

Visually Aided Real Estate Search System

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First and foremost, we attribute the completion of our project to the blessings of Almighty Allah without Whom, this would not have been possible.

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Certificate

I accept the work contained in the report titled Visually Aided Real Estate Search System, written by **M. Musa Bin Khalid** as a confirmation to the required standard for the partial fulfillment of the degree of Bachelor of Science in Computer Science.

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Abstract

To highlight the value of real estate in Pakistan I have compiled data that explains approaches how real estate market works in Pakistan. It includes all the aspects including building, land and natural resources. This record features the strategies and apparatuses used to value land costs in the city of Islamabad. Private property isn't just a multi-dimensional item yet in addition considered to have an esteem bearing trademark for some as far as speculation perspective. A preliminary study was conducted to gather data that was further utilized in and proposed that price of residential property is always dependent on few things such as economic, physical, social and legal variables. Thus, Hedonic evaluating model is utilized to distinguish the inherent estimation of the land dependent on both external and internal attributes of the land.

House sizes and values of various subsectors were compared based on relativity model additionally stretched out to display conclusive estimation of the land at better places can be distinctive few influencing factors. A nonlinear effect on cost has been seen while expanding floor measure is considered. Essentially, plots confronting School and commercial areas have been seen to be less favored by individuals and thus a lower exchange cost (limited cost) is determined as needs be. The examination inferred that a huge relationship existed between the large scale financial factors and the land costs.

To project all this data in such a way that it makes sense to normal person Data Visualization techniques are practiced across this project. This project can aid anyone to quickly navigate to the properties of their desired locations.

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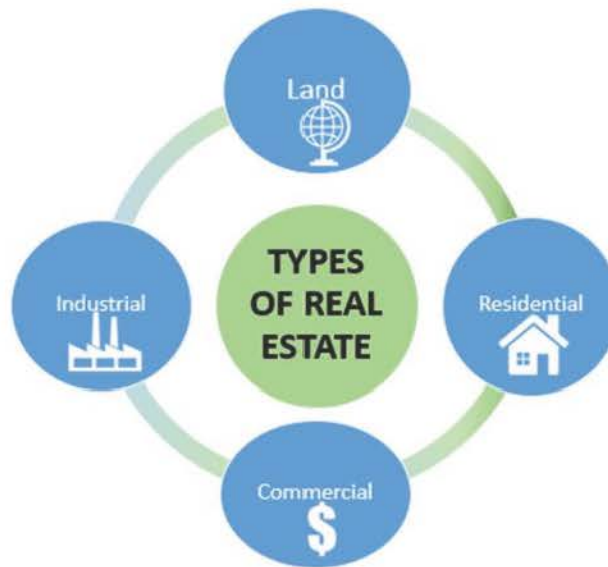
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Chapter 1

1. Introduction

1.1. Project background and overview

There are three types of land grouped according to their use: commercial, residential and industrial. Residential land incorporates undeveloped land, houses, apartment suites and town houses; and Commercial land are places of business, stockrooms and retail homes; and instances of mechanical land incorporate industrial facilities, mines and farms hence: media calls it “real estate market”.



There are loads of factors in real estate market and how nobody can ensure secure business since very few follow international standards in real estate market of Pakistan, The fundamental reason behind this project is to add value in terms of cutting out exploitation by creating awareness in the real estate sector by making justified prices of residential plots to the masses. The calculation of justified prices takes into account all relevant factors and will be made accessible to the masses online. The venture is unique since nobody has endeavored to outperform the valuation paradigm ever of. The realtors guarantee having exceptional information regarding the matter of property valuing and are the most counseled source yet they don't have any support behind their attestations of market costs.

While, Graana and Zameen are listing the market prices of property, our real estate valuation dashboard aims to educate the masses regarding inherent estimation of the same property, which could conceivably vary from the market price anytime. As a starting point, this venture will cover the valuation of residential property in DHA-II.

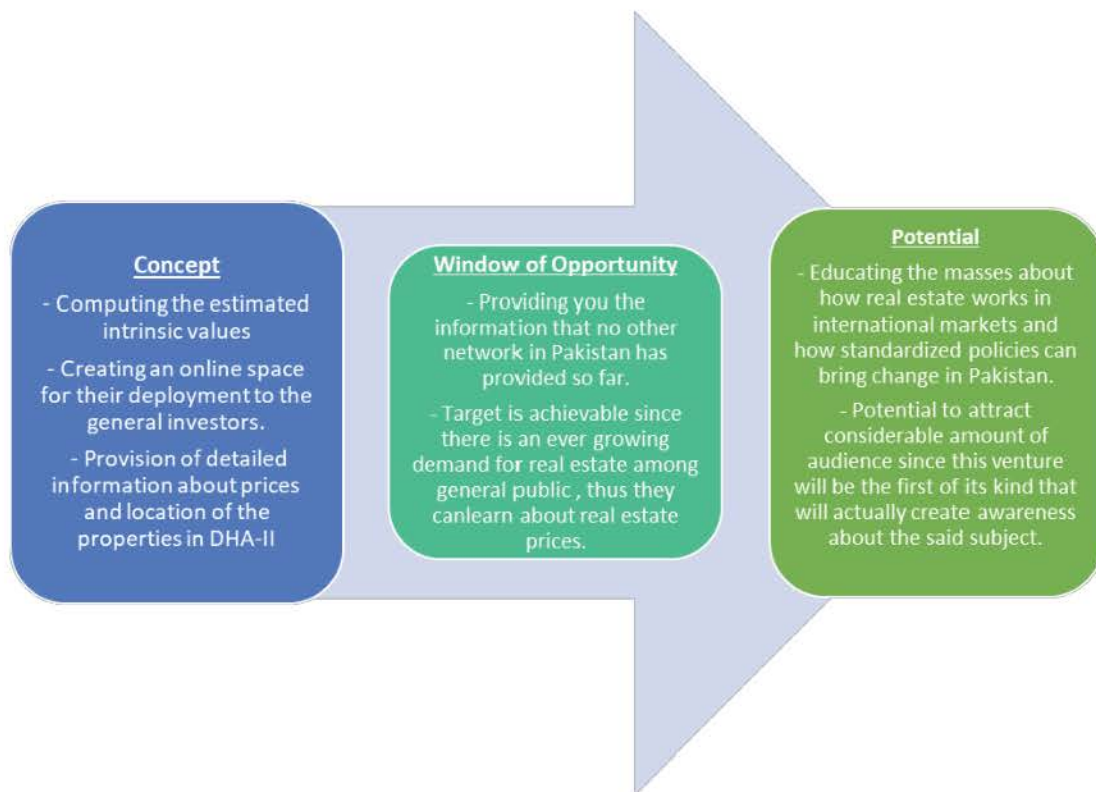


Fig. 1.1.

1.2. Problem Description

The real estate sector in Pakistan is victim to heavy manipulation and exploitation at the hands of real estate agents. This project helps to eliminate this manipulation altogether through the use of expert valuation techniques which incorporate the macroeconomic as well as the area specific factors that affect value of a certain piece of land to calculate the intrinsic/real value of properties. As well as provides an efficient way to provide customers the product altered to their needs with the help of visualization customers will be able to filter out the properties that are not required.

1.3. Project Objectives

The primitive aims of the project are as follows:

1. Planning a formal structure for the powerful utilization of valuation approaches underlying the innate estimation of land in the locality. Henceforth, the goal is to discover the factors affecting the price of the land.
2. To make an online dashboard which provides the results of our study to the general investor and making it a financially savvy and easily accessible path for them to analyze all the property related data.
3. Building up a working framework that provides cognizance to the general public and brings about development, innovation, transparency and clarity in the real estate market of Pakistan.

1.4. Project Scope

This project provides an efficient solution in search of real estate according to the user need but it will not factor in the political situation of the country which also effects the real estate market. The scope of this project also does not cover the environmental factors of the area focused on in this project. All these factors affect the Mathematical modelling of this project but we will ignore these factors because they are out of the scope of this project. The project will not focus on the ownership status of the properties.

Chapter 2

2. Literature Review

2.1 International Real Estate Valuation Practices

Worldwide practices are diverse since developed economies have various principles and have various methodologies that they continue in housing market. Each nation has its own arrangement of practices and rules and guidelines that administer their land area, because of protected and institutional contrasts. Nonetheless, the fundamental valuation techniques which are adequate across the world are inserted into these guidelines and approaches of various nations which hence helps in model structure and value assurance.

In the paper "Displaying Hong Kong Real Estate Prices" (Lennon H.T. Choy) , property valuation is done in Hong Kong based on Hedonic models which considers various elements like age, openness, neighborhood, sporting offices, ecological characteristics and all the more significantly size. To find the expense of a property, the trade costs are backslid on the characteristics inferable from the property. This yields the regard related with the characteristics of property. The Hedonic model demonstrates a worth limit and after that it uses different inferable characteristics that sway the expenses of property. At the point when the predetermined model predicts the expenses, a record is made which reflects the expenses of land in a given period of time.

Nations where Chinese are in larger part, for example, Hong Kong, Taiwan, Singapore and China, Chinese individuals counsel Feng Shi masters preceding purchasing property as they put stock in fortunate and unfortunate numbers. Business areas are chosen in the wake of counseling Feng Shi masters such models are constructed in order to take into account subjective factors which cannot be quantified otherwise.

The laws and strategies vary in various states which often impact the valuation methodology and in this manner, model is ill suited to expect the relative market assessment of the land/property now and again. To deal with this issue and researchers have developed a model which relies upon the "Somers System of Appraisal" which contrasts one section and another while managing the comparable factors and evaluating the particular variables. This has helped land valuers with utilizing their judgment and notion in a logical condition to blend the qualifications. The similar relative valuation method is predominant in surveying the innate gauge/cost of metropolitan land used for different purposes and for properties of practically identical nature.

In America, the strategy for relativity is regularly utilized with the goal that any metropolitan land utilized for business, private, business, or modern intention is completely normalized which helps in the correlation of the worth of land or property across various urban communities. This is on the grounds that the overall strategy utilizes uniform units for evaluation of the relative multitude of variables, henceforth making it more straightforward to look at comparative properties across

various regions or locales. Nonetheless, with the rise of new ideas and thoughts, the peculiarities of "significant worth" can't be confined to one orderly equation. This has assumed control over the traditional strategies and the valuers in America are embracing new methods to normalize the units for correlation.

The Royal Institute of Chartered Surveyors (RICS) creates and executes guidelines on land valuation. This is done in Europe and in UK, with the assistance of valuers and building related experts on its board. They layout and characterize the various approaches that can be utilized to esteem property in the Red Book. In the UK, the Red Book comprises of various strategies out of which the most widely recognized are as per the following:

2.1.1 Residual Method

This technique is utilized to think of the worth of a land or building that has not been grown at this point. The cost is subsequently determined by deciding the greatest sum that the property will yield when it is created, in the wake of deducting each of the expenses, for example, development costs and some other.

2.1.2 Investment Method

Here, the Discounted Cash Flows Model (DCF) is utilized to gauge the degree of pay that will be created by the property which is then used to think of its worth.

2.1.3 Comparative Method

This technique is utilized for those properties which are comparable and have noteworthy information accessible. Here, it is accepted that any objective financial backer cannot pay more than the comparative properties that are accessible on the lookout.

2.2 Real Estate Valuation Practices in Pakistan

As per the trends in real estate market, the valuation and appraisals of property is not popular among people of Pakistan. People usually utilize the old and traditional techniques, which require a lot of time to complete the process and these techniques do not favor the consumers. Sometimes, the process ends up with no results and the users meet fraud. There is a lack of check and balance in the maintenance of the property's record, which booms the possibility of manipulation and exploitation risk for the investors.

The valuation of property has no specific criteria in Pakistan, as the estimation of the prices is based on the previous estimates of the property, as the evaluators compare the current prices with the previous prices of the same property. This creates hype in the prices for the authorities to launch new societies. Most of the population of Pakistan is lower or middle class. When it comes to buying a property or land, these people mostly rely on the word of mouth, and people are reluctant to do the market research. This has led to the boom in prices of some regions and cities as a trend has been noticed that societies have always charged higher prices than before.

Pakistan is still considered as a safe haven for real estate investors. The real estate investors are mostly interested to invest in the properties, which offer less amount of risk and minimum amount

of reduction in their amount of wealth. Most of the REITs are interested in the commercial and residential properties. Over recent years, many foreign investors have shown their interest in the real estate market of Pakistan as history shows that real estate is the only service in Pakistan, which has never lost any value, both in the short and in the long run. This is why mostly people invest in real estate rather than any other avenue because it provides sure short gains at minimum risk.

Bahria Town, can be taken as a perfect example, of a mighty property developer, who has furnished individuals with such alluring opportunities, which have never been provided before. Bahria Golf City project is one of its kind because it will be built in the capital city of Pakistan with golf course as view from every house so it is kind of a jewel for Bahria developers. Because of this reason, the value of property has already hiked in the locality that people who used to own lands there have benefitted innumerable. The prices, which were in thousands, have doubled and a 1-Kanal villa is being sold at 55 million rupees averagely.

As the population of the world increases, more and more people are coming to live in the urban cities of Pakistan which has led to a constant rise in demand for both residential and commercial opportunities. Because of this, Pakistan spends approximately \$5.2 billion on construction annually.

As mentioned earlier, the high population increase in Pakistan ensures that more and more quantity of real estate will be demanded in the near future. Different investment trusts will bring multiple opportunities to everyday investors such as The China Pakistan Economic Corridor (CPEC), which is also going to open major avenues for investment to both local and foreign investors. This will provide incentives for foreign investments and will also be open to all new market entrants. Therefore, it can be seen that this sector still has a lot of room for investment and is open for all market players.

2.3 Comparison of International practices with practices of Pakistan

To regulate the real estate valuation, international valuation agencies are diligently playing their role. America, Europe and Asia Pacific countries have regulatory bodies that devise, rules, and standards appertain to real estate sector. It is advantageous as it brings conformity and accuracy and to attract foreign investors, it sets standards of consistency and reliability. These standards are often influenced by the factors such as location, economy, and weather conditions in some cases but still these policies are at one level across the globe. Authorized land evaluators are enlisted for this reason who are enrolled with the state division that manages this sector.

The second largest contributor to the economy of Pakistan is the real estate sector. This is because of the coordinated system of ventures, for example, development and lodging which is included and identified with this business. There are around 250 supporting enterprises which are subject to the real estate business. Enterprises like steel, brick, cement, and wood are being benefited from the business and development of the real estate. Increase in expenditure on this sector has huge impact on the income generated and be instrumental to the economy. This sector has seen low growth and development due to the limitations in the unstandardized valuation system. This sector

has huge potential but the limitations are directly affected by traditional valuation policies that can demoralize the investors and stunt growth.

Pakistan has not made much progress in this sector and is underdeveloped because of weak legal system to ensure that property is free of any dispute. Regulatory bodies that are required to administer the land properly are incompetent, laws exist but their effective implementation is impossible due to weak enforcement. Proper documentation is an essential prerequisite in having exchange deals or trades but Pakistan follows exchange enlistments rather than title registration. This trend is prevalent due to historical phenomenon, incompetency of regulatory bodies, and weak legal framework.

In developed countries, this sector has been improvised and policies and regulations have been adopted, and changed with the passage of time. Different models have been adopted to evaluate the real value of the land either it's commercial or residential. The real estate valuation has a central importance in all kind of businesses.

The sort of valuation approaches that valuers adopt in any country is reliant on various factors, for example, their instructive foundation, culture, understanding, introduction, etc. (Mackmin 1999). It has additionally been built up that the sort of property valuation strategies embraced in a nation could influence the economy of the nation and other countries can have a direct impact by these policies (Gilbertson and Preston 2005). At the point when this impact is negative, it could prompt a worldwide emergency. For example, the worldwide financial crisis that happened somewhere in 2007 and 2009 was due to the real estate sector, where it was contended that subprime contract loaning that began in the US and spread far and wide was because of the utilization of inappropriate and unreliable property valuation approach (es) (Duca, et al. 2010; King, et al. 2013). Especially, Quigley (2001) built up that the 1997 Asian money related crisis could be connected to the activities in the real estate sector (mortgage system).

2.4 Background

The up & down in the prices of the real estates is influenced by different trends and characteristics, such as supply & demand, buyer's behavior, demographic factors, trends in production, physical conditions of the property and more. This also challenges the relationship between the sustainability and market value. (Warren-Myers, 2012) The valuation of real estate is significant in identifying a positive impact on the relationship between sustainability and market value. The buyer's behavior also has a significant role in this process, the short-term expectations impacts on the year-to-year change in the property's prices. Whereas, the long-term expectations from a buyer would result in a boom in the high price rates for the property (Daly, 2003)

A buyer usually makes a comparison between different properties of same type to determine which one he would be interested to buy. During this comparison, different factors would come up. To estimate and assess the value of a residential property, it is critical to decide the influential factors, which are linked with the housing characteristics and the influence of external factors on the value of residential properties. When prices are being compared through the sales comparison approach, market value is evaluated by comparing with similar properties, which are sold or on the list. This comparative analysis is mostly based on similarities and the transaction that would affect the value.

Sales comparison approach is the most reliable approach in an independent market; adjustment can be made according to the requirement (Farlan, et al., 2017)

Property or land assets are considered as one of the main factors of production. It is one of the sources of the cash flow, despite depending on the demand and supply of it. The process of real state valuation provides measurable benefits and liabilities to secure the ownership of the property (Lorenz & Lutzkendorf, 2008). The real estate valuations can be utilized for numerous purposes, such as purchase and sale of the property, investment, inheritance, financing, tax evaluation & assessment, expropriation, and settlement between the parties.

Most significant elements are the size of area, location, view, condition, age of the property, architecture and parking of the building. The architectural infrastructure, equipment utilized in the construction and the reliability of the building matter a lot. Location is another factor in this regard, which is believed to have an impact on the social and economic elements. For example, people find it easier to live in an industrial neighborhood than an urban neighborhood. Similarly, accessibility also plays an important role. The connection between the location and the city's center will add more up to its market value (William & Ventolo, 2005)

The purpose of valuation is to provide validity and reliability to produce correct estimation of prices of property in the market. There are two types of valuation methods; traditional & advanced. The valuation method should reflect the market trends and market value when the valuation process is ongoing. It also should be a representation of the primary fundamentals of the market. In this regard, valuation is the best estimator of the trading price of the property. The valuation method should utilize a model, which estimates and forecasts these factors: market price, market value and the assets worth (Pagourtzi, et al., 2003).

Investment in property or real estate, most of the times is concerned with the assets that are worth more than their estimated cost. In the stock market, properties are frequently traded in the open market and access to the information is not limited. Whereas, the professional appraisers and investors would need accurate information about the comparative transactions, while the time of the assessment. This leads it to emergence of independent property data services, which provides the information about the market to make a decision on the investment.

The true value of a property makes a seller to arrive at the reasonable decision during the contract process with the buyer. The purpose of valuation is to make comparison between the prices on the market level. It helps the investors in deciding what kind of property is over or underpriced. Undervaluation causes a conflict in a sense that sometimes the same property is estimated to be less than it is to an independent appraiser (Adetiloye & Eke, 2014).

There are three approaches for the valuation of an investment property, the market data approach, cost approach and income method. The market data approach is established on the comparable sales in the real estate market. This approach is widely used in the market over many years and has been one of the factor, which influences the raise the price in the biggest cities, such as New York. The cost approach is used to determine the value of the land underlying the analyzed property and then adding the cost to rebuild per the current market prices. This approach is mostly used for the rent-stabilized properties. The income approach defines the property value as

the current worth of future benefits of owning a property. This approach has most of its emphasis on investment components rather than physical components of land or property (Sioni, 2010). It is considerable, that the real estate investors with the diversified strategies are more likely to have properties of all types and geographical regions in their portfolios. If we compare diversification within the American markets and Asian Markets, we will notice that diversification among the Asian investors has exposed to country and exchange rate risks. They mostly follow aversion against the currency risks (Cheok, et al., 2011).

The traditional valuation models and methods are utilized to generate expectations and forecast the behavior of the economy but do not fulfill an appropriate analysis of market and property cycles. Such methods or models may produce biased results and may illustrate false assumptions related with market. For example, when demand exceeds supply, it results in the capitalization of the cash flows and it is considered that the rental or purchase prices will rise above the inflation rate. This results in surging of property prices beyond a considerable level. Many theorists and practitioners ignore to use the recurring economic factors during the development of their valuation models. This might have happened possibly because of the lack of knowledge, difficulty in specifying analytical methods, lack of market analysis, and the use of traditional practices in the valuation process (Born & Phyr, 1994). There is a number of economic elements, which are connected with the cash flow and affect it, such as supply & demand, occupancy rates, aging factor, market relationship between new and old properties.

Real estate brings many opportunities to implement the real options valuation theories, which includes property purchase options, development and purchase feasibility, desertion and lawsuit. Different decisions are mutually exclusive and create different values. While decisions of the real options valuation theory are similar to the Discounted Cash Flow (DCF) theory and real estate valuation theory; real options valuation theory is a little different. It analyzes the probability of the decision-making and cash flow from each option; hence, it is called probabilistic. (Pomykacz & Olmsted, 2013)

An assertive trend has been noticed in the real estate market as investment in residual properties has increased from 5% to 7% in the years prior to 2017. However, the real estate market of Pakistan is declining and a fall in the prices can be observed in all cities and regions of Pakistan. The transaction made for the real estate business are recorded low. The impact of the amendments made in Tax Ordinance-2001 concerned with the property valuations can be noticed now. The demand in the real estate market is fading and people are gambling with interest for the investment, and it is resulting in the fall of real estate market of Pakistan. The new amendment in the tax ordinance, which was implemented in 2016, has made provincial government to refrain from the evaluation of the property (Arifeen, 2017).

It is the responsibility of State Bank of Pakistan to value the property and land assets, and it should refer the assets to the Federal Board of Revenue (FBR)'s in land revenue department. The decline in the real estate market of Pakistan may also be caused due to the disinterest of the overseas Pakistanis due to lower investor confidence brought about by high levels of manipulation. This is also resulting in the depressing inflows of financial settlements of the country. The writer has mentioned a research survey, which proposed the assumption that local real estate market has moved to the abroad mostly and investors are seeking alternative investment opportunities. The

serious blow among the investors and buyers in the real estate market is caused by the devolution of power by the government, which it has given to the FBR for estimation of the property prices and stop the valuation of land.

According to the Fiscal Year report of 2019, the real estate market in the major cities of Pakistan are under stress because of rise in the demand of the properties by the rural population which moved to cities for better opportunities. On the brighter note, it has also helped in the continuous cash flows over the recent years. The boost in the demands of the land & property purchase is also caused as the result of tax avoidance. Due to the interest of investors in real estate, a short-term investment in the sector was found, which has resulted to persist the price pressure in the market. After 2011, the prices of the land in major cities was three times higher than the prices of property. This indicates the interest of investors in the land of the major cities is consistent. Due to the high capital gains and increase in the transactions and tax accountability, an imaged has been created about real estate investors and firms as financial giants in the economy. This happened despite the interest of the investors remained in other services and productions. According to the State Bank of Pakistan the real estate sector has longed for, as in spite of any development in the real estate, many transactions are still being carried out for the frequent trading of land and property.

Chapter 3

3. Requirement Specifications

3.1. Existing System

In the past, there are few options already available for the customers in the real estate market in websites like Graana, Zameen and many more. But these are what you would call a Marketplace for real estate. Where someone or anyone can list a property and you would rely on the person on the other end of the deal to provide you with the details and pros & cons of the property. Though Zameen is now working on more and more visualization techniques to educate their customers about the characteristics of the properties they offer.

Pros of Existing systems:

- A lot more options available.
- Easy to locate the owner of the property.
- Free of cost for browsing.

Cons of Existing Systems:

- No real insight or view of the property without visiting.
- Unverified Prices.
- Not Visually Aided.

3.2. Proposed System

Proposed can easily fill the flaws and resolve the problems. Proposed system is **Visually Aided Real Search System**. It is not designed to replace the existing systems but to work in harmony and help people better understand their requirements and implement those requirement on their real estate searching process to find their properties more efficiently from the comfort of their home.

1

Benefits of the Proposed System

- **No Property Dealer Required**
No property dealer is required because everything is well managed online.
- **Data Consistency**
The major benefit of our proposed system is Data consistency. Now, if we change data in one portion of the system, it can automatically change data in every related portion.
- **Data Security**
In our proposed system, the user has security because only an authorized person can enter in this system.
- **Data Accuracy**
Our proposed system is accurate because what you see is gathered and maintained after verifying.
- **Removing Data Redundancy**
In our proposed system, we remove the data redundancy. Now, we get the information in a single place.

3.3. Requirement Specifications

As mentioned above that existing systems have some flaws. That's why we have proposed our system but a huge part of the proposed system is Data Collection. The individual data of each plot after all the analysis is carried out on the data is required at any given moment to be visualized in the dashboard.

Functional requirement:

- The dashboard should be able to make an approximate output.
- The system should project accurate visualization.
- Visualizations should be understandable to everyone.

Non-Functional Requirement:

- The accuracy of the system should be better.
- The system should have user friendly interface.
- In short amount of time, the system should perform effectively

Chapter 4

4. RESEARCH METHODOLOGY

The aim of this research was to identify the gap between the market prices and the true intrinsic values of the properties, and working towards its eradication.

4.1 Primary Research

4.1.1 Surveys

We used surveys to gather information to assess the needs of individuals and to see their level of satisfaction with the real estate dealers. To have a more structured approach towards the pricing of the plots, we opted for the methodology of surveys. The survey was created on surveymonkey.com and the questions in the survey were directed at the basic needs of investors and their preferences, when it came to the area and the location of different plots. This helped us gain an insight on the investors' preferences. For this purpose, we created different categories for various location aspects in order to make it more precise, and assigned every category with different weightages in the survey to get an idea of how much more or less, the investors would be willing to pay for different categories, on average. Initially, the kiosk mode of survey was adopted and physical visits to DHA office and property dealers were made to get the surveys filled. This was done to specifically target the relevant investors to avoid any inconsistency or biasness in our results. We could only collect as many as 350 responses due to our limited reach. The results of these responses were thoroughly analyzed to devise a realistic valuation model.

4.1.2 Interviews

To collect DHA-II specific information and to gain knowledge about the current pricing methodology applied there, we interviewed the relevant authorities. Col Ejaz Hussain (Secretary General), Col Iqtidar Ahmed Farooqi (Director Marketing), Col Muhammad Riaz Meem (Land Directorate) and lastly Col Azam Shehzad (Director Town Planning) were interviewed. From these interviews, we inferred that the role of DHA is limited to initial balloting and transfers of property and even a renowned society like DHA falls victim to manipulation at the hands of major realtors and traditional valuation practices prevail in the market. The interactive interviews helped us collect data regarding base prices, size of plots and the future prospects. As of now, 95% of the work in this phase has been completed and the remaining 5% is still under process.

After gathering enough internal information about DHA-II, it was time to start examining the market conditions. As our study was based on the comparison of market prices and the estimate of true value, we visited the leading property dealers dealing majorly in the trading of properties in DHA. The data collected from multiple real estate agents was compiled and an average market price for each area was computed for analysis.

4.2 Secondary Research

The secondary research has been conducted through the summary, collection and analysis of existing literature to gain knowledge about the different real estate valuation practices and methods that are being carried out around the world and the methods being currently used in Pakistan. Comparison between the two helped us to identify and analyze the weaknesses that exist in the current methodologies and hence, enabled us to work towards changing the dynamics of the real estate sector of Pakistan and aligning it with the developments happening across the world.

CHAPTER 5

5. VALUATION

Our intention/ vision while taking up this project of valuation was to encompass all the factors that majorly effect the prices of real estate. For this purpose, we approached our task with a more comprehensive and structured outlook. The steps of valuation are thus listed below:

5.1 Maps and physical visits

The first step was to get hold of the map of DHA II. It comprises of 9 sectors so it was important to get familiar with the area as well. Therefore, we coupled studying the maps to visiting DHA which helped a lot in clarity and confirmation of our understanding. We understood the lanes and streets; the structure of the map. 7 physical visits were conducted to get familiar with the area.

Another useful outcome of these visits was confirming the use of Google Earth. Google earth was a notable resource in our project. We wanted to point out vacant and non-vacant plots. For this purpose, we used Google Earth. The sectors, A, D and H were checked for vacancies through physical visits. These vacancies were then verified using the Google Earth. The accuracy of Google Earth was ensured when its findings were in line with the results of physical visits and so we used this strategy to collect data for the rest of the sectors.

5.2 Macro factors

The macro factors are the external factors that are not in control of any real estate agent or an investor. They change and along with it, the dynamics of the real estate market are affected. Hence, the demand and supply of property along with prices takes a shift. The intensity and extent to which each factor affects real estate is different and will be discussed below.

Before moving on to the categories, it is important to note that we have directly taken the effect of these macro variables in our initial launch price data that is; without any interference or manipulation that existed post launch till date. This is how the macro factors will purely effect the prices of the property of DHA II and give us a manipulation free base price for 2018 based on the launch prices.

5.2.1 Inflation

With high inflation comes time of uncertainty and people prefer keeping safety nets to protect themselves against inflation. Real estate is considered to be a hedge against inflation as its value is expected to generally appreciate over time and the prices of real estate move proportionately with the rate of inflation. According to data from the World Bank, Pakistan has seen an irregular trend in inflation. (Figure 15).

5.2.2 GDP per capita

GDP per capita growth and real estate prices are complementarily related; as when it is greater, greater will be the financial power of the investor which fuels up the demand for property. Use of the Granger causality test can verify this relationship between GDP and real estate prices. (Figure 16).

5.2.3 Urban population

As urban population will grow, the demand for residential plots will increase because now there will be more people looking for accommodation. DHA-II is an urban area which is why the growth in urban population can drive up its demand and bring about an increase in prices. (Figure 17).

5.2.4 Share of household income in property

Increase in income results in a desire among people to improve their living conditions or climb up the property ladder and thus, the share of income invested in property generally increases. This factor directly represents the growth in demand for property and hence, the surge in its prices (Figure 18).

5.3 Micro factors

By taking into account the relevant macro factors, we came up with a base price for 2018 which was used to calculate the intrinsic value after incorporating the micro factors.

The total area of DHA II comprises of approximately 9,523 residential plots spread over 15,075 kanals. The data for every plot of every sector was fed into excel sheets for computation and analysis. This was a milestone achievement as this was not at all an easy task to manually input the details of each and every plot.

This data was not simply inputting the location of the plots with reference to the road, lane or street number but other characteristics specific to an individual plot were also entered. The value of a plot has a lot to do with the characteristics it possesses and its surroundings. Therefore, these characteristics were important to list down. For every characteristic, we devised a category and plots were classified under these categories. The importance of these categories will be further enhanced during the valuation calculation.

These categories are called the micro factors and are explained below:

5.3.1 Main road

Plots can be divided into two categories: Located on the main road or inside the streets. The main roads of DHA are Jinnah Boulevard, Sector Road, Sir Syed Boulevard etc. This is an important distinction to create because majority customers prefer to have their houses located on the main roads. The reasons are greater visibility, easier access to the markets, parks and the rest of the city. Others might be disinterested in such locations because of business, rush and the noise that comes with it. According to our survey, majority of the investors prefer a plot on the main road and are willing to generally pay an average increment of about 6%-7%. (Figure 19 and 20)

5.3.2 Vacancy

DHA being a well renowned society, attracts a very large percentage of investors. As investors generally invest in the real estate sector to maximize returns or as a safety net, the demand for vacant plots is generally higher. The lower the supply of vacant plots, the higher the demand and hence, the price. 57.64% of the total plots of DHA-II are vacant. As currently, more than half of the phase is vacant, this factor does not play that much of a role in affecting prices. Also, we could not quantify the impact of this factor as we only had the data for one year whereas, this analysis required time series data over a number of years. (Figure 21)

5.3.3 Corner

The infamous category of plots: corner or non-corner. The obvious selection among these is corner and people prefer it because it leaves an opening on two ends of the house, sometimes comes with some extra decorative land and you do not have to share your wall with anyone. Some people are indifferent to this division and can go for non-corners without a second thought. The results of our survey tell us that some investors indeed prefer a corner plot when given a choice and are willing to pay an increment for it. (Figure 22 and 23)

5.3.4 Near Commercial Area

The commercial Area of DHA II is very vast with simple markets to fancy places like the popular Jacaranda Club, Giga Mall etc. Most people have preference for plots located near commercial area because of easier access. Such areas are sometimes considered safer because of having a lively neighborhood. Other people disregard these positives and negate living near commercial areas because of the traffic and noise. (Figure 24)

5.3.5 Near Mosque

Association with religion is subjective and no firm dialogue can be formed about it. However, people like living closer to mosques because of the sound of Adhaan, the spiritual association and ease on Fridays. (Figure 24)

5.3.6 Near School

Dropping kids off to school every morning and then leaving for office can be a hassle for many. Having school at a walking distance can ease this task and thus some people prefer these locations. However, we all know how inconveniently crowded these areas are during morning and afternoon times and so people tend to avoid residing near schools. The horns of the vehicles along with announcements can also sometimes disturb the peace of the residents. Nevertheless, people have their own preferences and according to our survey, people generally avoid property near schools. (Figure 24)

5.3.6 Near Hospital

Health is a great blessing of Allah. With age, comes deterioration of health and frequent visits to the hospital become a norm. People working at the hospital also have long working hours and want to rush home immediately after duty. Moreover, people generally prefer having a hospital nearby for quicker access in case of emergencies. In our opinion, these people can prefer the plots in vicinity of the hospital and are willing to pay an increment for their preference. (Figure 24)

5.3.7 Near DHA reserve

DHA reserve as the name tells is the area set aside for construction or development purposes in the future by the DHA Authorities. People generally prefer a plot near DHA reserves because they are maintained in the same way as parks and provide scenic beauty nearby.

5.3.8 Park facing

The idea of parks is greenery, good scenery, relaxation, healthy atmosphere, family outings and freshness. Therefore, people are likely to prefer parks in the vicinity. (Figure 24)

5.3.9 Near Graveyard

Due to the stigmas associated with graveyards, people having a choice will not reside besides a graveyard. Based on this, properties near graveyards are relatively cheaper. (Figure 24)

5.4 Calculations

5.4.1 Base prices

The first step for the calculation was to acquire the launch prices of the properties in DHA-II. This was a tedious task as this data is not publicly or readily available. To get a hold of this data, multiple visits to DHA office were made and finally we were able to get a range of prices of the properties in the launch year.

5.4.2 Incorporating the factors

As we have seen above, all the macro factors have a positive relation with the real estate prices which means that an increase in them results in an increase in the property rates. We devised a weighted factor by cumulating all the macro factors which was used to calculate the base price by compounding the launch prices over the years.

Since all the micro factors are qualitative in nature and subject to an individual investor's preference, we used our survey results for computing the weights to quantify the effect of these factors (Figure 27). Once quantified, these factors were applied to the base prices in our valuation model with the use of macros to calculate the intrinsic value automatically with just a single click of a button.

5.5 Findings

5.5.1 Analysis of General Category

General category plots include the ones which are not affected by any micro factors incorporated in our valuation model such as located on the main boulevard, near commercial areas, near mosques, park facing, corner plots etc.

From our analysis, based on the comparison of intrinsic value and market price, we identified that the general category plots on average, have market prices set closer to their estimated true value.

This is because, from what we observed; these general category plots included both, those which were under-valued and those which were over-valued. So on average, we observed that the market price of these general category plots was fairly close to their estimated intrinsic price.

Furthermore, the ones which appeared to be over-valued were those that were even slightly near the plots classified under special category. While those which appeared to be under-valued were located in areas that had no connection to the plots under the special category.

The under and over-valued characteristic cancelling out each other gave the average intrinsic value that moved closer to the average market price of regular plots as shown in the figure below:

5.5.2 Analysis of Special Category

According to our valuation model, the plots being affected greatly by the micro factors are classified under special category. These plots provide an avenue for huge amounts of manipulation and are traded at varying prices at different locations.

By taking advantage of their strategic locations, they are sold for prices far greater than their fundamental values. From our analysis, we identified that on average, the special category plots are over-valued and in some cases their market value moves inconsistently as compared to their estimate of true value.

Some of the properties of Sector E, F, G and H of DHA-II are the most expensive ones and their prices are mainly inflated based on the presence of Jacaranda Club and the commercial area on the main round about that touches all three of these sectors. Their prices go well beyond the justified prices based on the commercial area increment that people are generally willing to pay. As these areas have the highest demand, the small percentage of people who have the financial strength to pay the high increment drive up their prices. The figure below shows the movement of intrinsic value and market price for special category plots.

Chapter 6

6. Design

6.1 System Architecture

The system will operate on .CSV file, which will have a record of all the attributes of real estate data. Real estate data is acquired which is preprocessed using multiple steps such as additional data collection, handling null values, Encoding categorical and numerical data, etc. Then this cleaned data will be loaded into Microsoft SQL Database which is used to store big datasets. This SQL database is connected with Tableau with a localhost server connection. Finally, the data is analyzed inside Tableau which is a BI visualization tool where we can visualize our real estate plots on a map with multiple filter options to extract customized reports.

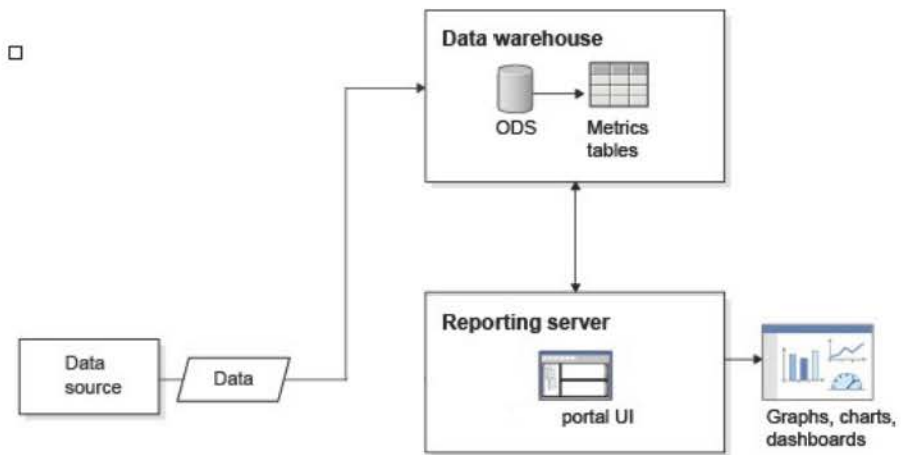
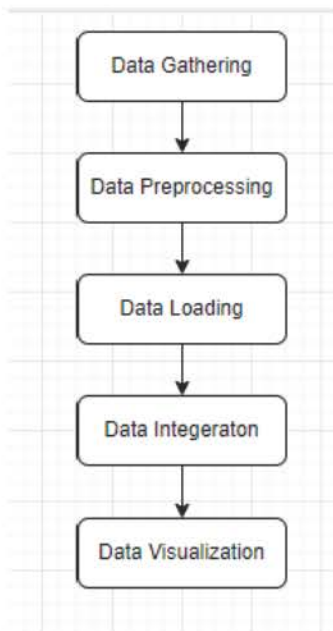


Fig.4.1. System Architecture diagram of proposed system

6.1.2 Data flow diagram (0-level)



6.2 Tools and Technology:

6.2.1 Backend:

- Data warehouse

6.2.2 Tools:

- Microsoft SQL Server 2012 R2.
- ETL (extract, transform and load) (Talend).

6.2.3 Tasks:

- Extract, Transform and Load (ETL).

6.3 Front End:

Dashboards Development in Tableau

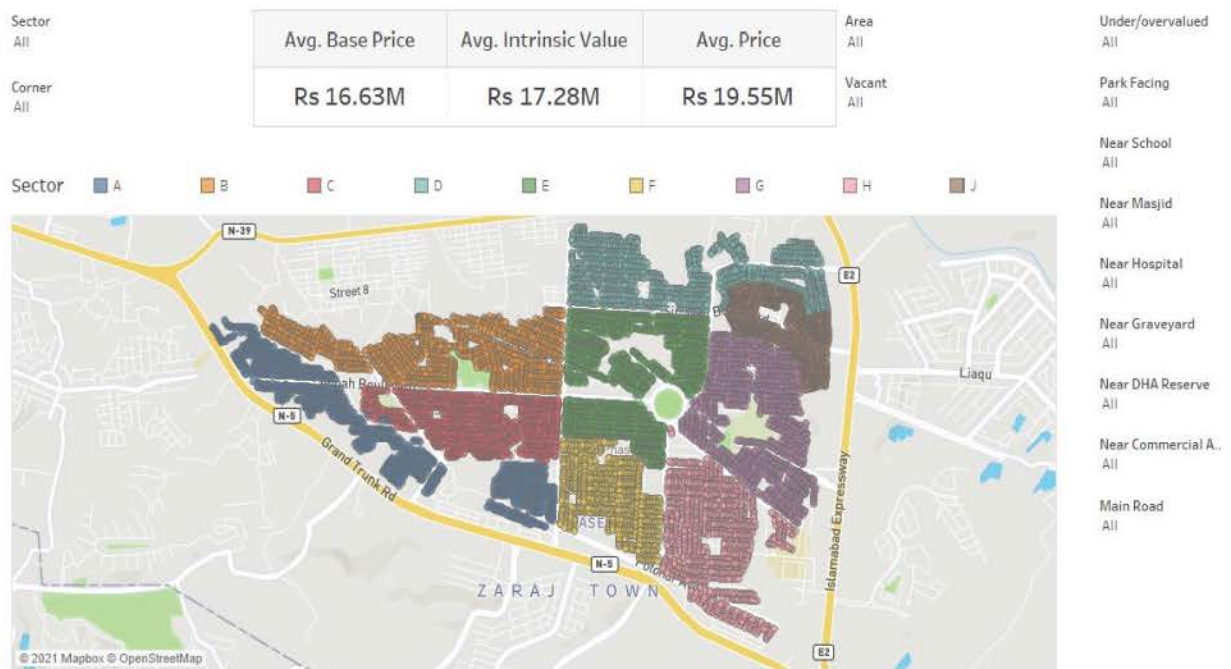
6.3.1 Front End development tool

We have used Tableau Dashboard as our front-end developing tool.

6.3.2 Front End User interfaces

Dashboard interfaces:

This is the interface of our Dashboard. There are dropdown selection bars at the top and right side of this dashboard. We must select the options to see the available real estate.



Chapter 7

7. System Implementation

The implementation of the analysis will be discussed in this section.

7.1 Data Collection:

The dataset contained domestic real estate plots in Islamabad with their locational attributes and price information. The sectors are distinguished in different sheets and price depends on neighborhood of each plot.

7.2 Data Preprocessing:

To perform the analysis there are some additional information required which is missing in the data. For this step, manual labeling is done to add the required data such as coordinates for each plot. These coordinates are then separated into latitude and longitude respectively.

7.3. Data Formatting:

In current data format, there was not any relationship among different sectors hence we were unable to analyze them at once. Then an additional column is added in each sheet for sector and all sectors are collected into a single sheet with all other columns showing the same attributes.

7.4. Handling Missing/Null values:

There are some missing or null values in the data.

For numerical data it is simply replaced with zero because we have numerical information for only price of the plots. Also, we cannot put any random value for price such as mean value which can be misleading for the analysis. Therefore, a zero is placed to avoid the null error and further this zero will be handled during visualization.

For categorical data the nulls are replaced with N/A so the viewer may know that there is not any value available for that variable.

7.5 Data Loading:

After all preprocessing steps the data is finally loaded into My SQL server which is a database management system for storing and handling large datasets. It secures the data using authentication services, encryptions and authorizations. The data is imported using a default schema and all columns are categorized into their respective data types.

7.6 Integration with Tableau:

Tableau is a Business Intelligence (BI) data visualization tool which is used at enterprise level to visualize different types of data. It can handle data in different formats such as excel, csv, spatial file, SQL etc. To connect our SQL database with Tableau, an ODBC driver is installed in tableau which is used to connect data sources from other database management systems.

After installing ODBC Driver, a connection is made into tableau with server information and credentials of our running DBMS.

7.7 Data Visualization:

The final yet most interesting part is visualizing the data inside Tableau using multiple interactivity options. We can have different graph options in tableau such as bar chart, pie chart, timeseries etc. which merely depends on the type of data we want to analyze. For my analysis I have used the Maps to show the plots using their latitude and longitude information. Then I have added the interactivity using the filters and making the map as filter such as selecting a plot will automatically filter down its price information and we can select multiple locations at once.

7.8 Reporting:

To convert this visual into report we can select multiple views using filters and export the report into our required format such as image or PDF.

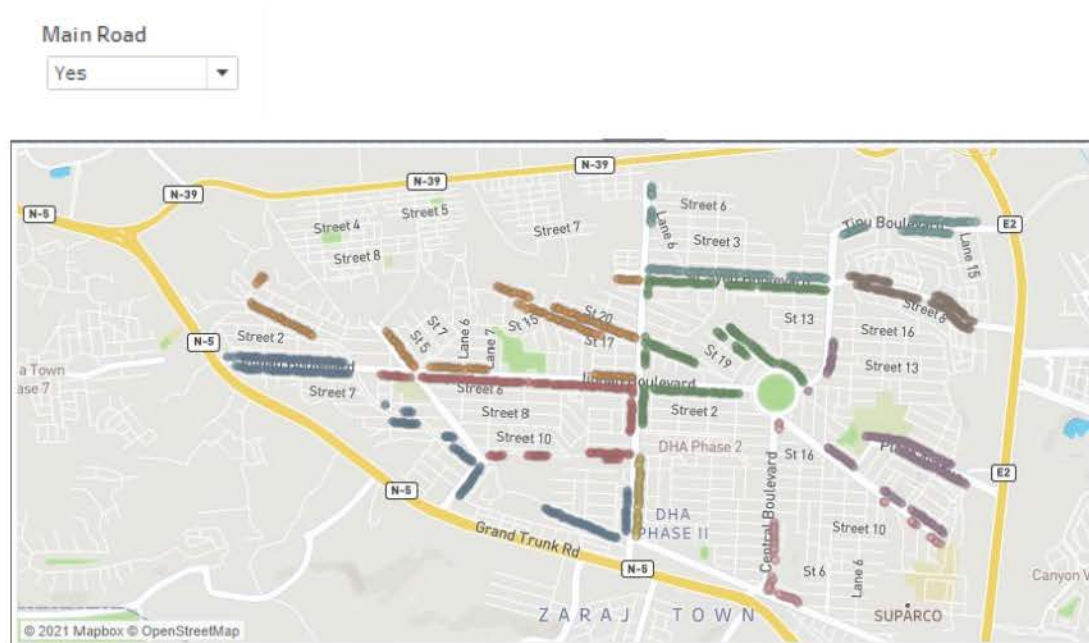
Chapter 8

8. System Testing and Evaluation

In the System Testing phase we tested our dashboard by extracting customized reports possible with the dataset we used. Here are some examples:

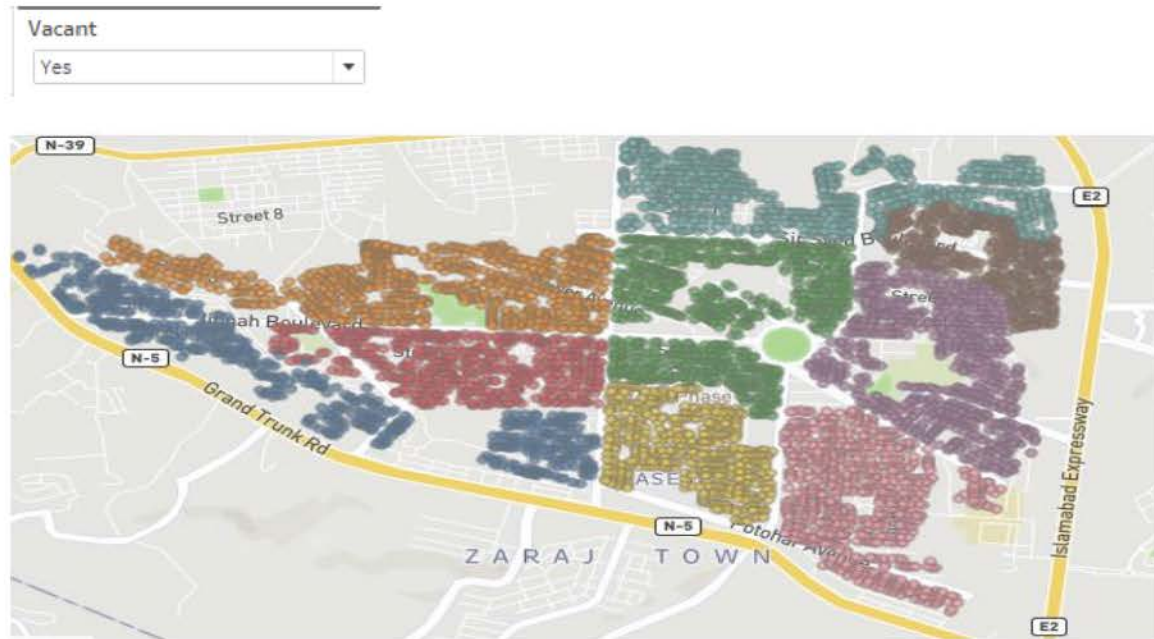
8.1 Main road

This report is visualizing all the plots on the main road. We can use multiple filters in whatever way want to get more customized reports.



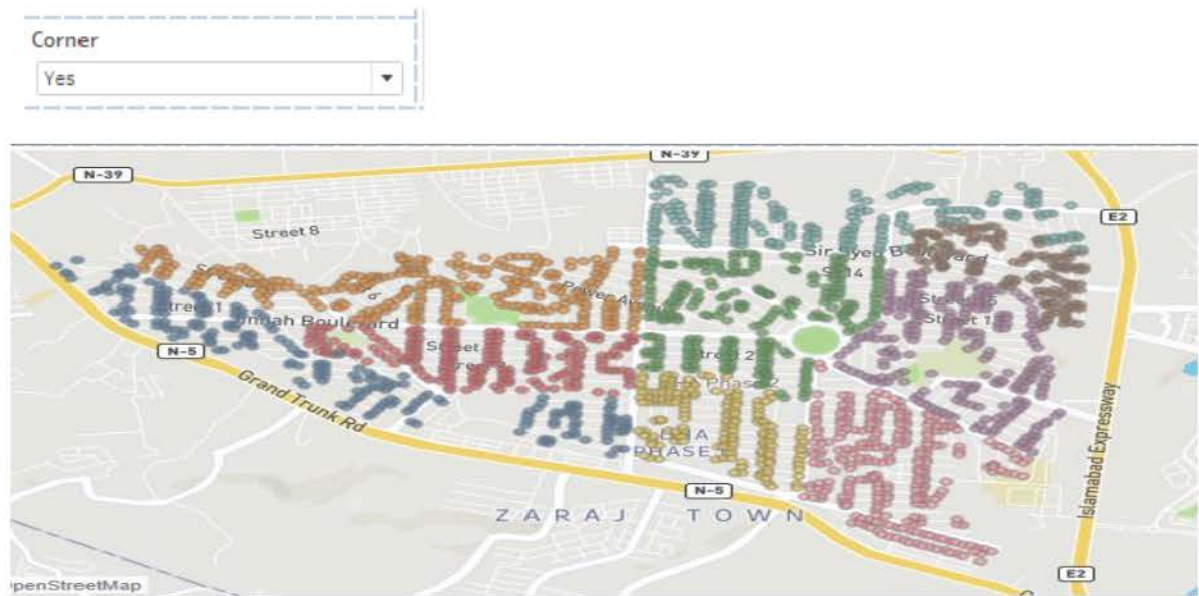
8.2 Vacancy

This report is visualizing all the vacant plots in DHA-2.



8.3 Corner

This report is visualizing all the corner plots. By combining the last filter with this one we can get all vacant corner plots in DHA-2.



8.4 Near Commercial Area

Near Commercial A..

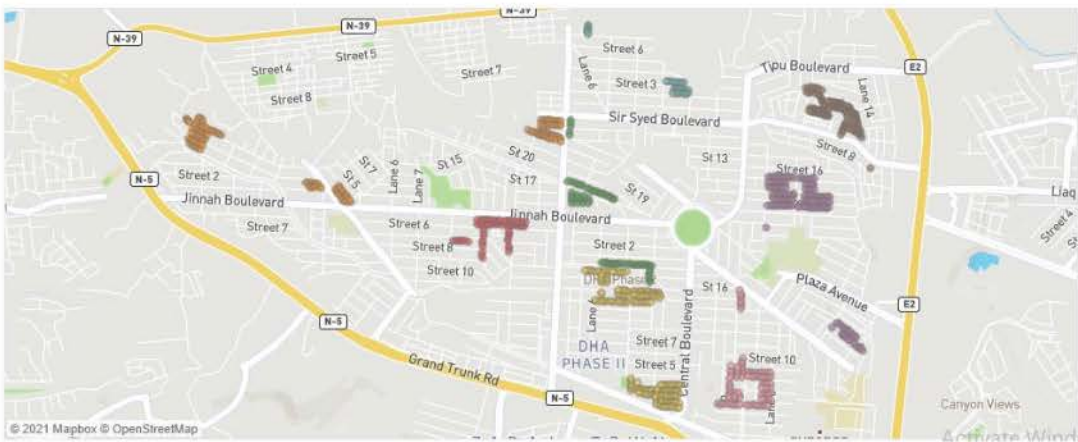
Yes ▾



8.5 Near Mosque

Near Masjid

Yes ▾



8.6 Near School

Near School

Yes ▾



8.7 Near Hospital

Near Hospital

Yes



8.8 Near DHA reserve

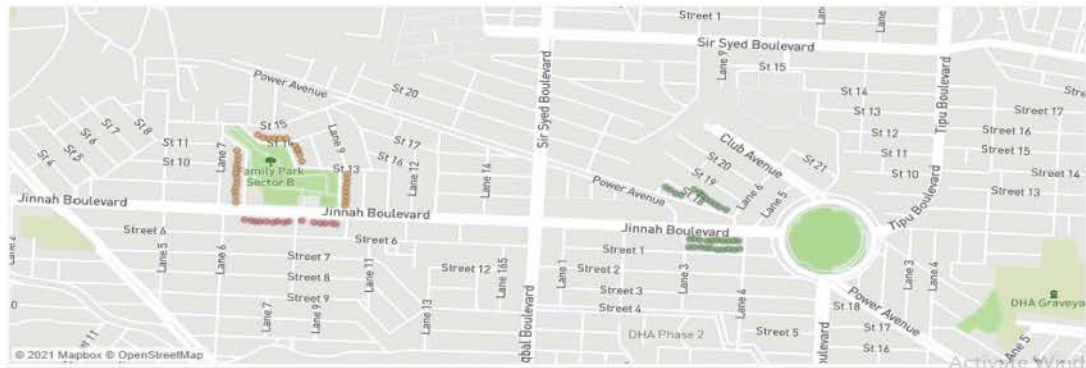
Near DHA Reserve

Yes



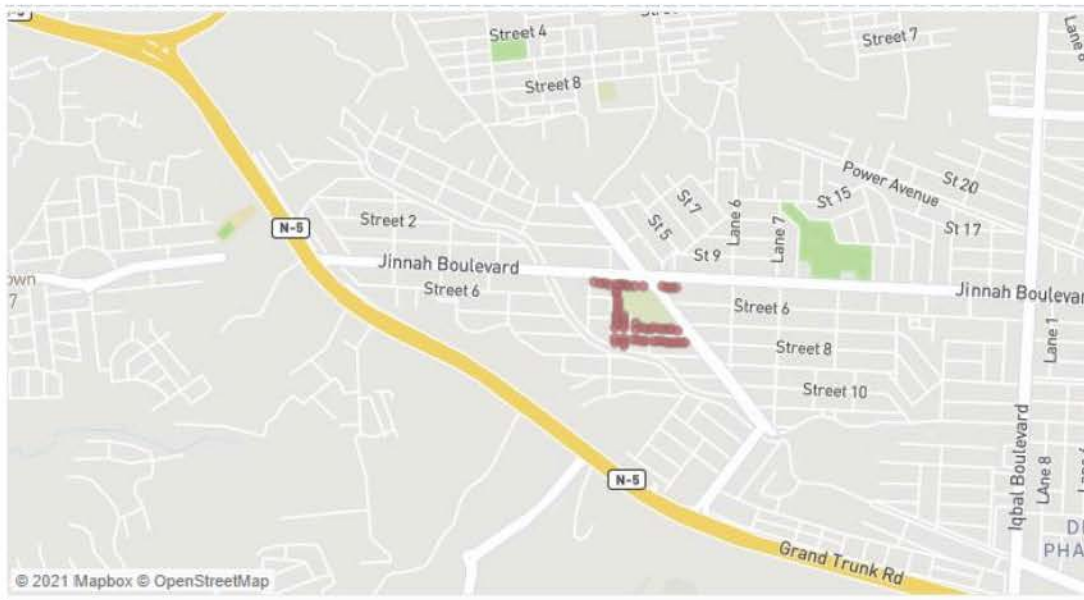
8.9 Park facing

X Park Facing
 Yes



8.10 Near Graveyard

X Near Graveyard
 Yes



We exhaustively tested all the possible combinations and creative ways to use and generate different visualizations and we are happy with what we have created.

Chapter 9

9. THE WAY FORWARD

9.1 Scalability

While we were working on this as a final year project, we had to face some budget, time and data collection constraints. This is why we have only completed the first stage of this idea i.e. to design the valuation methodology and come up with a Dashboard for DHA-2 only.

To look at this from a broader perspective, this project is far greater than a final year project and with careful planning and better access to resources, this has the potential to be a ground breaking development in the real estate game.

9.1.1 Moving forward with Graana.com

Once we have had greater experience in this line of work, we will be better equipped to cater to the needs of the masses. We will be able to improve our model by adding more relevant factors and learn how to tweak it to match the area specific needs which will vary from one location to another. As of now, we are in the process of collaborating with Graana.

Graana.com is already revolutionizing the real estate industry of Pakistan with their state of the art portal. According to Graanas’s goal, they intend to “develop a product that provides safe and transparent property transactions”. This goal caters to one of the two problems identified in this industry; low transparency. We believe that our product is one which can complement Graana and cater to the second identified problem

i.e. information asymmetry. A dashboard that is solely responsible for providing information to investors regarding properties such as real value, market prices, location, area, vacancy, category etc. Where investors can keep themselves updated with the latest information and improve their knowledge without any hassle.

With Graana by our side, we will have greater financial strength to recruit a team of software specialists and researchers which will allow us to expand our radius of valuation targets. By using them to our advantage we will be equipped to make valuations of more and more residential areas, moving from one major city to another and eventually throughout Pakistan.

In the last meeting with the Director Operations of Graana, we found out that they have hired teams of 150 engineers and 100 lawyers to keep a track record of the transactions and the history of investors along with the properties to their names and the amount that the properties have traded for.

We believe that by combining both of our efforts, we can develop an online property exchange on their platform by taking on board the relevant authorities and the bigger players in the market.

If and when the real estate exchange is finally set up, we will be needing brokers to handle the documentation and facilitate the transactions. As realtors are the party which is going to be most affected by our product, we plan to incorporate real estate agents in our road map by acting as brokers for which they can charge a justified and fair commission. This is going to be useful as instead of hiring new people and training them, we will have realtors acting as brokers which will put us at an advantage because they will already be aware of how the market works. This will help in eliminating the unethical practices while encouraging ethical profit making and also ensure that all the players are content within the industry and we have to face minimum retaliation and agitation.

This will greatly help change the dynamics of the Pakistani real estate industry and align it with new technological advancements that are taking place around the world.

9.1.2 Strategic partnerships with societies

We can provide you with a glimpse of how we are planning to proceed if our plan A does not work. DHA, being one of the top housing societies does not possess data about their own societies in such an organized manner as we do. Although, they have such a huge set up with a great number of experienced employees, they are unaware of how this information that we have collected and organized can prove to be of great value to them. DHA Islamabad is the first organization that has shown interest in our work, not only because of the data organization but also because of our valuation model which they realize can be used. With DHA 3, 4 and 5 which have recently launched, they can use our valuation model to value the properties there while we work on collecting and organizing the data in same way that we did for DHA-2. When new phases will be priced using our valuation model which takes into account justified micro and macro factors and transactions will take place on the basis of these fair prices, it will curb manipulation and exploitation from the very beginning and will create more awareness regarding the concept of real valuation. As more and more people will get to know about this new trend, trading over a definite price range will boost investor confidence and fuel up the demand for societies that value such developments. Furthermore, housing societies are likely to invest in our work to keep up with the growing trend towards digitization such as

Capital Smart City which is launching its own online portal where they will offer online registrations, electronic forms, online payment plans etc. Keeping in view the opportunity, we can shift to B2B, where we will provide land valuation that can provide the above mentioned services as well as property specific details such as vacancy, intrinsic value, market value, over and under valuation, categories like park facing, near commercial area, near mosque etc. to different housing societies that will be listed on their websites. While we will charge a fee for designing and implementing the valuation portal, we will also keep a cut of the revenue that is going to be generated online. This alternate business opportunity will derail us from our secondary goal of building an exchange, but it will work towards improving transparency and curbing exploitation which was our main objective.

From the revenue that we generate from these activities, we will be able to advance and upgrade our systems for more capacity. This will enable us to reach out to other societies besides DHA such as TopCity, Bahria Town etc. where we will be able to make the same contributions and further generate revenue and add value to these societies.

9.2 Constraints

Considering the size and scale of this project, it was inevitable to avoid constraints in terms of time, budget and resources.

9.2.1 Data Collection

One of the major limitations that we had was the tiresome process of gathering the information. The information that we were looking for was either not available or was classified as confidential. So we had to carry out the primary data collection processes. This included hectic visits to head office, sites and the associated realtors. It was quite time consuming and difficult to extract information and more often than not, the results we ended up with, from these sources were inconsistent which meant, they had to be standardized.

9.2.2 Factor selection and quantification

Another major issue that we faced was the quantification of qualitative factors. Our valuation methodology was built upon some qualitative aspects of properties which were not available in monetary terms. There were other factors which were quantifiable, but not feasible to incorporate into our model. Because there is an array of factors which do impact property prices but for some, we were unable to get their relevant data while for others it was not possible to calculate the magnitude of the impact they would have.

9.2.3 No baseline for reference

Since this is a first in Pakistan, we found it very difficult to explain our idea to people as they were not really able to grasp onto the concept of what we were doing. Because it was difficult for people to comprehend, we had little to no guidance at all. Using the internet to solve our problems also proved to be futile as we were unable to find any frame of reference in this regard.

All in all, we had to jump through a lot of hoops in order to move past some of our constraints while others got the best of us.

Chapter 10

10. Conclusion

The Visually Aided Real Estate Search System provides its customers with a platform where they can get all the information regarding property market prices, intrinsic prices, plot vacancy, plot category such as near Main Boulevard, near mosque, near park, near hospital etc. The intrinsic value that is going to be available to all our users will provide them with a benchmark to assist in decision making. Using our intrinsic values as the lower bound and the market prices as the upper bound, it will provide users a price range to use in negotiations.

Unlike any other real estate business, our platform not only uses a financial model to evaluate the land but incorporates all the relevant macro and micro economic factors to provide users with an accurate estimate of the prices.

A business with such a nature does not previously exist in Pakistan. Zameen.com, Lamudi and Graana.com are online businesses which provide their customers with a platform to advertise their properties for rent and sale to buyers. This is very different from what we are doing as we are providing a platform to offer details about a property and providing a price range between the market price and the intrinsic price that is based on justified factors having a direct relationship with property prices.

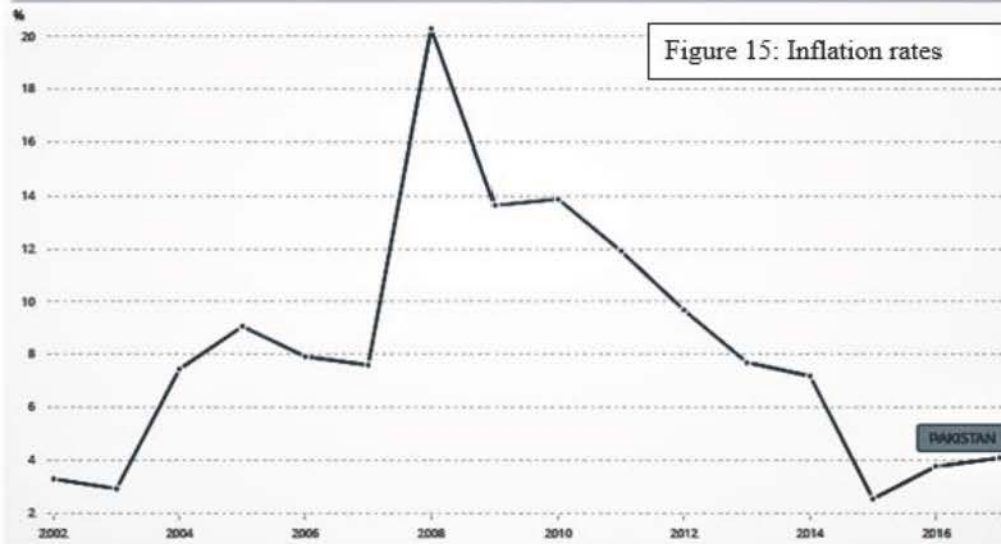
With the growth and development of the economy of Pakistan, the ²⁰ real estate sector plays an important role in contributing to the exchequer. With an increasing amount of foreign investors eyeing Pakistan due to the China Pakistan Economic Corridor (CPEC), amplified opportunities relating to the real estate industry will open up. A platform such as Visually Aided Real Estate Search System will not only provide investors with all the data they need but also an estimate of the intrinsic value which will enable investors to know whether the property is currently over-valued or under-valued.

In short, our platform will provide an easy access to all those people who are interested to learn about the opportunities that exist and can be exploited. The real estate agents that are available in the market use traditional methods and are not of much help when it comes to proper valuations and this is one major gap that our dashboard will help to bridge.

APPENDICES

Inflation, consumer prices (annual %)

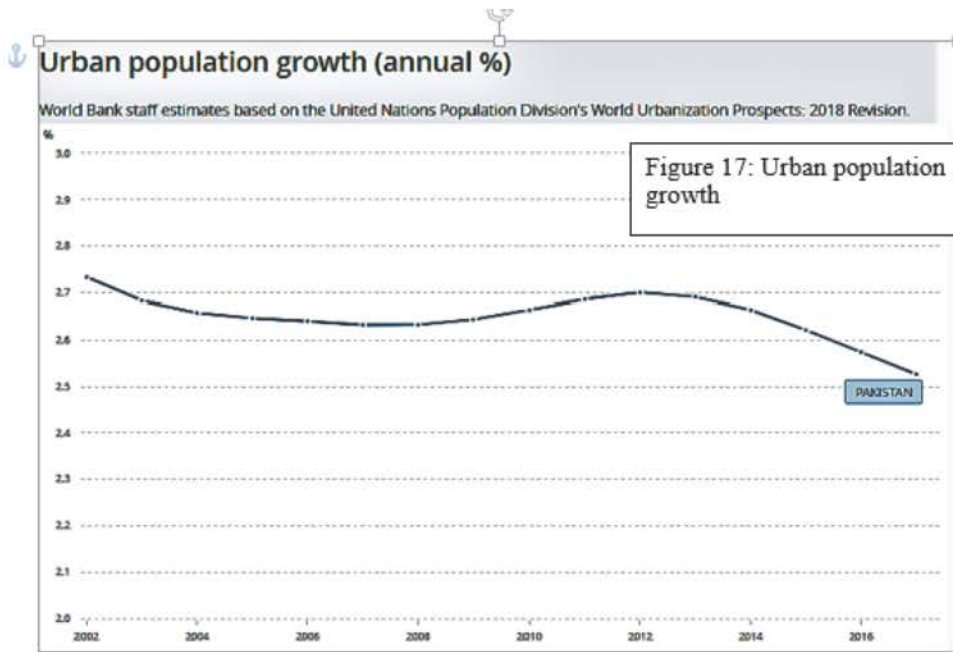
International Monetary Fund, International Financial Statistics and data files.



GDP per capita growth (annual %)

World Bank national accounts data, and OECD National Accounts data files.





PERCENTAGE OF MONTHLY HOUSEHOLD INCOME SHARE (PROPERTY) BY HIES

Year	Property (Own Occupied Houses Excluded)	YoY growth
2002	2.69%	
2003	2.75%	2%
2004	2.82%	3%
2005	2.86%	1%
2006	2.88%	1%
2007	2.87%	0%
2008	2.89%	1%
2009	3%	4%
2010	3.10%	3%
2011	3.10%	0%
2012	3.20%	3%
2013	3%	-6%
2014	3%	0%
2015	3.03%	1%
2016	3.08%	2%
2017	3.10%	1%
2018	3.14%	1%

Figure 18: % of monthly household income share

Source: Household Integrated Economic Survey (HIES) - Pakistan Bureau of Statistics

	Plots	Vacant	Percentage
Sector A	1046	539	52%
Sector B	1398	844	60%
Sector C	904	461	51%
Sector D	1064	677	64%
Sector E	1197	711	59%
Sector F	774	444	57%
Sector G	1180	657	56%
Sector H	1160	624	54%
Sector J	800	444	56%
Total	9523	5401	
		56.72%	

Figure 21:
Vacancy

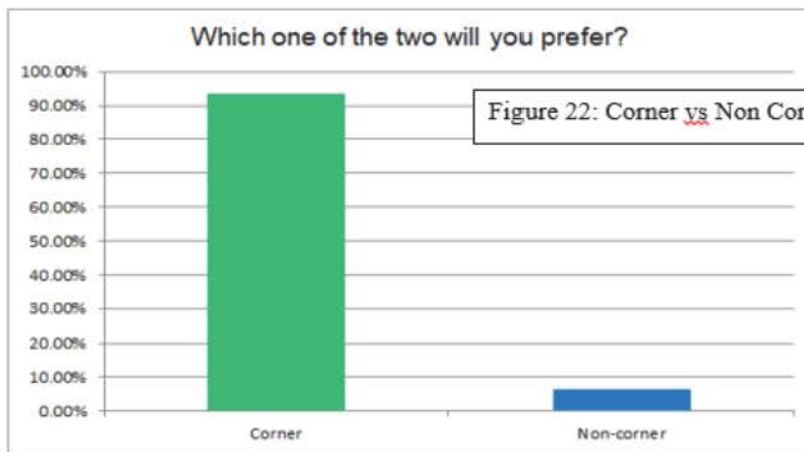


Figure 22: Corner vs Non Corner

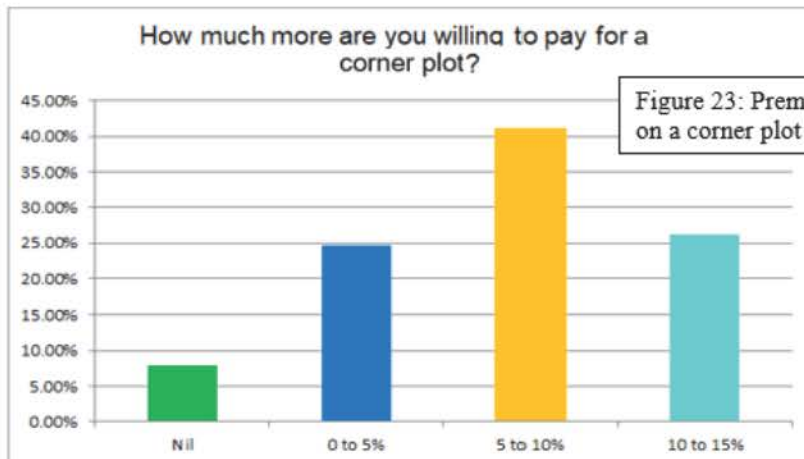
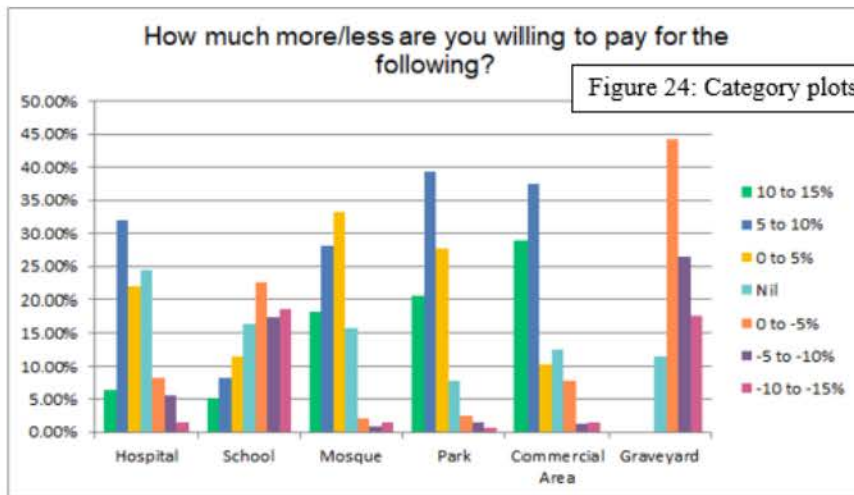


Figure 23: Premium on a corner plot



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