said that *Techo Propio* was not enough to support their expenses and some of them complained about the delay of the disbursements of the subsidy from government. None of them mentioned or expressed a particular interest in implemented a land strategy even in the projects which obtained a nice profit because of land: it was a good opportunity that they took advantage of this.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	ANNEX 2: PROJECT A							REAL CASH FLOW IN SOLES AND CORRECTION FOR PERUVIAN INFLATION RATE								
2																
3	INCOMES			-1	0	1	2	3	4	5	6	7	8	9	10	11
4	Type	N° houses	Price	2003	2003	2003	2003	2003	2003	2003	2004	2004	2004	2004	2004	2004
5	A	1,200	S/. 27,776	June	July	August	September	October	November	December	January	February	March	April	May	June
6																
7	Time for sales (months)		24	Delay to receive subsidy		2										
8	Sales speed		30	Delay to receive bank loan		4										
9	Average sales speed		50,00													
10	N° houses sold / month		1,200	50	50	50	50	50	50	50	50	50	50	50	50	50
11	Downpayment		10%	138,880	138,880	138,880	138,880	138,880	138,880	138,880	138,880	138,880	138,880	138,880	138,880	138,880
12	Subsidy		45%			624,960	624,960	624,960	624,960	624,960	624,960	624,960	624,960	624,960	624,960	624,960
13	Bank loan		45%					624,960	624,960	624,960	624,960	624,960	624,960	624,960	624,960	624,960
14	Sales Incomes		S/. 32,081,280	138,880	138,880	763,840	763,840	1,388,800	1,388,800	1,388,800	1,388,800	1,388,800	1,388,800	1,388,800	1,388,800	1,388,800
15	inflation rates: 1+π			1	1.00013456	1.00558598	1.00049032	1.00167685	1.00563951	1.00537447	1.01086085	1.00460449	0.999772299	1.00353845	1.00563807	
16	inflation correction			1	1.00013456	1.00572129	1.00621442	1.00790169	1.01358576	1.01903325	1.03010081	1.0348439	1.034608263	1.03826917	1.044123	
17	Sales incomes (real)		S/. 33,390,267	138,880	138,899	768,210	768,587	1,399,774	1,407,668	1,415,233	1,430,604	1,437,191	1,436,864	1,441,948	1,450,078	
18																
19	EXPENSES															
20	Time for urbanization		12													
21	Time for construction (months)		36													
22	Serviced land / m2		S/.123.38 /m2													
23	Construction / m2		S/.381.46 /m2													
24	Serviced land		S/. 1,852,903			154,409	154,409	154,409	154,409	154,409	154,409	154,409	154,409	154,409	154,409	154,409
25	Construction		S/. 20,336,341							564,898	564,898	564,898	564,898	564,898	564,898	564,898
26	Design cost		S/. 1,850,986				616,995	616,995	616,995							
27	Marketing costs		S/. 320,813	13,367	13,367	13,367	13,367	13,367	13,367	13,367	13,367	13,367	13,367	13,367	13,367	13,367
28	Financial costs		S/. 2,440,361							67,788	67,788	67,788	67,788	67,788	67,788	67,788
29	Legal fees: property regist		S/. 508,409													
30	Overhead costs		S/. 2,781,422	66,224	66,224	66,224	66,224	66,224	66,224	66,224	66,224	66,224	66,224	66,224	66,224	66,224
31	Taxes		S/. 27,860							774	774	774	774	774	774	774
32	Profit		S/. 1,016,817													
33	Total expenses		S/. 31,135,910	79,592	79,592	234,000	850,995	850,995	850,995	867,460	867,460	867,460	867,460	867,460	867,460	867,460
34	inflation rates			1	1.00013456	1.00558598	1.00049032	1.00167685	1.00563951	1.00537447	1.01086085	1.00460449	0.999772299	1.00353845	1.00563807	
35	inflation correction			1	1.00013456	1.00572129	1.00621442	1.00790169	1.01358576	1.01903325	1.03010081	1.0348439	1.034608263	1.03826917	1.044123	
36	Total expenses (real)		S/. 31,734,968	79,592	79,602	235,339	856,284	857,720	862,557	883,971	893,571	897,686	897,481	900,657	905,735	
37	NPV expenses		S/. 26,842,188													
38																
39	PLOT															
40	Plot gross area (m2)		30,036.90													
41	Plot net area (m2)		15,018.45													
42	Nominal Unitary value (S/./m2)		S/.52.2 /m2													
43	Nominal Total Value (S/.)		S/. 1,567,733													
44	Real (correct by inflation)		S/. 1,565,394													
45	Present value of plot at July 2003		S/. 1,577,876													
46	PROJECT CASH FLOW			-S/. 1,577,876	S/. 59,288	S/. 59,296	S/. 532,871	-S/. 87,697	S/. 542,054	S/. 545,111	S/. 531,263	S/. 537,033	S/. 539,505	S/. 539,383	S/. 541,291	S/. 544,343
47																
48	INDICATORS AT JULY 2003															
49																
50	K (land)		10%	contribution to the value		0.797%	monthly	annual								
51	K (project)		10%			0.797%										
52	NPV project		S/. 1,358,455	51.97%	IRR project	#¡DIV/0!	#¡DIV/0!									
53	NPV land		S/. 1,255,443	48.03%	IRR land											
54	NPV total		S/. 2,613,899	100.00%	IRR total											
55				2,613,899												
56	LAND PROFIT < PROJECT PROFIT, THEN HYPOTHESIS IS NOT PROVED															

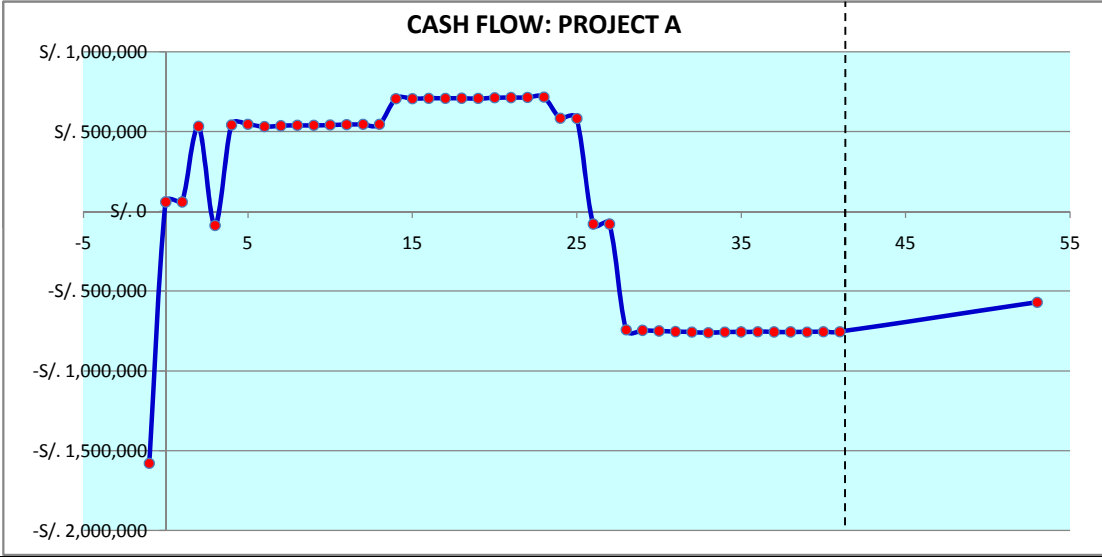
	TOTAL	PROJECT	LAND
Profit per m2 built: NPV / built area	S/.49.0 /m2	S/.25.5 /m2	S/.23.5 /m2
Profitability: ROI = NPV / total cost	9.20%	4.58%	79.57%
Land value per m2: NPV / plot gross area	S/.87.0 /m2	S/.45.2 /m2	S/.41.8 /m2
Land value per m2: NPV / plot net area	S/.174.0 /m2	S/.90.5 /m2	S/.83.6 /m2
% increment of land value: %Δ LV = NPV / raw land	165.66%	86.09%	79.57%

	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU
1														
2														
3	29	30	31	32	33	34	35	36	37	38	39	40	41	53
4	2005	2006	2006	2006	2006	2006	2006	2006	2006	2006	2006	2006	2006	2007
5	December	January	February	March	April	May	June	July	August	September	October	November	December	December
6														
7														
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21														
22														
23														
24														
25	564,898	564,898	564,898	564,898	564,898	564,898	564,898	564,898	564,898	564,898	564,898	564,898	564,898	
26														
27														
28	67,788	67,788	67,788	67,788	67,788	67,788	67,788	67,788	67,788	67,788	67,788	67,788	67,788	
29														508,409
30	66,224	66,224	66,224	66,224	66,224	66,224	66,224	66,224	66,224	66,224	66,224	66,224	66,224	
31	774	774	774	774	774	774	774	774	774	774	774	774	774	
32														
33	699,684	699,684	699,684	699,684	699,684	699,684	699,684	699,684	699,684	699,684	699,684	699,684	699,684	508,409
34	1.00419225	1.00499609	1.00548278	1.00457163	1.00510007	0.99472048	0.99867463	0.9982956	1.00139347	1.00027368	1.00043789	0.99717845	1.00025812	
35	1.06454233	1.06986088	1.07572669	1.08064451	1.08615588	1.0804215	1.07898954	1.0771505	1.07865148	1.07894668	1.07941915	1.07637351	1.07665134	1.11893875
36	744,844	748,565	752,669	756,110	759,966	755,954	754,952	753,665	754,716	754,922	755,253	753,122	753,316	568,878
37														
38														
39														
40														
41														
42														
43														
44														
45														
46	-S/. 744,844	-S/. 748,565	-S/. 752,669	-S/. 756,110	-S/. 759,966	-S/. 755,954	-S/. 754,952	-S/. 753,665	-S/. 754,716	-S/. 754,922	-S/. 755,253	-S/. 753,122	-S/. 753,316	-S/. 568,878
47														
48														
49														
50														
51														
52														
53														
54														
55														
56														

S/.135 /m2
4,062,095
3,771,149
2,833,320

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	ANNEX 3: PROJECT B							REAL CASH FLOW IN SOLES AND CORRECTION FOR PERUVIAN INFLATION RATE								
2																
3	INCOMES			-74	0	1	2	3	4	5	6	7	8	9	10	11
4	Type	N° houses	Price	1997	2003	2003	2003	2003	2003	2004	2004	2004	2004	2004	2004	2004
5	A	628	S/. 27,847	June	August	September	October	November	December	January	February	March	April	May	June	July
6																
7	Time for sales (months)		22	Delay to receive subsidy		2										
8	Sales speed		30	Delay to receive bank loan		4										
9	Average sales speed		28.55													
10	N° houses sold / month		628	28	28	28	28	28	28	28	28	29	29	30	30	30
11	Downpayment		10%	77,972	77,972	77,972	77,972	77,972	77,972	77,972	77,972	80,757	80,757	83,542	83,542	83,542
12	Subsidy		45%			350,875	350,875	350,875	350,875	350,875	350,875	350,875	350,875	363,406	363,406	375,938
13	Bank loan		45%					350,875	350,875	350,875	350,875	350,875	350,875	350,875	350,875	363,406
14	Sales Incomes		S/. 17,488,066	77,972	77,972	428,847	428,847	779,723	779,723	779,723	782,507	782,507	797,823	797,823	822,886	
15	inflation rates: 1+π			1	1.00558598	1.00049032	1.00167685	1.00563951	1.00537447	1.01086085	1.00460449	0.9997723	1.003538447	1.00563807	1.001931086	
16	inflation correction			1	1.00558598	1.00607904	1.00776608	1.01344939	1.01889614	1.02996222	1.03470467	1.03446907	1.038129479	1.04398253	1.045998546	
17	Sales incomes (real)		S/. 18,226,184	77,972	78,408	431,454	432,178	790,209	794,456	803,085	809,664	809,480	828,244	832,914	860,737	
18																
19	EXPENSES															
20	Time for urbanization		12													
21	Time for construction (months)		30													
22	Serviced land / m2		S/. 69.35 /m2													
23	Construction / m2		S/. 426.53 /m2													
24	Serviced land		S/. 3,796,179										316,348	316,348	316,348	316,348
25	Construction		S/. 9,107,244													303,575
26	Design cost		S/. 193,213	64,404	64,404	64,404										
27	Marketing costs		S/. 193,213	8,782	8,782	8,782	8,782	8,782	8,782	8,782	8,782	8,782	8,782	8,782	8,782	8,782
28	Financial costs															
29	Legal fees: property regist		S/. 141,849													
30	Overhead costs		S/. 174,881	4,265	4,265	4,265	4,265	4,265	4,265	4,265	4,265	4,265	4,265	4,265	4,265	4,265
31	Taxes		S/. 358,377	8,741	8,741	8,741	8,741	8,741	8,741	8,741	8,741	8,741	8,741	8,741	8,741	8,741
32	Profit		S/. 1,165,087	28,417	28,417	28,417	28,417	28,417	28,417	28,417	28,417	28,417	28,417	28,417	28,417	28,417
33	Total expenses		S/. 15,130,042	114,610	114,610	114,610	50,205	50,205	50,205	50,205	50,205	366,554	366,554	366,554	670,128	
34	inflation rates			1	1.00558598	1.00049032	1.00167685	1.00563951	1.00537447	1.01086085	1.00460449	0.9997723	1.003538447	1.00563807	1.001931086	
35	inflation correction			1	1.00558598	1.00607904	1.00776608	1.01344939	1.01889614	1.02996222	1.03470467	1.03446907	1.038129479	1.04398253	1.045998546	
36	Total expenses (real)		S/. 16,005,508	114,610	115,250	115,306	50,595	50,881	51,154	51,710	51,948	379,188	380,530	382,676	700,953	
37	NPV expenses		S/. 13,479,867													
38																
39	PLOT															
40	Plot gross area (m2)		108,213.66													
41	Plot net area (m2)		56,520.00													
42	Nominal Unitary value (S/./m2)			S/. 2.66 /m2	S/. 34.81 /m2											
43	Nominal Total Value (S/.)			S/. 287,720	S/. 3,766,814											
44	Real (correct by inflation)			S/. 343,986	S/. 3,766,814											
45	Present value of plot at August 2003			S/. 619,149	S/. 3,766,814											
46	PROJECT CASH FLOW			-S/. 619,149	-S/. 36,637	-S/. 36,842	S/. 316,148	S/. 381,583	S/. 739,329	S/. 743,302	S/. 751,375	S/. 757,716	S/. 430,291	S/. 447,714	S/. 450,238	S/. 159,784
47																
48	INDICATORS AT AUGUST 2003															
49																
50	K (land)		10%	contribution to the value		0.797%	monthly	annual								
51	K (project)		10%			0.797%										
52	NPV project		S/. -824,291	-35.48%			IRR project	232.22%	#####							
53	NPV land		S/. 3,147,665	135.48%			IRR land									
54	NPV total		S/. 2,323,374	100.00%	2,323,374	IRR total										
55																
56	LAND PROFIT > PROJECT PROFIT, THEN HYPOTHESIS IS PROVED															

	TOTAL	PROJECT	LAND
Profit per m2 built: NPV / built area	S/.108.8 /m2	-S/.38.6 /m2	S/.147.4 /m2
Profitability: ROI = NPV / total cost	16.48%	-4.78%	508.39%
Land value per m2: NPV / plot gross area	S/.21.5 /m2	-S/.7.6 /m2	S/.29.1 /m2
Land value per m2: NPV / plot net area	S/.41.1 /m2	-S/.14.6 /m2	S/.55.7 /m2
% increment of land value: %Δ LV = NPV / raw lan	375.25%	-133.13%	508.39%

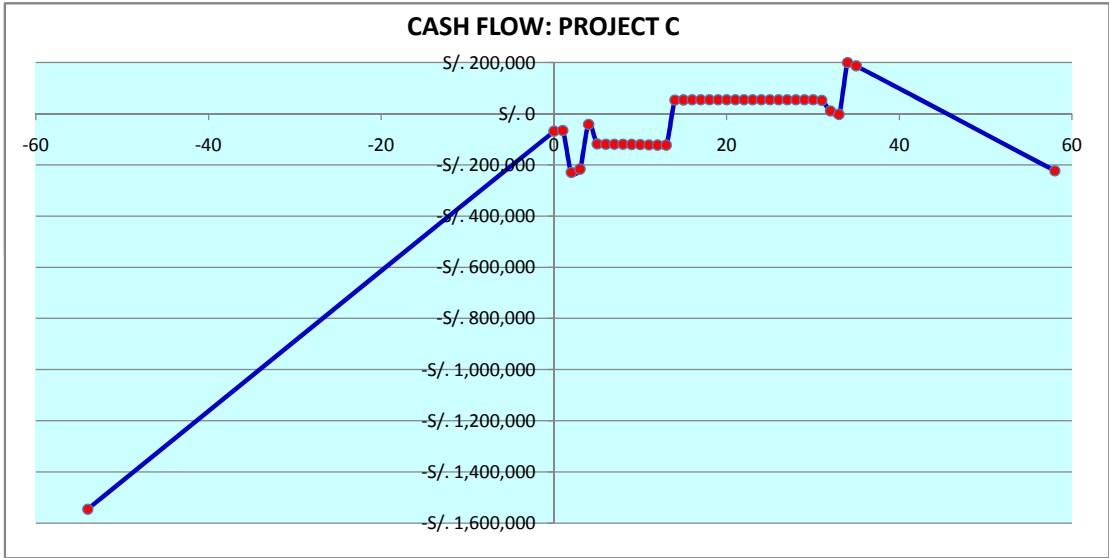
	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU
1														
2														
3	29	30	31	32	33	34	35	36	37	38	39	40	64	85
4	2006	2006	2006	2006	2006	2006	2006	2006	2006	2006	2006	2006	2008	2010
5	January	February	March	April	May	June	July	August	September	October	November	December	December	September
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														
21														
22														
23														
24														
25	303,575	303,575	303,575	303,575	303,575	303,575	303,575	303,575	303,575	303,575	303,575	303,575		
26														
27														
28														
29														141,849
30	4,265	4,265	4,265	4,265	4,265	4,265	4,265	4,265	4,265	4,265	4,265	4,265		
31	8,741	8,741	8,741	8,741	8,741	8,741	8,741	8,741	8,741	8,741	8,741	8,741		
32	28,417	28,417	28,417	28,417	28,417	28,417	28,417	28,417	28,417	28,417	28,417	28,417		
33	344,998	344,998	344,998	344,998	344,998	344,998	344,998	344,998	344,998	344,998	344,998	344,998		141,849
34	1.00499609	1.00548278	1.00457163	1.00510007	0.99472048	0.99867463	0.9982956	1.00139347	1.00027368	1.00043789	0.99717845	1.00025812		
35	1.06971694	1.07558196	1.08049912	1.08600974	1.08027613	1.07884437	1.07700558	1.07850635	1.07880152	1.07927392	1.07622869	1.07650649		1.19965654
36	369,050	371,073	372,770	374,671	372,693	372,199	371,565	372,082	372,184	372,347	371,297	371,392		170,170
37														
38														
39														
40														
41														
42														
43														
44														
45														
46	-S/. 369,050	-S/. 371,073	-S/. 372,770	-S/. 374,671	-S/. 372,693	-S/. 372,199	-S/. 371,565	-S/. 372,082	-S/. 372,184	-S/. 372,347	-S/. 371,297	-S/. 371,392	S/. 0	-S/. 170,170
47														
48														
49														
50														
51														
52														
53														
54														
55														
56														

S/.56.1 /m2
6,067,053
5,084,734
3,058,491

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P																																																																																												
57	<div data-bbox="555 528 1648 1090" data-label="Figure"> <p style="text-align: center;">CASH FLOW: PROJECT B</p> <table border="1"> <caption>Estimated Cash Flow Data for Project B</caption> <thead> <tr> <th>Time (x)</th> <th>Cash Flow (y)</th> </tr> </thead> <tbody> <tr><td>-75</td><td>-800,000</td></tr> <tr><td>-70</td><td>-700,000</td></tr> <tr><td>-60</td><td>-550,000</td></tr> <tr><td>-50</td><td>-400,000</td></tr> <tr><td>-40</td><td>-250,000</td></tr> <tr><td>-30</td><td>-100,000</td></tr> <tr><td>-20</td><td>50,000</td></tr> <tr><td>-10</td><td>150,000</td></tr> <tr><td>0</td><td>250,000</td></tr> <tr><td>2</td><td>380,000</td></tr> <tr><td>4</td><td>750,000</td></tr> <tr><td>5</td><td>750,000</td></tr> <tr><td>6</td><td>750,000</td></tr> <tr><td>8</td><td>450,000</td></tr> <tr><td>10</td><td>450,000</td></tr> <tr><td>12</td><td>150,000</td></tr> <tr><td>14</td><td>120,000</td></tr> <tr><td>16</td><td>100,000</td></tr> <tr><td>18</td><td>150,000</td></tr> <tr><td>20</td><td>450,000</td></tr> <tr><td>22</td><td>380,000</td></tr> <tr><td>24</td><td>0</td></tr> <tr><td>25</td><td>-400,000</td></tr> <tr><td>26</td><td>-400,000</td></tr> <tr><td>27</td><td>-400,000</td></tr> <tr><td>28</td><td>-400,000</td></tr> <tr><td>29</td><td>-400,000</td></tr> <tr><td>30</td><td>-400,000</td></tr> <tr><td>31</td><td>-400,000</td></tr> <tr><td>32</td><td>-400,000</td></tr> <tr><td>33</td><td>-400,000</td></tr> <tr><td>34</td><td>-400,000</td></tr> <tr><td>35</td><td>-400,000</td></tr> <tr><td>36</td><td>-400,000</td></tr> <tr><td>37</td><td>-400,000</td></tr> <tr><td>38</td><td>-400,000</td></tr> <tr><td>39</td><td>-400,000</td></tr> <tr><td>40</td><td>-400,000</td></tr> <tr><td>45</td><td>-250,000</td></tr> <tr><td>50</td><td>-100,000</td></tr> <tr><td>60</td><td>0</td></tr> <tr><td>65</td><td>0</td></tr> <tr><td>70</td><td>-100,000</td></tr> <tr><td>80</td><td>-200,000</td></tr> <tr><td>85</td><td>-200,000</td></tr> </tbody> </table> </div>																Time (x)	Cash Flow (y)	-75	-800,000	-70	-700,000	-60	-550,000	-50	-400,000	-40	-250,000	-30	-100,000	-20	50,000	-10	150,000	0	250,000	2	380,000	4	750,000	5	750,000	6	750,000	8	450,000	10	450,000	12	150,000	14	120,000	16	100,000	18	150,000	20	450,000	22	380,000	24	0	25	-400,000	26	-400,000	27	-400,000	28	-400,000	29	-400,000	30	-400,000	31	-400,000	32	-400,000	33	-400,000	34	-400,000	35	-400,000	36	-400,000	37	-400,000	38	-400,000	39	-400,000	40	-400,000	45	-250,000	50	-100,000	60	0	65	0	70	-100,000	80	-200,000	85	-200,000
Time (x)																	Cash Flow (y)																																																																																											
-75																	-800,000																																																																																											
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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P				
1	ANNEX 4: PROJECT C							REAL CASH FLOW IN SOLES AND CORRECTION FOR PERUVIAN INFLATION RATE												
2																				
3	INCOMES			-54	0	1	2	3	4	5	6	7	8	9	10	11				
4	Type	N° houses	Price	1997	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2004	2004				
5	A	478	S/. 27,840	September	March	April	May	June	July	August	September	October	November	December	January	February				
6																				
7	Time for sales (months)		32	Delay to receive subsidy		2														
8	Sales speed		30	Delay to receive bank loan		4														
9	Average sales speed		14.94																	
10	N° houses sold / month		478	14	15	15	15	15	15	15	15	15	15	15	15	15				
11	Downpayment		10%	38,976	41,760	41,760	41,760	41,760	41,760	41,760	41,760	41,760	41,760	41,760	41,760	41,760				
12	Subsidy		45%			175,394	187,922	187,922	187,922	187,922	187,922	187,922	187,922	187,922	187,922	187,922				
13	Bank loan		45%				175,394	187,922	187,922	187,922	187,922	187,922	187,922	187,922	187,922	187,922				
14	Sales Incomes		S/. 13,307,647	38,976	41,760	217,154	229,682	405,076	417,604	417,604	417,604	417,604	417,604	417,604	417,604	417,604				
15	inflation rates: 1+π			1	0.99949143	0.999679749	0.99526871	0.99850783	1.00013456	1.00558598	1.00049032	1.00167685	1.005639508	1.005374474	1.010860849					
16	inflation correction			1	0.99949143	0.999171342	0.99444397	0.99296009	0.9930937	0.99864111	0.99913076	1.00080615	1.006450202	1.011859343	1.022848995					
17	Sales incomes (real)		S/. 13,734,651	38,976	41,739	216,974	228,406	402,224	414,720	417,037	417,241	417,941	420,298	422,557	427,146					
18																				
19	EXPENSES																			
20	Time for urbanization		12																	
21	Time for construction (months)		29																	
22	Serviced land / m2		S/. 58.23 /m2																	
23	Construction / m2		S/. 467.39 /m2																	
24	Serviced land		S/. 2,056,578		171,382	171,382	171,382	171,382	171,382	171,382	171,382	171,382	171,382	171,382	171,382	171,382				
25	Construction		S/. 7,484,298					258,079	258,079	258,079	258,079	258,079	258,079	258,079	258,079	258,079				
26	Design cost		S/. 505,177		168,392	168,392	168,392													
27	Marketing costs																			
28	Financial costs																			
29	Legal fees: property registration, municipality																			
30	Overhead costs		S/. 1,393,510	40,986	40,986	40,986	40,986	40,986	40,986	40,986	40,986	40,986	40,986	40,986	40,986	40,986				
31	Taxes																			
32	Profit		S/. 2,255,114	66,327	66,327	66,327	66,327	66,327	66,327	66,327	66,327	66,327	66,327	66,327	66,327	66,327				
33	Total expenses		S/. 13,694,678	107,312	107,312	447,087	447,087	447,087	536,773	536,773	536,773	536,773	536,773	536,773	536,773	536,773				
34	inflation rates			1	0.99949143	0.999679749	0.99526871	0.99850783	1.00013456	1.00558598	1.00049032	1.00167685	1.005639508	1.005374474	1.010860849					
35	inflation correction			1	0.99949143	0.999171342	0.99444397	0.99296009	0.9930937	0.99864111	0.99913076	1.00080615	1.006450202	1.011859343	1.022848995					
36	Total expenses (real)		S/. 14,288,024	107,312	107,258	446,716	444,602	443,939	533,066	536,044	536,307	537,206	540,236	543,139	549,038					
37	NPV expenses		S/. 12,541,267																	
38																				
39	PLOT																			
40	Plot gross area (m2)		60,512.40																	
41	Plot net area (m2)		35,321.09																	
42	Nominal Unitary value (S/./m2)		S/. 14.00 /m2	S/. 41.26 /m2																
43	Nominal Total Value (S/.)		S/. 847,174	S/. 2,496,594																
44	Real (correct for inflation)		S/. 1,006,276	S/. 2,498,665																
45	Present value of plot at March 2003		S/. 1,545,199	S/. 2,459,287																
46	PROJECT CASH FLOW			-S/. 1,545,199	-S/. 68,336	-S/. 65,519	-S/. 229,742	-S/. 216,196	-S/. 41,715	-S/. 118,346	-S/. 119,007	-S/. 119,066	-S/. 119,265	-S/. 119,938	-S/. 120,583	-S/. 121,892				
47																				
48	INDICATORS AT MARCH 2003																			
49																				
50	K (land)		10%	contribution to the value		0.797%	monthly	annual									TOTAL	PROJECT	LAND	
51	K (project)		10%			0.797%											-S/.136.5 /m2	-S/.193.5 /m2	S/.57.1 /m2	
52	NPV project		S/. -3,099,194	141.8%		IRR project	#DIV/0!	#DIV/0!									-15.51%	-20.66%	59.16%	
53	NPV land		S/. 914,088	-41.8%		IRR land											-S/.36.1 /m2	-S/.51.2 /m2	S/.15.1 /m2	
54	NPV total		S/. -2,185,106	100.0%		IRR total											-S/.61.9 /m2	-S/.87.7 /m2	S/.25.9 /m2	
55																	% increment of land value: %Δ LV = NPV / raw lan	-141.41%	-200.57%	59.16%
56	LAND PROFIT > PROJECT PROFIT, THEN HYPOTHESIS IS PROVED																			

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ANNEX 5: PROJECT D REAL CASH FLOW IN US DOLLAR AND CORRECTION FOR US INFLATION RATE

1																	
2																	
3	INCOMES			-371	0	1	2	3	4	5	6	7	8	9	10	11	12
4	Type	N° houses	Price	1973	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2004	2005	2005
5	TP	328	\$8,000	March	February	March	April	May	June	July	August	September	October	November	December	January	February
6	MV	82	\$18,885														
7	Total	410															

Ratio TP/total 0.800 **Evaluation TP**

9	Time for sales (months)	6
10	Sales speed	50
11	Average sales speed	54.67
12	N° houses TP sold/month	328
13	N° houses TP sold/month	82
14	TP Downpayment	10%
15	TP Subsidy	45%
16	TP Bank loan	45%
17	Incomes from TP	\$2,624,000
18	MV Downpayment	10%
19	MV Bank loan	90%
20	Incomes from MV	\$1,548,570
21	Incomes from TP+MV	\$4,172,570
22	inflation rates: 1+π	
23	inflation correction	
24	Sales incomes (real)	\$2,670,918

Delay to receive subsidy	2
Delay to receive bank loan	4

	54	55	55	55	55	54											
							13	14		14		14		14		13	
	\$43,200	\$44,000	\$44,000	\$44,000	\$44,000	\$43,200											
			\$194,400	\$198,000	\$198,000	\$198,000	\$198,000	\$194,400									
				\$194,400	\$198,000	\$198,000	\$198,000	\$198,000	\$198,000	\$194,400							
	\$43,200	\$44,000	\$238,400	\$242,000	\$436,400	\$439,200	\$396,000	\$392,400	\$198,000	\$194,400							
							\$24,551	\$26,439	\$26,439	\$26,439	\$26,439	\$26,439	\$26,439	\$26,439	\$24,551		
									\$220,955	\$237,951	\$237,951	\$237,951	\$237,951	\$237,951	\$237,951	\$237,951	
							\$24,551	\$26,439	\$247,394	\$264,390	\$264,390	\$264,390	\$262,502	\$237,951			
	\$43,200	\$44,000	\$238,400	\$242,000	\$436,400	\$439,200	\$420,551	\$418,839	\$445,394	\$458,790	\$264,390	\$262,502	\$237,951				
	1	1.0064000	1.0032000	1.0059000	1.0032000	0.9984000	1.0005000	1.0021000	1.0053000	1.0005000	0.9963000	1.0021000	1.0058000				
	1	1.0064	1.00962048	1.01557724	1.01882709	1.01719696	1.01770556	1.01984274	1.02524791	1.025760535	1.021965221	1.024111348	1.03005119				
	\$43,200	\$44,282	\$240,694	\$245,770	\$444,616	\$446,753	\$403,011	\$400,186	\$202,999	\$199,408	\$0	\$0	\$0				

26	EXPENSES	
27	Time for urbanization	3
28	Time for construction (mo)	12
29	Serviced land / m2	25.36 \$/m2
30	Construction / m2	117.60 \$/m2
31	Serviced land	\$204,353
32	Construction	\$1,906,603
33	Design cost	\$49,192
34	Marketing costs	\$9,880
35	Financial costs	\$47,852
36	Legal fees: property regis	\$3,760
37	Overhead costs	\$218,968
38	Taxes	\$2,196
39	Profit	\$95,330
40	Total expenses	\$2,538,133
41	inflation rates	
42	inflation correction	
43	Total expenses (real)	\$2,543,637
44	NPV expenses	\$1,917,384

			\$16,397	\$16,397	\$16,397												
	\$1,647	\$1,647	\$1,647	\$1,647	\$1,647	\$1,647											
	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977
	\$6,623	\$6,623	\$23,020	\$23,020	\$23,020	\$6,623	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977
	1	1.0064	1.0032	1.0059	1.0032	0.9984	1.0005	1.0021	1.0053	1.0005	0.9963	1.0021	1.0058				
	1	1.0064	1.00962048	1.01557724	1.01882709	1.01719696	1.01770556	1.01984274	1.02524791	1.025760535	1.021965221	1.024111348	1.03005119				
	\$6,623	\$6,623	\$23,020	\$23,020	\$23,020	\$6,623	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977				

46	PLOT	
47	Plot gross area (m2)	8,279.28
48	Plot net area (m2)	8,059.07
49	Nominal Unitary value (US\$/m2)	\$1.08
50	Nominal Total Value (US\$)	\$8,961.73
51	Real (correct by US inflation)	\$23,808.36
52	Present value of plot at February 2004	\$453,370.49

IS PLOT A SUNK COST? NO

53	PROJECT CASH FLOW	-\$453,370	\$36,577	\$37,658	\$217,673	\$222,749	\$421,596	\$440,130	\$398,035	\$395,210	\$198,023	\$194,431	-\$4,977	-\$4,977	-\$4,977
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INDICATORS AT FEBRUARY 2004 **Δ NPV_{total}: (MV+TP)/TP 455.15%**

57	K (land)	10%	contribution to the value
58	K (project)	10%	
59	NPV project	\$394,788	205.3%
60	NPV land	-\$202,504	-105.3%
61	NPV total	\$192,284	100.0%

0.797%	monthly	annual
0.797%		
IRR project	# DIV/0!	# DIV/0!
IRR land		
IRR total		

	TOTAL	PROJECT	LAND	
Profit per m2 (built): NPV / built area	US\$9.5 /m2	US\$19.5 /m2	-US\$10.0 /m2	9.49 \$/m2
Profitability: ROI = NPV / total cost	8.11%	18.21%	-44.67%	
Land value per m2: NPV / plot gross area	US\$23.2 /m2	US\$47.7 /m2	-US\$24.5 /m2	23.22 \$/m2
Land value per m2: NPV / plot net area	US\$23.9 /m2	US\$49.0 /m2	-US\$25.1 /m2	23.86 \$/m2
% increment of land value (%Δ LV = NPV / raw lan	42.41%	87.08%	-44.67%	42.41%

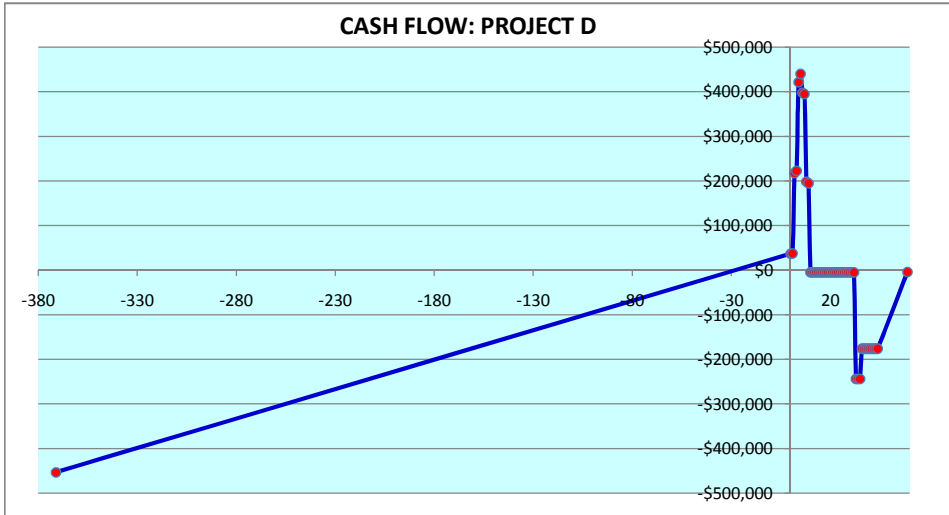
LAND PROFIT < PROJECT PROFIT, THEN HYPOTHESIS IS NOT PROVED

	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ
1																			
2																			
3	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
4	2005	2005	2005	2005	2005	2005	2005	2005	2005	2005	2006	2006	2006	2006	2006	2006	2006	2006	2006
5	March	April	May	June	July	August	September	October	November	December	January	February	March	April	May	June	July	August	September
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18																			
19	\$220,955																		
20	\$220,955																		
21	\$220,955																		
22	1.0078000	1.0067000	0.9990000	1.0005000	1.0046000	1.0051000	1.0122000	1.0020000	0.9920000	0.9960000	1.0076000	1.0020000	1.0055000	1.0085000	1.0050000	1.0020000	1.0030000	1.0020000	0.9951000
23	1.03808559	1.04504077	1.04399573	1.04451772	1.04932251	1.05467405	1.06754107	1.06967616	1.06111875	1.05687427	1.06490652	1.06703633	1.07290503	1.08202472	1.08743485	1.08960972	1.09287854	1.0950643	1.08969849
24	\$0																		
25																			
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37	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977
38																			
39																			
40	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977
41	1.0078	1.0067	0.999	1.0005	1.0046	1.0051	1.0122	1.002	0.992	0.996	1.0076	1.002	1.0055	1.0085	1.005	1.002	1.003	1.002	0.9951
42	1.03808559	1.04504077	1.04399573	1.04451772	1.04932251	1.05467405	1.06754107	1.06967616	1.06111875	1.05687427	1.06490652	1.06703633	1.07290503	1.08202472	1.08743485	1.08960972	1.09287854	1.0950643	1.08969849
43	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977	\$4,977
44																			
45																			
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50																			
51																			
52																			
53	-\$4,977	-\$4,977	-\$4,977	-\$4,977	-\$4,977	-\$4,977	-\$4,977	-\$4,977	-\$4,977	-\$4,977	-\$4,977	-\$4,977	-\$4,977	-\$4,977	-\$4,977	-\$4,977	-\$4,977	-\$4,977	-\$4,977
54																			
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59																			
60	-105.31%																		
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\$41.69
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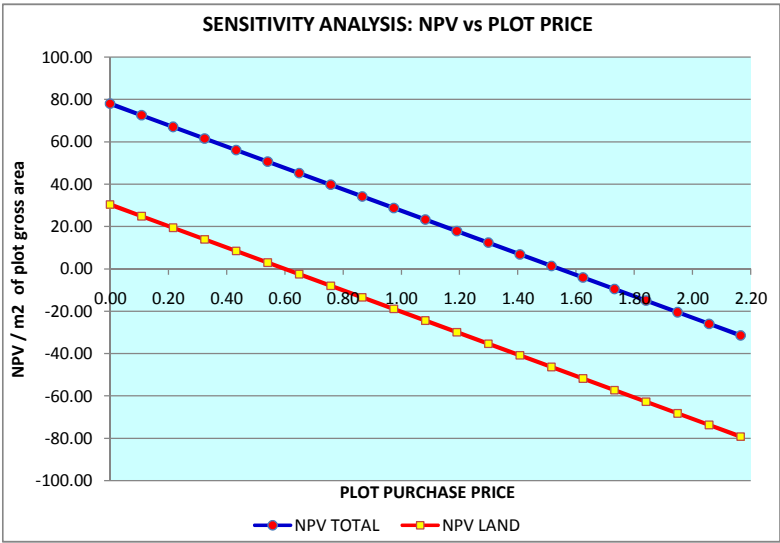
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PLOT PURCHASE PRICE SENSIVITY ANALYSIS

Max plot price (NPV total = 0)		1.54	
Max plot price (NPV land = 0)		0.60	
plot price variation	0%	price/m2	1.08

	price/m2	NPV total	NPV land	NPV project
plot price variation	1.08	US\$23.2 /m2	-US\$24.5 /m2	US\$47.7 /m2
-100%	0.00	77.98	30.30	47.68
-90%	0.11	72.51	24.82	47.68
-80%	0.22	67.03	19.35	47.68
-70%	0.32	61.56	13.87	47.68
-60%	0.43	56.08	8.40	47.68
-50%	0.54	50.60	2.92	47.68
-40%	0.65	45.13	-2.56	47.68
-30%	0.76	39.65	-8.03	47.68
-20%	0.87	34.18	-13.51	47.68
-10%	0.97	28.70	-18.98	47.68
0%	1.08	23.22	-24.46	47.68
10%	1.19	17.75	-29.94	47.68
20%	1.30	12.27	-35.41	47.68
30%	1.41	6.80	-40.89	47.68
40%	1.52	1.32	-46.36	47.68
50%	1.62	-4.16	-51.84	47.68
60%	1.73	-9.63	-57.31	47.68
70%	1.84	-15.11	-62.79	47.68
80%	1.95	-20.58	-68.27	47.68
90%	2.06	-26.06	-73.74	47.68
100%	2.16	-31.53	-79.22	47.68



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R				
1	ANNEX 6: PROJECT E							REAL CASH FLOW IN SOLES AND CORRECTION FOR PERUVIAN INFLATION RATE														
2																						
3	INCOMES			-84	0	1	2	3	4	5	6	7	8	9	10	11	12	13				
4	Type	N° houses	Price	2002	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2009	2009				
5	A	204	S/. 42,250	January	January	February	March	April	May	June	July	August	September	October	November	December	January	February				
6	B	300	S/. 42,600																			
7	1° sta	504																				
8	Total	1,700																				
9																						
10	Time for sales (months)	10																				
11	Sales speed	50																				
12	Average sales speed	50,40																				
13	N° houses A sold / month	204																				
14	N° houses B sold / month	300																				
15	Downpayment	10%																				
16	Subsidy	45%																				
17	Bank loan	45%																				
18	Sales Incomes	S/. 21,399,000																				
19	inflation rates: 1+π																					
20	inflation correction																					
21	Sales incomes (real)	S/. 22,400,838																				
22																						
23	EXPENSES																					
24	Time for urbanization	12																				
25	Time for construction (months)	30																				
26	Serviced land / m2	S/. 269.03 /m2																				
27	Construction / m2	S/. 724.90 /m2																				
28	Serviced land	S/. 2,512,455																				
29	Construction	S/. 13,152,631																				
30	Design cost	S/. 535,429																				
31	Marketing costs	S/. 213,990																				
32	Financial costs	S/. 1,578,316																				
33	Legal fees: property regis	S/. 328,816																				
34	Overhead costs	S/. 169,640																				
35	Taxes																					
36	Profit	S/. 657,632																				
37	Total expenses	S/. 19,148,909																				
38	inflation rates																					
39	inflation correction																					
40	Total expenses (real)	S/. 20,345,872																				
41	NPV expenses	S/. 17,623,647																				
42																						
43	PLOT																					
44	Plot gross area (m2)	18,677.65																				
45	Plot net area (m2)	9,338.82																				
46	Nominal Unitary value (S/. /m2)	S/. 10.4 /m2																				
47	Nominal Total Value (S/.)	S/. 193,927																				
48	Real (correct by inflation)	S/. 224,389																				
49	Present value of plot at January 2008	S/. 437,270																				
50	PROJECT CASH FLOW	-S/. 437,270	-S/. 57,181	-S/. 53,436	S/. 721,400	S/. 924,180	S/. 1,707,053	S/. 1,824,905	S/. 1,835,042	S/. 2,233,130	S/. 2,245,796	S/. 2,651,402	S/. 2,411,267	S/. 2,419,953	S/. 1,197,246	S/. 1,196,350						
51																						
52	INDICATORS AT JANUARY 2008																					
53																						
54	K (land)	10%	contribution to the value	0.797%	monthly	annual													TOTAL	PROJECT	LAND	
55	K (project)	10%		0.797%															S/. 166.0 /m2	S/. 164.7 /m2	S/. 1.3 /m2	S/. 166 /m2
56	NPV project	S/. 2,987,424	99.21%	IRR project	295%	#####													16.67%	16.52%	5.46%	
57	NPV land	S/. 23,890	0.79%	IRR land															S/. 161.2 /m2	S/. 159.9 /m2	S/. 1.3 /m2	S/. 161 /m2
58	NPV total	S/. 3,011,314	100.00%	IRR total															S/. 322.5 /m2	S/. 319.9 /m2	S/. 2.6 /m2	S/. 322 /m2
59																						
60	LAND PROFIT < PROJECT PROFIT, THEN HYPOTHESIS IS NOT PROVED																					
61																						

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
1	ANNEX 7: PROJECT F							REAL CASH FLOW IN SOLES AND CORRECTION FOR PERUVIAN INFLATION RATE (CONSIDERING ONLY TP)												
2																				
3	INCOMES			-2	0	1	2	3	4	5	6	7	8	9	10	11	12	13	26	
4	Type	N° houses	Price	2007	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2009	2009	2010	
5	TP	100	S/. 20,850	November	January	February	March	April	May	June	July	August	September	October	November	December	January	February	March	
6	MV	3,300	S/. 64,000																	
7	Total	3,400																		
8																				
9	Time for sales (months)	1																		
10	Sales speed	100																		
11	Average sales speed	100.00																		
12	N° houses TP sold/month	100																		
13	N° houses MV sold/month	3,300																		
14	TP Downpayment	10%																		
15	TP Subsidy	45%																		
16	TP Bank loan	45%																		
17	Incomes from TP	S/. 2,085,000																		
18	MV Downpayment	10%																		
19	MV Bank loan	90%																		
20	Incomes from MV	S/. 211,200,000																		
21	Incomes from TP+MV	S/. 213,285,000																		
22	inflation rates: 1+π																			
23	inflation correction																			
24	Sales incomes (real)	S/. 2,126,763																		
25																				
26	EXPENSES																			
27	Time for urbanization	12																		
28	Time for construction (months)	30																		
29	Serviced land / m2	S/. 239.9 /m2																		
30	Construction / m2	S/. 474.0 /m2																		
31	Serviced land	S/. 880,960																		
32	Construction	S/. 2,796,600																		
33	Design cost	S/. 56,957																		
34	Marketing costs																			
35	Financial costs	S/. 198,171																		
36	Legal fees: property regist	S/. 41,602																		
37	Overhead costs	S/. 247,556																		
38	Taxes	S/. 365,750																		
39	Profit																			
40	Total expenses	S/. 4,587,596																		
41	inflation rates																			
42	inflation correction																			
43	Total expenses (real)	S/. 4,831,272																		
44	NPV expenses	S/. 4,511,941																		
45																				
46	PLOT																			
47	Plot gross area (m2)	6,677.84																		
48	Plot net area (m2)	3,672.81																		
49	Nominal Unitary value (US\$/m2)	S/. 44.0 /m2																		
50	Nominal Total Value (US\$)	S/. 294,118																		
51	Real (correct by inflation)	S/. 296,106																		
52	Present value of plot at August 2003	S/. 300,848																		
53	PROJECT CASH FLOW	-S/. 300,848	S/. 208,500	S/. 0	S/. 956,624	S/. 0	S/. 942,180	-S/. 19,609	-S/. 19,718	-S/. 1,172,409	-S/. 1,179,058	-S/. 1,186,288	-S/. 1,189,954	S/. 0	S/. 0	S/. 0	S/. 0	S/. 0	-S/. 44,779	
54																				
55	INDICATORS AT JANUARY 2008																			
56	Δ NPV _{total} = (MV+TP)/TP			2882.34%																
57	K (land)	10%	contribution to the value	0.797%	monthly	annual														
58	K (project)	10%		0.797%																
59	NPV project	S/. -2,773,815	101.56%	IRR project	15%	444%														
60	NPV land	S/. 42,643	-1.56%	IRR land																
61	NPV total	S/. -2,731,173	100.00%	IRR total																
62																				
63	LAND PROFIT > PROJECT PROFIT, THEN HYPOTHESIS IS PROVED																			
64																				

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S																																																												
65	<p style="text-align: center;">CASH FLOW: PROJECT F</p> <table border="1"> <caption>Estimated Cash Flow Data for Project F</caption> <thead> <tr> <th>Period</th> <th>Cash Flow (S/.)</th> </tr> </thead> <tbody> <tr><td>1</td><td>-1,000,000</td></tr> <tr><td>2</td><td>-500,000</td></tr> <tr><td>3</td><td>950,000</td></tr> <tr><td>4</td><td>950,000</td></tr> <tr><td>5</td><td>-1,200,000</td></tr> <tr><td>6</td><td>-1,200,000</td></tr> <tr><td>7</td><td>-1,200,000</td></tr> <tr><td>8</td><td>-1,200,000</td></tr> <tr><td>9</td><td>-1,200,000</td></tr> <tr><td>10</td><td>-1,200,000</td></tr> <tr><td>11</td><td>-1,200,000</td></tr> <tr><td>12</td><td>-1,200,000</td></tr> <tr><td>13</td><td>-1,200,000</td></tr> <tr><td>14</td><td>-1,200,000</td></tr> <tr><td>15</td><td>-1,200,000</td></tr> <tr><td>16</td><td>-1,200,000</td></tr> <tr><td>17</td><td>-1,200,000</td></tr> <tr><td>18</td><td>-1,200,000</td></tr> <tr><td>19</td><td>-1,200,000</td></tr> <tr><td>20</td><td>-1,200,000</td></tr> <tr><td>21</td><td>-1,200,000</td></tr> <tr><td>22</td><td>-1,200,000</td></tr> <tr><td>23</td><td>-1,200,000</td></tr> </tbody> </table>													Period	Cash Flow (S/.)	1	-1,000,000	2	-500,000	3	950,000	4	950,000	5	-1,200,000	6	-1,200,000	7	-1,200,000	8	-1,200,000	9	-1,200,000	10	-1,200,000	11	-1,200,000	12	-1,200,000	13	-1,200,000	14	-1,200,000	15	-1,200,000	16	-1,200,000	17	-1,200,000	18	-1,200,000	19	-1,200,000	20	-1,200,000	21	-1,200,000	22	-1,200,000	23	-1,200,000																		
Period														Cash Flow (S/.)																																																																	
1														-1,000,000																																																																	
2														-500,000																																																																	
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1	ANNEX 8: PROJECT G							REAL CASH FLOW IN SOLES AND CORRECTION FOR PERUVIAN INFLATION RATE												
2																				
3	INCOMES			-18	0	1	2	3	4	5	6	7	8	9	10	11	12	13		
4	Type	N° houses	Price	2006	2007	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2009		
5	TP1	84	S/. 33,500	June	December	January	February	March	April	May	June	July	August	September	October	November	December	January		
6	TP2	55	S/. 42,000																	
7	Total TP	139																		
8	MV	68	S/. 60,000																	
9	Total	207																		
10				Ratio TP/total		0.671		Evaluation		TP										
11	Time for sales (months)			12		Delay to receive subsidy		2		Delay to receive bank loan									4	
12	Average sales speed TP1			7.00		Average sales speed TP2		4.58												
13	Average sales speed TP2			4.58		N° houses sold/month TP1		84												
14	N° houses sold/month TP1			84		N° houses sold/month TP2		55												
15	N° houses sold/month TP2			55		N° houses sold/month MV		207												
16	N° houses sold/month MV			207		Downpayment		10%												
17	Downpayment			10%		Subsidy		45%												
18	Subsidy			45%		Bank loan		45%												
19	Bank loan			45%		Incomes from TP		S/. 5,048,400												
20	Incomes from TP			S/. 5,048,400		MV Downpayment		10%												
21	MV Downpayment			10%		MV Bank loan		90%												
22	MV Bank loan			90%		Incomes from MV		S/. 12,420,000												
23	Incomes from MV			S/. 12,420,000		Incomes from TP+MV		S/. 17,468,400												
24	Incomes from TP+MV			S/. 17,468,400		inflation rates: 1+π		1.00000000												
25	inflation rates: 1+π			1.00000000		inflation correction		1.00222046												
26	inflation correction			1.00222046		Sales incomes (real)		S/. 5,331,624												
27	Sales incomes (real)			S/. 5,331,624																
28																				
29	EXPENSES																			
30	Serviced land / m2			S/. 72.5 /m2																
31	Construction / m2			S/. 710.4 /m2																
32	Serviced land			S/. 393,065																
33	Construction			S/. 2,962,214																
34	Design cost			S/. 19,685																
35	Marketing costs																			
36	Financial costs			S/. 198,171																
37	Legal fees: property registrat			S/. 41,602																
38	Overhead costs			S/. 247,556																
39	Taxes			S/. 126,407																
40	Profit																			
41	Total expenses			S/. 3,988,700																
42	inflation rates			1.00000000																
43	inflation correction			1.00222046																
44	Total expenses (real)			S/. 4,258,163																
45	NPV expenses			S/. 3,705,855																
46																				
47	PLOT																			
48	Plot gross area (m2)			10,744.13																
49	Plot net area (m2)			5,418.50																
50	Nominal Unitary value (US\$/m2)			S/. 58.1 /m2																
51	Nominal Total Value (US\$)			S/. 624,493																
52	Real (correct by inflation)			S/. 647,614																
53	Present value of plot at December 2007			S/. 747,146																
54	PROJECT CASH FLOW			-S/. 747,146	S/. 23,450	S/. 23,502	S/. 130,434	S/. 131,793	S/. 239,993	S/. 240,879	S/. 242,733	S/. 244,082	S/. 238,653	S/. 240,006	S/. 241,478	-S/. 48,914	-S/. 56,183	-S/. 56,242		
55																				
56	INDICATORS AT DECEMBER 2007			Δ NPV_{total}: (MV+TP)/TP		2649.65%														
57																				
58	K (land)			10%		contribution to the value		0.797%		monthly		annual		TOTAL		PROJECT		LAND		
59	K (project)			10%				0.797%						S/. 80.4 /m2		S/. 58.9 /m2		S/. 21.5 /m2		
60	NPV project			S/. 245,633		73.22%		IRR project		#i DIV/0!		#i DIV/0!		7.53%		5.41%		12.02%		
61	NPV land			S/. 89,838		26.78%		IRR land						S/. 31.2 /m2		S/. 22.9 /m2		S/. 8.4 /m2		
62	NPV total			S/. 335,471		100.00%		IRR total						S/. 61.9 /m2		S/. 45.3 /m2		S/. 16.6 /m2		
63				335,471										S/. 62 /m2				S/. 62 /m2		
64	LAND PROFIT < PROJECT PROFIT, THEN HYPOTHESIS IS NOT PROVED																			
64																				

	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI
1																	
2																	
3	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
4	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2010	2010	2010	2010	2010	2010
5	February	March	April	May	June	July	August	September	October	November	December	January	February	March	April	May	June
6																	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	
15	4	4	4	5	5	5	4	4	4	4	4	4					
16										34	34	35	35	35	34		
17	16,800	16,800	16,800	21,000	21,000	21,000	16,800	16,800	16,800	16,800	16,800						
18	75,600	75,600	75,600	75,600	75,600	94,500	94,500	94,500	75,600	75,600	75,600	75,600	75,600				
19	105,525	105,525	75,600	75,600	75,600	75,600	75,600	94,500	94,500	94,500	75,600	75,600	75,600	75,600			
20	197,925	197,925	168,000	172,200	172,200	191,100	186,900	205,800	186,900	186,900	168,000	151,200	151,200	75,600			
21										204,000	204,000	210,000	210,000	210,000	204,000		
22												1,836,000	1,836,000	1,890,000	1,890,000	1,890,000	1,836,000
23										204,000	204,000	2,046,000	2,046,000	2,100,000	2,094,000	1,890,000	1,836,000
24	197,925	197,925	168,000	172,200	172,200	191,100	186,900	205,800	186,900	390,900	372,000	2,197,200	2,197,200	2,175,600	2,094,000	1,890,000	1,836,000
25	0.99925213	1.00360219	1.00019011	0.99956994	0.99660424	1.00186688	0.997925959	0.99912813	1.00122626	0.99887932	1.00317107	1.00295916	1.00322508	1.00280812	1.00025357	1.0023786	1.00250849
26	1.06683176	1.0706747	1.07087825	1.0704177	1.06678282	1.06877438	1.066557695	1.0656278	1.06693454	1.06573885	1.06911838	1.07228207	1.07574027	1.07876108	1.07903463	1.08160122	1.0843144
27	211,153	211,913	179,908	184,326	183,700	204,243	199,340	219,306	199,410	199,187	179,612	162,129	162,652	81,554	0	0	0
28																	
29																	
30																	
31																	
32	28,076.10	28,076.10	28,076.10	28,076.10	28,076.10	28,076.10	28,076.10	28,076.10	28,076.10	28,076.10	28,076.10						
33	211,586.70	211,586.70	211,586.70	211,586.70	211,586.70	211,586.70	211,586.70	211,586.70	211,586.70	211,586.70	211,586.70						
34																	
35																	
36	14,155.07	14,155.07	14,155.07	14,155.07	14,155.07	14,155.07	14,155.07	14,155.07	14,155.07	14,155.07	14,155.07						
37														41,601.72			
38	17,682.57	17,682.57	17,682.57	17,682.57	17,682.57	17,682.57	17,682.57	17,682.57	17,682.57	17,682.57	17,682.57						
39	9,029.07	9,029.07	9,029.07	9,029.07	9,029.07	9,029.07	9,029.07	9,029.07	9,029.07	9,029.07	9,029.07						
40																	
41	280,529.50	280,529.50	280,529.50	280,529.50	280,529.50	280,529.50	280,529.50	280,529.50	280,529.50	280,529.50	280,529.50	0.00	0.00	41,601.72			
42	0.99925213	1.00360219	1.00019011	0.99956994	0.99660424	1.00186688	0.99792596	0.99912813	1.00122626	0.99887932	1.00317107	1.00295916	1.00322508	1.00280812			
43	1.06683176	1.07067470	1.07087825	1.07041770	1.06678282	1.06877438	1.06655769	1.06562780	1.06693454	1.06573885	1.06911838	1.07228207	1.07574027	1.07876108			
44	299,277.78	300,355.84	300,412.94	300,283.75	299,264.05	299,822.74	299,200.90	298,940.04	299,306.62	298,971.19	299,919.25	0.00	0.00	44,878.31			
45																	
46																	
47																	
48																	
49																	
50																	
51																	
52																	
53																	
54	-S/. 88,125	-S/. 88,443	-S/. 120,505	-S/. 115,958	-S/. 115,564	-S/. 95,580	-S/. 99,861	-S/. 79,634	-S/. 99,897	-S/. 99,785	-S/. 120,307	S/. 162,129	S/. 162,652	S/. 36,676	S/. 0	S/. 0	S/. 0
55																	
56																	
57																	
58																	
59																	
60																	
61																	
62																	
63																	
64																	

S/.97.4 /m2
S/. 1,046,380
S/. 981,081
S/. 836,984

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R																																																																																															
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ANNEX 9: PROJECT H

REAL CASH FLOW IN SOLES AND CORRECTION FOR PERUVIAN INFLATION RATE

NOTE: The developer did not invest in the plot, it was the owner

3	INCOMES		-16	0	1	2	3	4	5	6	7	8	9	10	11	12	13	
4	Type	N° houses	Price	2006	2007	2007	2007	2007	2007	2008	2008	2008	2008	2008	2008	2008	2008	
5	A	1,034	S/. 33,200	March	July	August	September	October	November	December	January	February	March	April	May	June	July	August

7	Time for sales (months)	6
8	Sales speed	172.33
9	Average sales speed	172.33
10	N° houses sold / month	1,032
11	Downpayment	10%
12	Subsidy	45%
13	Bank loan	45%
14	Sales Incomes	S/. 34,262,400
15	inflation rates: 1+π	
16	inflation correction	
17	Sales incomes (real)	S/. 34,922,401

7	Delay to receive subsidy	2
8	Delay to receive bank loan	4

7	172	172	172	172	172	172												
8	571,040	571,040	571,040	571,040	571,040	571,040												
9			2,569,680	2,569,680	2,569,680	2,569,680	2,569,680	2,569,680	2,569,680	2,569,680	2,569,680	2,569,680	2,569,680	2,569,680	2,569,680	2,569,680	2,569,680	2,569,680
10	571,040	571,040	3,140,720	3,140,720	5,710,400	5,710,400	5,139,360	5,139,360	2,569,680	2,569,680	2,569,680	2,569,680	2,569,680	2,569,680	2,569,680	2,569,680	2,569,680	2,569,680
11	1	1.00136908	1.00612501	1.00314015	1.00111007	1.00453105	1.00222046	1.00907018	1.01041851	1.01041851	1.01041851	1.01041851	1.01041851	1.01041851	1.01041851	1.01041851	1.01041851	1.01041851
12	1	1.00136908	1.00750247	1.01066617	1.01178809	1.01637255	1.01862936	1.02786852	1.03857737	1.03857737	1.03857737	1.03857737	1.03857737	1.03857737	1.03857737	1.03857737	1.03857737	1.03857737
13	571,040	571,822	3,164,283	3,174,219	5,777,715	5,803,894	5,235,103	5,282,586	2,668,812	2,672,927	2,672,927	2,672,927	2,672,927	2,672,927	2,672,927	2,672,927	2,672,927	2,672,927

EXPENSES

20	Time for urbanization	
21	Time for construction (months)	
22	Serviced land / m2	S/.0.0 /m2
23	Construction / m2	S/.665.0 /m2
24	Serviced land	S/. 0
25	Construction	S/. 21,479,617
26	Design cost	
27	Marketing costs	
28	Financial costs	
29	Legal fees: property regis	S/. 319,799
30	Overhead costs	S/. 1,761,243
31	Taxes	
32	Profit	S/. 1,662,093
33	Total expenses	S/. 25,222,753
34	inflation rates	
35	inflation correction	
36	Total expenses (real)	S/. 27,370,387
37	NPV expenses	S/. 23,058,489

7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	1	1.00136908	1.00612501	1.00314015	1.00111007	1.00453105	1.00222046	1.00907018	1.01041851	1.01041851	1.01041851	1.01041851	1.01041851	1.01041851	1.01041851	1.01041851	1.01041851	1.01041851
9	1	1.00136908	1.00750247	1.01066617	1.01178809	1.01637255	1.01862936	1.02786852	1.03857737	1.03857737	1.03857737	1.03857737	1.03857737	1.03857737	1.03857737	1.03857737	1.03857737	1.03857737
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PLOT

40	Plot gross area (m2)	55,531.00
41	Plot net area (m2)	55,531.00
42	Nominal Unitary value (US\$/m2)	S/.200.42 /m2
43	Nominal Total Value (US\$)	S/. 11,129,282
44	Real (correct by inflation)	S/. 11,338,032
45	Present value of plot at July 2007	S/. 12,874,427

S/.222.55 /m2
S/. 12,358,645
S/. 11,682,231
S/. 10,620,210

46	PROJECT CASH FLOW	-S/. 12,874,427	S/. 571,040	S/. 571,822	S/. 3,164,283	S/. 3,174,219	S/. 5,777,715	S/. 5,803,894	S/. 5,235,103	S/. 5,282,586	S/. 2,668,812	S/. 2,672,927	S/. 0	S/. 0	S/. 0	S/. 0	S/. 0	S/. 0
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INDICATORS AT JULY 2007

50	K (land)	10%	contribution to the value
51	K (project)	10%	
52	NPV project	S/. -170,086	7.02%
53	NPV land	S/. -2,254,217	92.98%
54	NPV total	S/. -2,424,303	100.00%

-2,424,303

0.797%	monthly	annual
0.797%		
IRR project	#DIV/0!	#DIV/0!
IRR land		
IRR total		

	TOTAL	PROJECT	LAND	
Profit per m2 (built): NPV / built area	-S/.75.1 /m2	-S/.5.3 /m2	-S/.69.8 /m2	-S/.75 /m2
Profitability: ROI = NPV / total cost	-6.75%	-0.51%	-17.51%	
Land value per m2: NPV / plot gross area	-S/.43.7 /m2	-S/.3.1 /m2	-S/.40.6 /m2	-S/.44 /m2
Land value per m2: NPV / plot net area	-S/.43.7 /m2	-S/.3.1 /m2	-S/.40.6 /m2	-S/.44 /m2
% increment of land value (%Δ LV = NPV / raw lan	-18.83%	-1.32%	-17.51%	-18.83%

LAND PROFIT < PROJECT PROFIT, THEN HYPOTHESIS IS NOT PROVED

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ANNEX 10: RESULTS SUMMARY: COMPARISON AMONG PROJECTS

LAND VALUE INCREMENTS IN SOLES WITHOUT CORRECTION

Project	Location	NPV total per m ²	NPV _p per m ²	NPV _L per m ²	NPV _L / NPV (total)	Date of comparison	Greater NPV component	Hypothesis testing
A	East	S/.87.02 /m ²	S/.45.23 /m ²	S/.41.80 /m ²	48.03%	July 2003	PROJECT	NO
B	North	S/.21.47 /m ²	-S/.7.62 /m ²	S/.29.09 /m ²	135.48%	August 2003	LAND	YES
C	South	-S/.36.11 /m ²	-S/.51.22 /m ²	S/.15.11 /m ²	-41.83%	March 2003	LAND	YES
D	East	US\$23.22 /m ²	US\$47.68 /m ²	-US\$24.5 /m ²	-105.31%	February 2004	PROJECT	NO
E	North	S/.161.23 /m ²	S/.159.95 /m ²	S/.1.28 /m ²	0.79%	January 2008	PROJECT	NO
F	East	-S/.409.0 /m ²	-S/.415.4 /m ²	S/.6.39 /m ²	-1.56%	January 2008	LAND	YES
G	North	S/.31.22 /m ²	S/.22.86 /m ²	S/.8.36 /m ²	26.78%	December 2007	PROJECT	NO
H	North	-S/.43.66 /m ²	-S/.3.06 /m ²	-S/.40.59 /m ²	92.98%	July 2007	PROJECT	NO

LAND VALUE INCREMENTS IN SOLES: CORRECTION FOR INFLATION AT JULY 2010

Project	Location	NPV total per m ²	NPV _p per m ²	NPV _L per m ²	NPV _L / NPV (total)	Date of comparison	Greater NPV component	Hypothesis testing
A	East	S/.105.97 /m ²	S/.55.07 /m ²	S/.50.90 /m ²	48.03%	July 2003	PROJECT	NO
B	North	S/.26.14 /m ²	-S/.9.27 /m ²	S/.35.42 /m ²	135.48%	August 2003	LAND	YES
C	South	-S/.43.66 /m ²	-S/.61.93 /m ²	S/.18.26 /m ²	-41.83%	March 2003	LAND	YES
D	East	US\$27.7 /m ²	US\$56.8 /m ²	-US\$28.9 /m ²	-104.50%	February 2004	PROJECT	NO
E	North	S/.175.07 /m ²	S/.173.68 /m ²	S/.1.39 /m ²	0.79%	January 2008	PROJECT	NO
F	East	-S/.444.1 /m ²	-S/.451.0 /m ²	S/.6.93 /m ²	-1.56%	January 2008	LAND	YES
G	North	S/.33.98 /m ²	S/.24.88 /m ²	S/.9.10 /m ²	26.78%	December 2007	PROJECT	NO
H	North	-S/.48.29 /m ²	-S/.3.39 /m ²	-S/.44.90 /m ²	92.98%	July 2007	PROJECT	NO

LAND VALUE INCREMENTS IN US\$: CORRECTION FOR EXCHANGE RATE AT JULY 2010

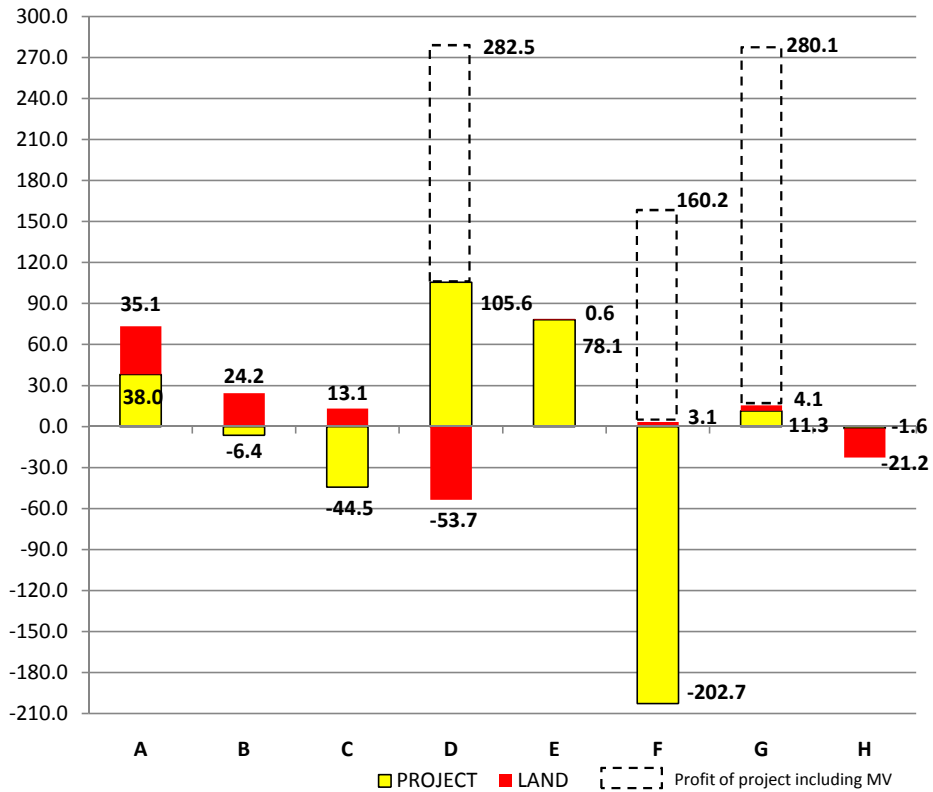
Project	Location	NPV total per m ²	NPV _p per m ²	NPV _L per m ²	NPV _L / NPV (total)	Date of comparison	Greater NPV component	Hypothesis testing
A	East	37.53 \$/m ²	19.51 \$/m ²	18.03 \$/m ²	48.03%	July 2003	PROJECT	NO
B	North	9.26 \$/m ²	-3.28 \$/m ²	12.54 \$/m ²	135.48%	August 2003	LAND	YES
C	South	-15.46 \$/m ²	-21.93 \$/m ²	6.47 \$/m ²	-41.83%	March 2003	LAND	YES
D	East	27.67 \$/m ²	56.81 \$/m ²	-28.91 \$/m ²	-104.50%	February 2004	PROJECT	NO
E	North	62.01 \$/m ²	61.51 \$/m ²	.49 \$/m ²	0.79%	January 2008	PROJECT	NO
F	East	-157.29 \$/m ²	-159.75 \$/m ²	2.46 \$/m ²	-1.56%	January 2008	LAND	YES
G	North	12.03 \$/m ²	8.81 \$/m ²	3.22 \$/m ²	26.78%	December 2007	PROJECT	NO
H	North	-17.10 \$/m ²	-1.20 \$/m ²	-15.90 \$/m ²	92.98%	July 2007	PROJECT	NO

Δ LAND VALUE		NPV / plot gross area (US\$ PER M2)			K	10%	0.79%	Profitability ROI = NPV / total cost (%)				
Project	Location	TOTAL NPV	PROJECT	LAND	NPV _L / NPV (total)	Date of comparison	Greater NPV component	Hypothesis testing	TOTAL	PROJECT	LAND	Hypothesis testing
A	East	73.1	38.0	35.1	48.03%	July 2010	PROJECT	NO	9%	5%	80%	YES
B	North	17.9	-6.4	24.2	135.48%	July 2010	LAND	YES	16%	-5%	508%	YES
C	South	-31.4	-44.5	13.1	-41.83%	July 2010	LAND	YES	-16%	-21%	59%	YES
D	East	51.4	105.6	-53.7	-104.50%	July 2010	PROJECT	NO	8%	18%	-45%	NO
E	North	78.7	78.1	0.6	0.79%	July 2010	PROJECT	NO	17%	17%	5%	NO
F	East	-199.6	-202.7	3.1	-1.56%	July 2010	LAND	YES	-57%	-57%	14%	YES
G	North	15.4	11.3	4.1	26.78%	July 2010	PROJECT	NO	8%	5%	12%	YES
H	North	-22.8	-1.6	-21.2	92.98%	July 2010	PROJECT	NO	-7%	-1%	-18%	NO

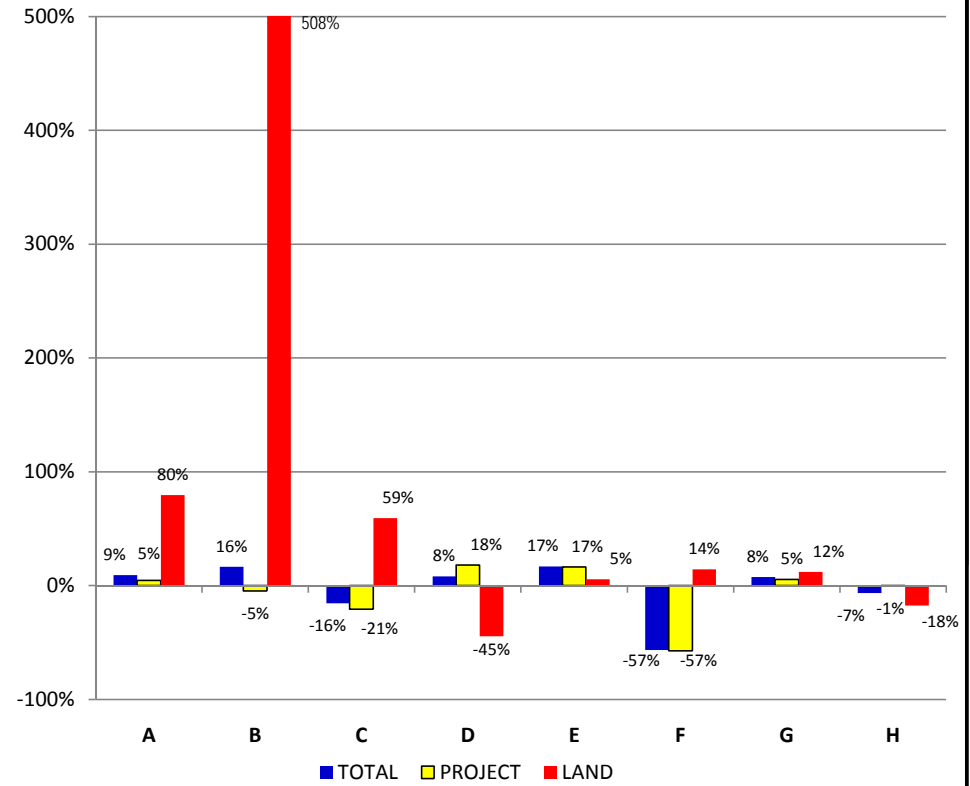
Mean	-2.15 \$/m ²	-2.78 \$/m ²	.68 \$/m ²
Median	16.65 \$/m ²	4.84 \$/m ²	3.62 \$/m ²
Standard Deviation	83.70 \$/m ²	87.94 \$/m ²	25.86 \$/m ²

Mean	-2.63%	-4.80%	77.07%
Median	7.82%	2.04%	13.10%
Standard Deviation	22.93%	22.87%	167.12%

INCREMENTS OF LAND VALUES: NPV (US\$/M2)



PROFITABILITY: ROI = NPV / total cost



STATISTICS: NPV (US\$/M2)

	TOTAL NPV	PROJECT	LAND
Mean	-38.10156298	-66.88702636	28.78546338
Typical error	83.73725507	81.0365427	10.64388515
Median	6.185921563	-10.07994035	18.77263527
Mode	#N/A	#N/A	#N/A
Standard deviation	236.8447236	229.2059555	30.10545347
Sample variance	56095.42309	52535.37002	906.3383287
Kurtosis	4.60128386	4.789503222	5.253086241
Skewness coefficient	-1.914960033	-1.959634607	2.150018565
Rank	757.4453289	761.7208189	98.17303554
Minimum	-574.4768129	-588.6019692	0.281178473
Maximum	182.968516	173.1188497	98.45421401
Sum	-304.8125038	-535.0962109	230.2837071
Sample size	8	8	8
Greater	182.968516	173.1188497	98.45421401
Lower	-574.4768129	-588.6019692	0.281178473
Confidence Level (95.0%)	198.007144	191.6209741	25.16878895

STATISTICS: ROI (%)

	TOTAL	PROJECT	LAND
Mean	-2.63%	-4.80%	77.07%
Typical error	8.67%	8.64%	63.17%
Median	7.82%	2.04%	13.10%
Mode	#N/A	#N/A	#N/A
Standard deviation	24.52%	24.45%	178.66%
Sample variance	6.01%	5.98%	319.20%
Kurtosis	356.61%	284.31%	686.64%
Skewness coefficient	-184.33%	-160.97%	256.14%
Rank	73.42%	75.34%	553.05%
Minimum	-56.75%	-57.13%	-44.67%
Maximum	16.67%	18.21%	508.39%
Sum	-21.01%	-38.36%	616.59%
Sample size	8	8	8
Greater	16.67%	18.21%	508.39%
Lower	-56.75%	-57.13%	-44.67%
Confidence Level (95.0%)	0.20497715	0.20439715	1.4936471