SUSTAINABLE HOUSING AFFORDABILITY BY USING MCDM APPROACH: A COMPARATIVE ANALYSIS OF PAKISTANI PROVINCES

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<u>CERTIFICATE</u>

This is to certify that this thesis entitled: **"Sustainable housing affordability by using MCDM approach: A Comparative analysis of Pakistani provinces."** submitted by **Ms. Kinza Tahir** is accepted in its present form by the School of Economics, Pakistan Institute of Development Economics (PIDE), Islamabad as satisfying the requirements for partial fulfillment of the degree in Master of Philosophy in Economics and Finance.

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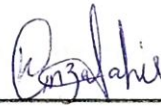PIDE School of Economics: <u>Dr. Shujaat Farooq</u>　　Signature: _____

Author's Declaration

I, *Kinza Tahir,* hereby state that my MPhil thesis titled *"Sustainable Housing Affordability by Using MCDM Approach: A Comparative Analysis of Pakistani Provinces."* is my work and has not been submitted previously by me taking any degree from Pakistan Institute of Development Economics or anywhere else in the country.

At any time, if my statement found is to be incorrect even after the completion of my degree the university has a right to withdraw my MPhil degree.

Student Name   **Kinza Tahir**

Signature_____

Date___18-3-2022_____

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Dedication

To my family

I dedicate this thesis to my loved family, who always teach me to trust in ALLAH ALMIGHTY, to believe in hard work, and taught me that so much could done with little.

To My Respected Teacher

(Abid Rehman)

Teachers are always a great source of inspiration and motivation for me. However, one teacher remained a beacon of light for me. His sincere guidance and prudent leadership guided me not only in achieving this dissertation but also definite directions for my professional career.

Acknowledgment

Thanks to Almighty Allah the most merciful and the most beneficent, who has given me the potential and ability to complete my M.Phil research work. I pay my immense gratitude to my supervisor Dr. Farhat Mahmood. Moreover, I would like to thank Mr. Abid Rehman for his encouragement and support. He has been a source of great help to me in every step of my research. Friends who do not lose faith are the best ones to have. I thank all my friends whose names are not included but without their support, it would have been difficult for me to compile such great work finally yet importantly, Special thanks to my mother and father for their contribution to the completion of this thesis. Allah may bless them all the way. Ameen.

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LIST OF ABBREVIATIONS

Words	Abbreviations
PSLM	Pakistan Social Living And Measurement Survey
HIES	Household Integrated Economic Survey
PBS	Pakistan Bureau Of Statistics
MCDM	Multiple Criteria Decision Making Approach
COPRAS	Complex Proportion Assessment
TOPSIS	Technique For Order Preferences By Similarity To Ideal Solution
WSM	Weighted Sum Method
WPM	Weighted Product Method
KP	Khyber Pakhtun Khawn

ABSTRACT

The objective of this study is to do a comparative analysis of all the provinces of Pakistan including the rural and urban areas by using the MCDM (Multiple Criteria Decision Making Approach) and its four methods including TOPSIS, COPRAS, WSM and, WPM. The data for the study is taken from the different surveys conducted in 2018-19 from PSLM, HIE, conducted by the PBS. The findings showed that Punjab is the best province among all based on housing affordability including a factors (e.g. expenditure on housing and incomes of the people are better than other provinces) secondly in terms of sustainable communities (e.g. availability of schools, hospitals, transport, employment opportunities) are better in Punjab. Then Sindh is on the second number. Baluchistan is on the last number and KP is on the third number while considering all the factors.

CHAPTER 1

INTRODUCTION

Housing affordability is defined and measured in terms of economic feasibility and sustainability, which include factors like (Ahsan, 2019) quality and housing location, so both issues must be tackled simultaneously. Internationally (as explained by (Mulline, 2013) housing affordability can be measured by finding the relationship between household income and expenditure[1]. In the current time, period housing affordability and sustainable communities are the most important challenges facing in many developing as well as developed countries (kaygysuz, 2012).

Shelter is one of the necessities of life, housing is mostly depending on two factors the one is affordability of housing, and the second is creating sustainable community. Housing affordability includes many components like expenditure on housing, electricity, education, medical care, construction of housing, rents of houses in that particular area and many more. Whereas sustainability is more concerned with creating a sustainable communities like clean green environment, availability of schools, hospitals, access to clean water, maintenance of public areas and many other factors. Therefore, for buying a house or taking on rent both are the components that are important and necessary for the living of people. Only one factor is not enough for the survival.

Housing is the most important problem to contemplate in providing healthy and eye-catching communities. In some areas housing, lack of supply and subsequent issues of affordability have

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[1] If expenditures exceed than income so person is unable to afford house and vice versa.

generated persistent social and economic pressure (Maliene, 2008). For the creation of sustainable communities, housing should be available easily, high quality, economic, ecological, appealingly designed, and comfortable, thus well suiting the requirements of the individual. Furthermore, the housing must be inexpensive according to the local and national situation.

Housing is not only a problem of one country or a city rather it is a problem of the whole world. It has been estimated that an annual population rise of about 83 million people all over the world will raise a total population of 8.9 billion by the year 2050 (Yeom, 2020) Research conducted by (Maliene, 2015; Xianxian Dang, 2020).

Another research conducted by (Raphael, 2004) found that in most of the developed countries including England, America, Canada most of the people are unable to afford to house due to low income, poor governance, too much documentation required for borrowing money from financial institutions, old housing policies, and poor infrastructure or technology, etc. Therefore, both developed and less developed countries try to put more effort to resolve the problems relating to housing affordability and sustainable communities due to the rapid increase in population.

Like all other countries, the rapid urbanization since 2000 onward has generated severe problems of housing especially in the major cities of Pakistan (i.e. Lahore, Karachi, and Islamabad. (Iqbal, 2020) analyzed that housing shortage and massive increase in housing prices are the two main problems that have created the unaffordability of housing in Pakistan. Therefore, it is very difficult for the lower as well as the middle-income group to make own house. Moreover, the bank provides loans to only those who are educated, understand the terms and conditions regarding loans, can show salary slips, while most of the poor populations belonging to the segment are not educated, and do not have such slips so they cannot take loans.

Besides housing affordability, the availability of electricity, water and, gas is also very low in most of the areas of Pakistan and still, people have to pay high bills to avail such house-related facilities. At present, about 20% of the population of Pakistan has access to clean drinking water while the rest of 80% is on health risk (Khan et al., 2017). Cleanliness is one of the import ant factors for physical wellbeing and a healthy environment but in Pakistan, due to improper solid waste management, about 5 million people die each year due to waste-related diseases (Massoud et al., 2009).

Unaffordable housing is a great threat to the prospective sustainable development of emerging countries as researched by (Amin et al., 2019). The decline occurred in housing affordability is due to supply side as well as in demand side because of too many increases in the prices of building materials. According to the current scenario in case of Pakistan, the total demand of housing per year is about 350,000. Out of which 62 percent is for the lower income people 25 percent is for the middle income people and the rest of 10 percent is for the upper groups. The formal supply in Pakistan is only 150,000 units. These challenges need to be address by the local municipalities and to figure out the facts and problems and try to resolve them to reduce the housing shortage. They need to create such type of environment that strengthens the legal frameworks and departments to provide affordable housing to all segments of society including the poor and rich.

This research study will be an attempt to conduct a comparative analysis of the provinces of Pakistan in terms of housing affordability and sustainable communities. The present study considers different factors like for measuring housing affordability expenditure done by household or the income they received during a period of one month. Second the other important factors is sustainability and it is measure through access to different factors like basic amenities

education, hospitals, safety, cleanliness, maintenance of housing, access to different type of construction material and many more.

1.1 Research Problem

Pakistan is a developing country and facing a huge problem of urban housing crisis from past many years. The major problems that people are facing regarding housing are poverty, lack of facilities, insecurity in different areas, problems associated with gas, electricity, water, lack of education and medical care and many other factors that are problematic in Pakistan. However, Housing affordability and sustainable communities are the problems of both developed and developing economies. The component of sustainable communities researched by many authors in developed economies like the UK, China, and the USA (see e.g. (Dang et al., 2020; Mulliner, 2015; Raphael et al., 2004). In the case of developing economies like Pakistan, the component of housing affordability was researched by many authors including (Wang et al., 2017) but the second component that is sustainable communities is almost negligible. Most of the authors have done work on this topic but it is just area-specific and they did not focus on all the provinces of Pakistan in one research. The present study will identify which province is better in both the components including housing affordability as well as sustainability and on what grounds So that these changes can implement in all the provinces to provide a better lifestyle for all the people of Pakistan including every class.

1.2 Research question

- Which province of Pakistan is performing better in terms of providing affordable housing?
- Which province of Pakistan is performing better in terms of creating sustainable community?

1.3   Research objective

The objective of this research is to do a comparative analysis of all the provinces of Pakistan based on housing affordability and sustainable communities by using the multiple criteria decision-making approach.

1.4   Significance of study

Housing affordability is a multifaceted issue that not only be evaluated in terms of economic viability. To increase the quality of life and community sustainability the environmental and social sustainability of housing also need attention. The present study based on the provincial analysis of Pakistan in the case of both affordability and sustainable communities. Therefore, findings from that study will be beneficial for people they can easily determine which province is better for their living and have all the necessities required by humans to live a peaceful life. Secondly, it will be supportive for policymakers liking for the housing ministry and they can make policies according to the current situation and make them better.

1.5   Organization of study

The thesis divided into six chapters. The first chapter includes the background about the housing affordability and sustainable communities of Pakistan at the provincial level. The second and third chapter based on introduction and literature review respectively. Data and methodology are covering in the fourth chapter including the sources of data and discusses the methodology required to find the accurate results for the research. The fifth and sixth chapter of this study comprises Empirical Results, Conclusions, and Policy Recommendations respectively.

CHAPTER 2

BACKGROUND

Background of housing affordability and sustainable communities in Pakistan

2.1 History of housing

The first housing policy in Pakistan formed in 2001. It included several issues that people were facing at that time and tried to provide ease to the people at both local and provincial level, building and construction of houses including the middle and poor income groups. The major focuses of the policy was on the mobilization of resources and encourage organizations to give loans for building of houses at market rates. After facilitating the mortgage loans, the poor community was still not in the position to build their own houses.

Current scenario

At the start of 21st century, Pakistan adopted neo-liberal policies for its housing and economic sectors. After that, families started accessing the market that conquered by developers in huge cities. These developers took lands from the private owners; government planned schemes, and approved their loans from HBFCL to making their products more affordable. Today the societies developed like DHA and Bahria town provide luxurious and residential lifestyle to the people but are limited for the rich class.

Housing schemes by different government

The poor and middle classes are still not able to get all the facilities. Governments initiated many schemes to provide affordable housing to people for example, Nawaz sharif government initiated

Low Cost Housing Scheme, Apna Ghar Housing scheme but not implemented as per the plans. Now the Imran Khan governments is planning the Naya Pakistan Husing Scheme and are trying to provide about five million housing units to people of Pakistan. However, making this large number of units is not an easy task because Pakistan is also facing a huge debt burden therefore it is not possible to work on this project. Secondly, people who take the house, it is very difficult for them to deposit initial amount of about two lakhs as a first installment. Therefore, the issue of housing affordability still not countered in it. The second component, sustainability, also not considered very clearly in this scheme. Thirdly, they impose another condition on the homebuyers that they must earn about Rs 25000 per month so they can get the house under the Naya Pakistan Housing scheme. Therefore, the major issue is that about half of the population of Pakistan is below the poverty line out of which most of the people work on daily wages and their incomes is less than Rs 25000 per month.

In countries like Pakistan, where housing affordability is not easy, people prefer getting home on rents. Then people started finding homes on rent according to their ability of paying rent and facilities provided in the society. However, living on rent is not safe and easy it is according to the will of owner of house that they can ask them to shift in any other house at any time. Most of the people are facing number of problems in rental homes.
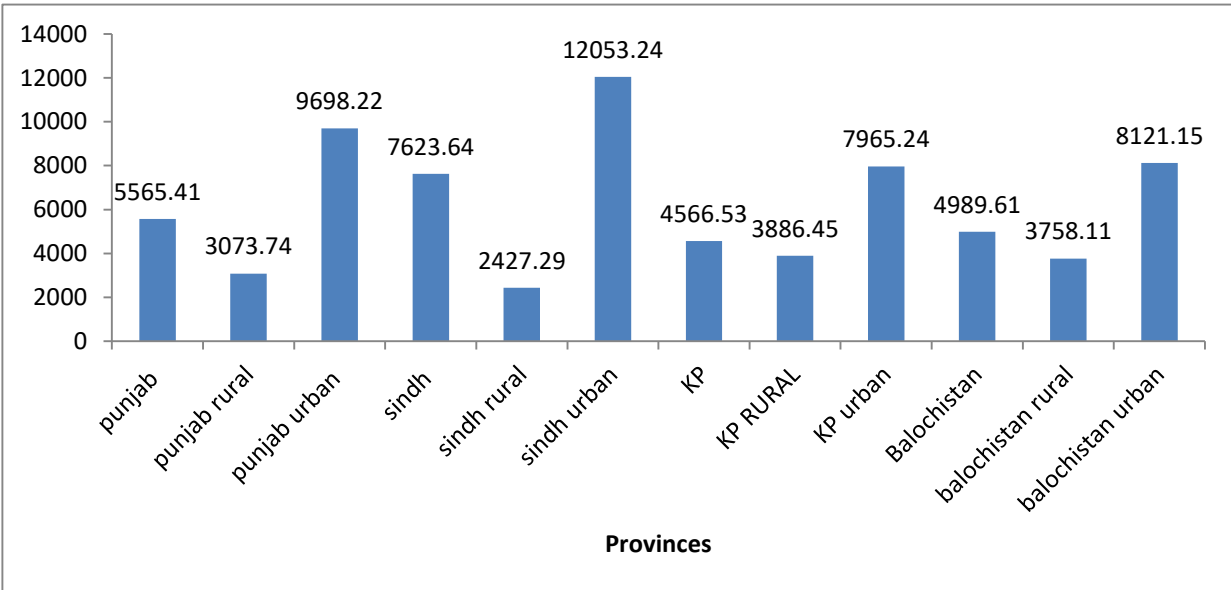
***Figure 2.1*: Average monthly expenditure on house rent per household (RS)**

The above figure 2.1 shows the amount of rent as the average monthly expenditure done per household on their house rents. The average values of monthly rent vary from 4227.29 to 12053.23 rupees. The expenditure on rent in the urban areas is more as compared to the rural areas and the reason identified behind that is that in rural areas, most of the people own their homes; very few people live in rental homes. In urban areas where prices of land, as well as construction costs, are very high so buying a house is not easy for every person so most people prefer to live in rented homes. In the case of all four provinces including rural and urban areas people of Sindh urban pay, the highest rent for houses that is 12053 on average on the other side Sindh rural has the lowest value in terms of paying the house rent that is 2427.29.

The reason behind the high rent rate in urban Sindh is the availability of a large number of amenities. The second main issue behind the high rent is the demand and supply issue. The housing

demand in Karachi is about 120,000 units out of which the formal sector supplies 42000 units and informal sectors supply 32000 units. Due to that shortage and huge population in Sindh urban areas, housing rents are high.

Punjab is the highest population province including big cities like Lahore, Faisalabad, and Islamabad. It is second on the scale of paying the highest rents. Baluchistan is the third and KP is the last in list.

Other expenditure

Other expenditures include gas, electricity, education, and medical expenses of all provinces. In case of gas expenditure, Sindh urban areas have a high gas expenditure that is 78%. On the same side, a rural area of Sindh has the lowest gas expenditure that is 4%. As far as electricity expenditure is concerned, on average, in Sindh its 66% and it is highest among all and KP rural has the lowest expenditure on electricity that is about 24%. However, in the case of expenditure on electricity and gas Sindh is on top as compared to all other provinces.
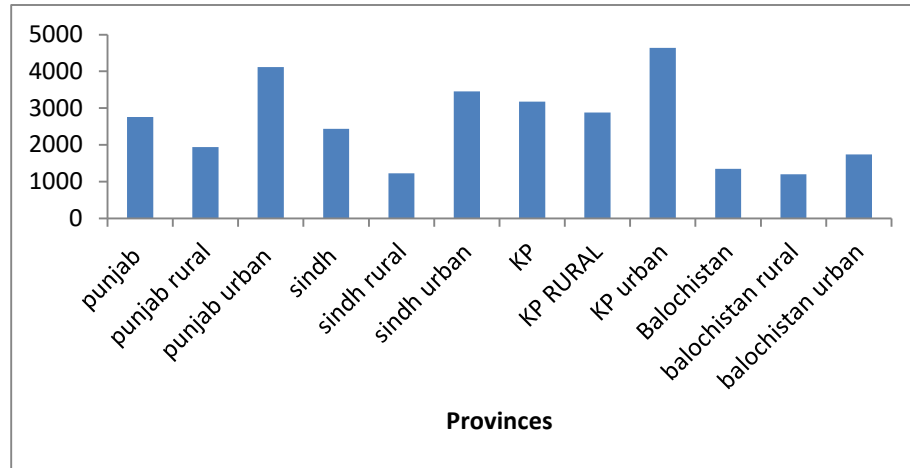
Figure 2.2: **Average monthly expenditure on health and education**

Besides gas and electricity, other main expenditures are education and health expenses. In addition, percentage of income they spent on these two expenses.

Figure 2.2 shows surprising results that KP urban people bear the highest expenditure on education and health. The main reason is that KP is in the development phase and is trying to provide better facilities to their residents. Therefore, for that people pay high expenditure on education and health. The KP government introduced "*Spending Effectively for Enhanced Development (SPEED)'* program. The objective is to improve the quality of education at the school level and improve the situation of health care centers. Punjab urban is on the second number because here the availability of education and health care center is far better than other provinces. Baluchistan faces least expenditures in terms of both education and medical care.

The reason behind low expenditure is that very few people educate their children especially in rural areas of Baluchistan. Most of the people are poor; they cannot afford the expenditure of education. The health care system is not well managed properly in Baluchistan even the hospital and dispensaries are very rare. In Sindh, the expenditure is even less than in Baluchistan.

Education

Education is the most important component for the economic and social development of a country. In the case of developed countries where education provided through a number of media and are focused on the quality of education. The students able to easily accept theoretical and practical knowledge and eases their critical thinking, because of the accessibility to knowledge that comfort the conceptualization of ideas, use of knowledge, and its application. Nevertheless, here in developing countries like Pakistan due to lack of technology, equipment and funds resources are the major hurdles in the path of providing quality education to the children of Pakistan.
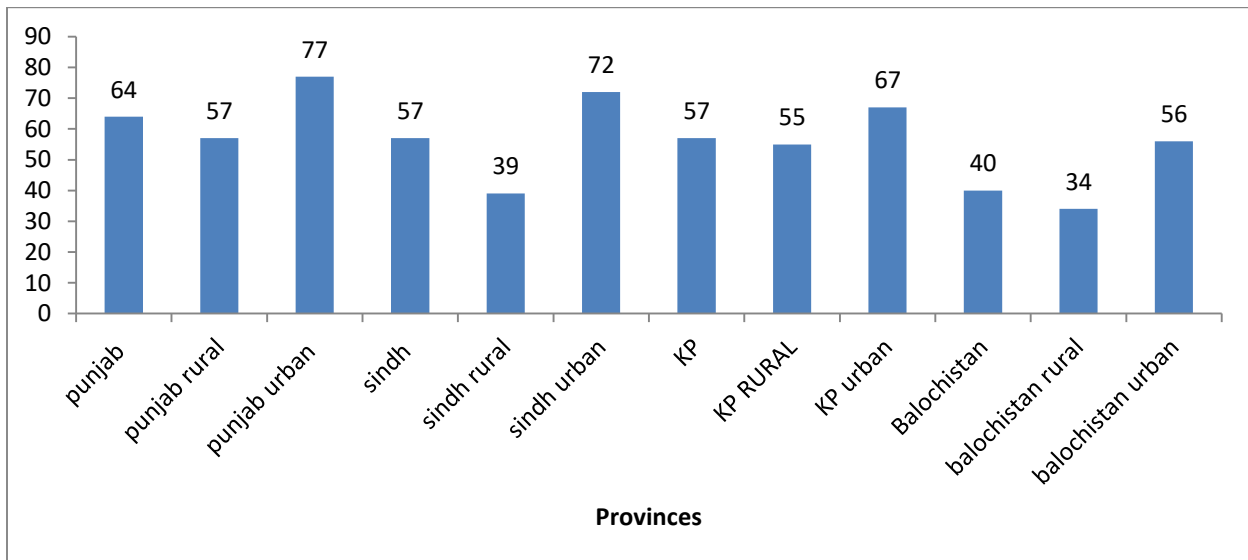
Source: PSLM (Pakistan Social and Living Standard Measurement)

Figure 2.3: **Access to Schools across provinces of Pakistan**

Figure 2.3 depicts a true picture of the education system of Pakistan access to school and measured by the literacy rate of the people of different provinces. Punjab urban has the highest literacy rate that is 77%. On the other side, the literacy rate in the urban areas is more as compared to rural

areas. However, it shows that there is much need to focus on the education system in the rural areas and devise such policies to counter this issue. Sindh urban has second-highest literacy rate that is 72% and among Punjab and Sindh provinces, Sindh has improved over the past previous years. Sindh and Baluchistan rural has the lowest literacy rate that is 39% and 34% respectively.

The reason behind the high literacy rate in Punjab and the Sindh urban areas is the availability of large numbers of schools and people now want their children to get an education. KP urban is also progressing in terms of accessibility to schools. On the other side in rural areas schools are very rare, Secondly, people do not want to educate their children especially females due to some societal barriers. Thirdly, poverty is one of the major barriers that stop children from getting education. They start working just to support their families at the very early age.

Health

The health care system in Pakistan is not that much good. It controlled by the provincial and federal governments. Health is the most important component for humans when they decide their living in any particular area. In countries like Pakistan where the health care, system is not up to mark in any province. The reason behind this is the lack of technical equipment, resources, poor management, lack of health care staff, and many more reasons. In most cities of Pakistan where hospitals are not present, residents need to take their patients to other cities for treatment and in case of emergency, most of the patients died on the way. Therefore, hospitals are now the basic need for any resident.

The second most important issue highlighted in the health care system is quality. In Pakistan, the quality of the health system provided by the government hospitals is not satisfactory. The shortage of beds, medicines, well trained staff, cleanliness, weak governance are some major reasons.

People tend to focus on the private sectors for getting better health care facilities but the poor people are not able to afford the expenses of private health care.
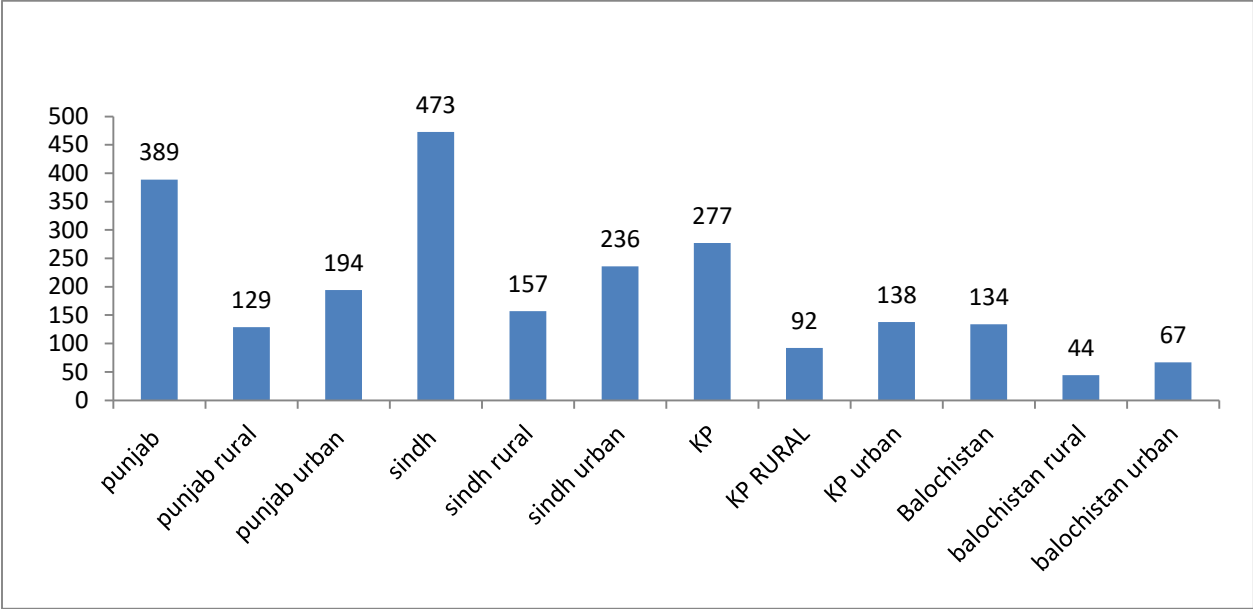
***Figure 2.4*: Access to Hospitals across provinces of Pakistan**

Figure 2.4 demonstrates access to medical care and it is measure by the availability of several hospitals in each province. In Sindh, the number of hospitals is 473 and in Punjab, it is 389. The number of hospitals in KP and Baluchistan is 277 and 134 respectively. According to the data of 2019, about 2819 dispensaries are available in Sindh, 1286 in Punjab, 983 in KP, and 573 in Baluchistan. The number of hospitals in rural areas is very less as compared to urban. Therefore, the better medical care facility is present in Sindh as compared to other provinces but there must be a need to work on improving the quality of medical care in every province including rural and urban areas.

Water supply and hygiene

Water is the most essential and basic component for living. It is the right of every human to get safe drinking water. The Government of Pakistan took many initiatives to bring awareness among people regarding cleanliness and safe drinking water. In 2009, government made a national water policy and in 2006 national sanitation policy formed for creating awareness among people about water conservation, safe hygiene practices, and water safety. However, the issues regarding water and cleanliness are still in debate. Poor quality water and an unhygienic sanitation system lead to many infectious diseases for the people living in Pakistan. In the current time, only 20% of the whole population has access to clean drinking water, the rest of the 80% is drinking unsafe water.
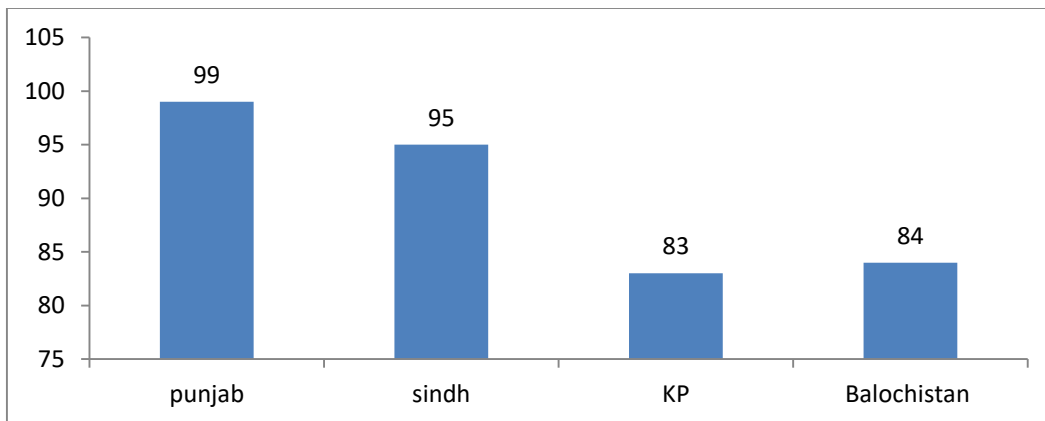
Source: PSLM (Pakistan Social Living Standard Measurement Survey)

Figure 2.5: Percentage of Household with Improved Source of Drinking Water

According to the PSLM (Pakistan Social Living Standard Measurement Survey) source of water categorized into seven forms. Tap water, motor pump, filtration plant, hand pump, dug well, spring bottled water, and many more. In Pakistan, about 35% of the people are using motorized pumps as the main source of drinking water. In all over Punjab, about 99% of people have access to water, and then 95% in Sindh and KP has the lowest access to water among all other provinces that is

83%. The availability of clean drinking water percentage is higher in urban areas as compared to rural.

Access to water

In Pakistan, about 70% of households have access to water inside their homes the rest of 30% have to travel to get water from the poorest sources including canals, rivers and lakes. The above table shows the distance of water source from the homes of the people in which 20% of the people are on average 0-0.5 km away from water source.

Garbage collection system

Table 2.1: Distance to Source of Drinking Water across provinces of Pakistan

Source	Inside Household	0 +– 0.5 Km	0.5 +-1 Km	1 +– 2 Km	2 +- 5 Km	5 + Km
Tap Water	93	6	1	0	0	0
Hand Pump	75	16	4	3	1	0
Motor Pump	84	13	2	1	0	0
Dug well	66	26	5	1	1	1
Others	19	50	17	6	4	4
Total	70	20	5	2	1	1

Pakistan produces about 48.5 million tons of solid waste a year, which has been accumulative more than 2 percent yearly. Like other developing countries, Pakistan absences of waste management infrastructure, generating serious environmental problems. Most municipal waste burned; either dumped or buried on vacant lots, threatening the health and welfare of the general population. The Government of Pakistan (GOP) estimates that 87,000 tons of solid waste generated per day, mostly from major metropolitan areas. Karachi, Pakistan's largest city generates more than 13,500 tons

of municipal waste daily. All major cities face huge challenges on how to manage urban waste. Bureaucratic hurdles, lack of urban planning, inadequate waste management equipment, and low public awareness contribute to the problem Existing Solid Waste Management System in Pakistan.

Both the municipal and local government is responsible for collecting the waste from all over the Pakistan including the big cities like in Punjab Islamabad, Lahore, Faisalabad, Multan in Sindh Karachi is highly responsible for generating waste. About very low amount of solid waste collected in rural as well as in urban areas the primary ways of collecting solid waste are handcarts and donkey pull carts. The secondary way of collecting is tractor trolley, open trucks, containers. Some of the people hire sweepers for making their areas clean.

A garbage collection system is a collection of solid waste management and through into proper disposable places. Solid waste management is divided into three components one is the collection done by the municipality the second is the private sector and the last one is no system. However, unfortunately in Pakistan, most of the provinces are base on no system of garbage collection. In all over Pakistan, 75% of people reported that there is no system of garbage collection in their areas.
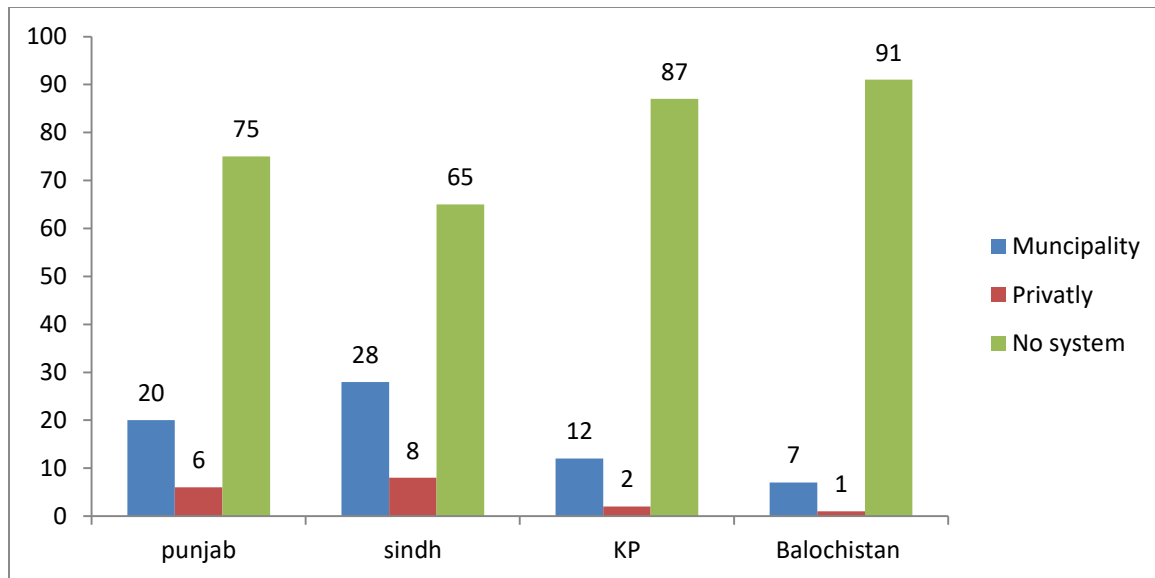
Figure 2.6: **Garbage Collection System**

The above graph is representing that in Punjab 75% based on no system, the municipality manages 20% and only 6% managed by private sectors. In big cities in Punjab like Lahore, Islamabad where societies like DHA, Bahria Town, and other small towns in Lahore private sectors managed the garbage collection efficiently. Most of the areas based on slums and kachi abadi areas so here solid waste management system is poor in such areas. However, in the case of Sindh 65% is based on no system it is a highly polluted area and generates 9000 tons daily of municipal waste. The worse situation of the garbage collection system is in Baluchistan that is 91%.

Safety

Safety considered as one of the most essential components while deciding on living. In case of Pakistan crime rate is rising rapidly due to many reasons like high inflation, increasing poverty, high unemployment rate, urbanization and many more. Security is one of the major priorities of people. Due to many crimes like child abuse, street crimes, harassment, robbery, murder, and many

more causes unfavorable circumstances in Pakistan. Therefore, in such a situation everyone wants to live a safe life and prefers to live where they can stay safe.
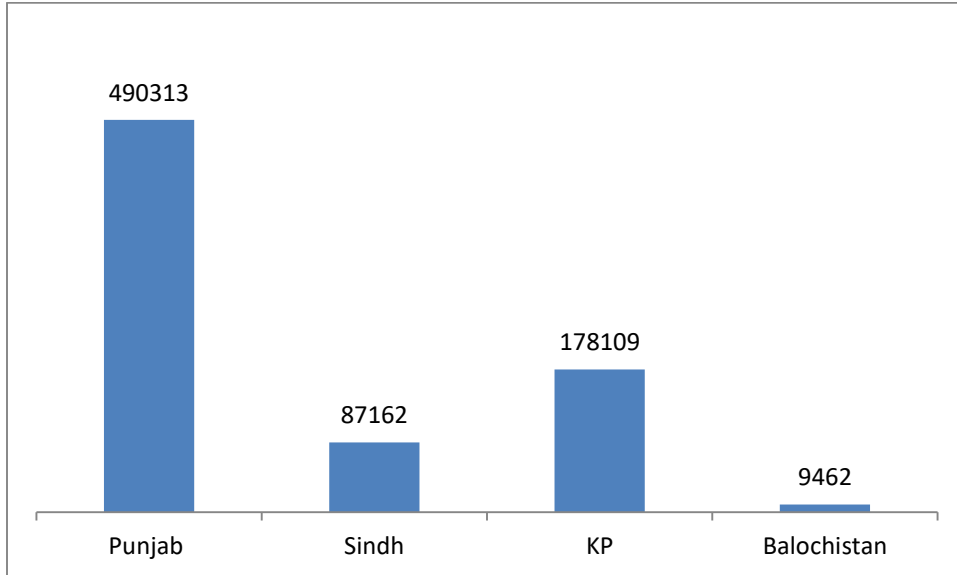
Figure 2.7: **Crime Rate**

The safety of all the provinces is measure by the crime rate in the provinces of Pakistan. The above graph is showing that Punjab has the highest crime rate where the cities like Islamabad, Rawalpindi, and Lahore have the highest crimes including murders, rape cases, child abuse, and many more. The worst thing that is rising in the areas of Punjab rapidly is sexual violence. That create a huge insecurity in the minds of people when they decides to live in the areas of Punjab especially Lahore. Whereas in Sindh the street crime is slightly higher as compared to Punjab and in Karachi, street crime is a very common activity. Then Baluchistan is at the lowest in crime rate and its most secure place according to the statistics as compared to all other provinces.

Employment opportunities and average income

In a developing country like Pakistan where job saturation is one of the major issues, people are facing in the current time. Unemployment is one of the alarming factors in Pakistan. People are graduating from the top universities they have degrees but they cannot get good job. The major reason identified behind this issue is that low quality education, rapid increase in population, lack of industries, global recession, impact of inflation on the unemployment rate and many more factors are responsible for increasing unemployment rate in Pakistan. The solution identified by researcher is improving the education system they need to establish well-organized and technical institution to improve the growth of the country.

Most of the people migrated from one city to another or from one province to another just to get a good job. Therefore, availability of more employment opportunities in an area forces people to live in that place. In urban areas job opportunities are more as compare to rural. In rural areas, people have their own business of land ownership. Secondly, they prefer to do farming and earn a handsome amount from it. While people in the urban areas face more issues in finding jobs.
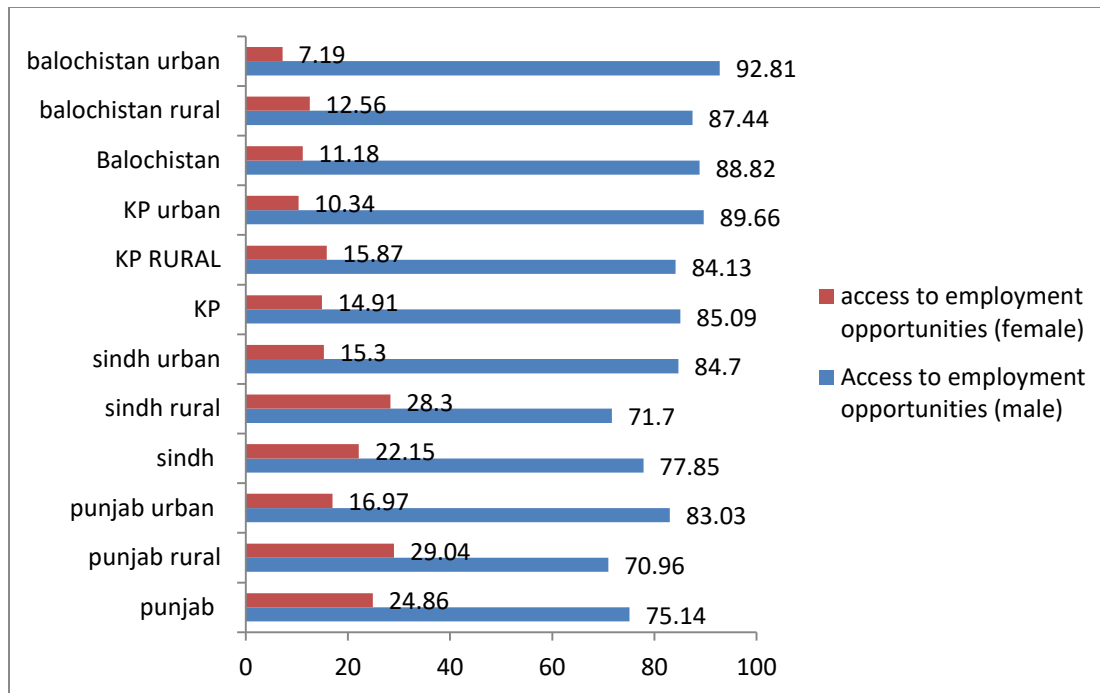
Source: PSLM (2018-19)

Figure 2.8: **Employment opportunities (Male & Female)**

The above graph is representing the availability of employment opportunities of both the male and females in all provinces of Pakistan including rural and urban. Therefore, areas of Baluchistan are on highest number regarding male opportunities that are 92% and the lowest regarding female opportunities that 7%. The rate is higher in urban as compared to rural areas. In KP, the employment rate is more similar to Baluchistan but here the female rate is much better than Baluchistan's female rate that is 15% and the male employment rate is 85% that is less than Baluchistan. The common reason behind the highest rate is that here people are not that much educated and competition is less among them so they get a job very easily as compare to all other provinces.

Punjab is the biggest province among all so here competition is tough and the employment rate is less among all other provinces. The other reason is that the female employment rate in Punjab is

about 30%. In addition, the male employment rate is about 70%. The situation of Sindh is almost the same as Punjab in it the male employment rate is 77% and the female employment rate is 22%. In both, the province's males are dominant than females but in the case of Punjab employment rate of the female is more as compared to Sindh.
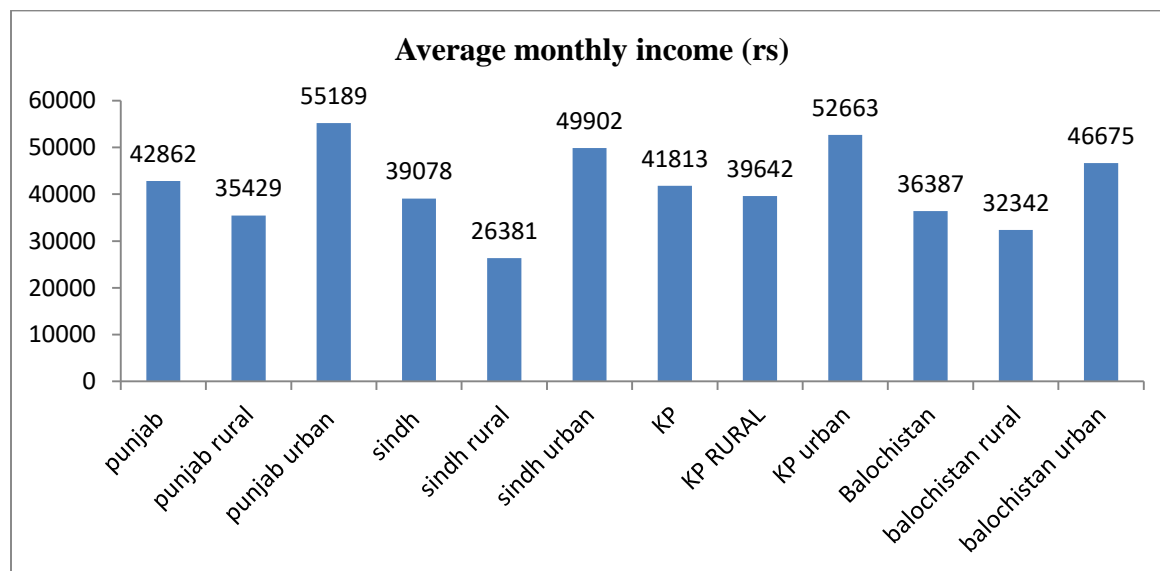
Source: HIES (Household Integrated Survey)

Figure 2.9: **Average Monthly Income across provinces of Pakistan**

The above graph is demonstrating the average monthly income of a household in all provinces. The resident of Punjab urban receives the highest income on average that is 55189. In which 44% earn their incomes from wages and salaries. However, 21% earn from nonagricultural activities, 5% receive foreign remittances and the rest of the people earn from sources like property, pensions, agricultural products, and many other ways.

KP urban people earn the second-highest average monthly income that is 52663 two major big sources where KP people earn incomes are wages and nonagricultural activities that are 42% and

23% respectively. Whereas 9% receive, foreign remittances and the rest of the 25% earn from the other different sources.

Sindh urban is on the third number in terms of earnings monthly income in which 57% earn from employment like wages and salaries, 17% from owner-occupied houses and 16% from nonagricultural based activities. The rest of 10% earn from other different sources.

Baluchistan urban is on the fourth number in this provinces highest percent of people earn from wages and salaries that are 61% among all the other three provinces and 19% earn from nonagricultural activities. People in the urban areas earn more income on average as compared to rural areas.

As far as rural areas are concerned so KP rural earn the highest income that 39642 here in KP 33% earn from wages, 9% from livestock, 14% from nonagricultural activities, and 11% from foreign remittances. Punjab rural is on the second number and average earns 35429 per household. They earn 30% from wages, 15% from crop production, 14% from livestock, 11% from nonagricultural activities, and many other sources. The people of Baluchistan rural areas earn more on average as compared to Sindh rural people.

The research conducted in the past and emphasize on the housing policy made in 2001. There are many challenges that contained in this policy like low income group is still not able to afford house, lack of revenue collection, gap between the supply and demand is still rising, housing units prices are increasing rapidly, lack of facilities and many more. To making the housing policy more effective land, infrastructure, governmental bodies, real estate market, finances are the most important factors the helps to make the policy more effective and valuable.

The above chapter based on the detail discussions of the variables identified by the previous and the brief profile of housing. The figures showed that the problem of affordability and sustainability is present in each province. The present study will incorporate all the above indicators and then examine which province is better than the other is. The findings will be beneficial for the people, as they know that which province is better for their living.

Chapter 3

Literature Review

3.1. Theoretical literature

The literature conducted on housing and sustainable communities has improved from the past many years based on model specification, choice of variables, and econometric estimation techniques. (Maliene et al., 2013) found that demand for a house would be low where there are only homes with no other facility like jobs, green spaces, shopping malls, health, and safety would present. There is a difference between building homes and building communities. Therefore, government and people both should focus on creating striving communities. These are the type of communities where people like to live and work. They must be safe active and inclusive or environmentally sensitive, well connected, and built and it should be fair for every person including the poor and middle-income groups.

3.2. International literature:

Situation of Housing affordability in developed world

Developed countries like UK, USA, CANADA, and China are also working to achieve affordable and sustainable communities in their countries. The major factor that is responsible for arising public concern over housing affordability (Power, 2004). Housing considered as one of the largest expenditures in the budget of individuals and families. On average in the USA about people spend one-quarter of their income on housing expenditure and those who are very poor spend about half of their income on housing expenditures. Therefore, the result indicates that a very small proportion of changes in the rents and housing prices lead to a high impact on the people's income,

which in turn affects the consumption pattern and it all leads to a bad impact on the housing wellbeing.

Situation of sustainability in developed countries

As far as sustainability is, concerned urban environment received a lot of attention at the city level. Most of the countries including the developed world used different standards to measure the performance of districts, neighborhoods, cities, for the achievement of sustainable development goals. (Wilde et al., 2020) used four standards from UK and China to examine the importance of green and sustainable development. China's innovative Assessment Standard for Green Eco-districts (ASGE) aims to maintain China's New-type Urbanization Plan from the intangible stage to the existing implementation. The result of that research showed the rating systems of ASGE are in route with China's countrywide conditions, and that some non-technical factors are progressive, but that there is stillroom for development in terms of execution routes, weight assignment, number of indicators, and index system.

The research conducted in Ghana by (Chan et al., 2020) found that housing construction is one of the main contributors to the emissions of co2. It is also analyze that 54% of the electricity is use for the running of houses in Ghana. About 43% and 59% were the levels of poverty recorded in both the rural and urban areas of Ghana. Therefore, it is very difficult for them to produce sustainable technologies for their houses.

In central Asia, Kazakhstan is considered to be the largest greenhouse gas emitter (Azhar et al., 2020). Renewable ways like wind, solar, small hydro, and bioenergy presently subsidize less than 1% of the country's energy mix. The building segment in Kazakhstan used 30% of final energy

consumption. In this concern, the part of the construction industry is tremendously significant due to its important portion in energy consumption and carbon emissions.

In the UK, people are also facing social, economic, and environmental problems for the past decade. The urban areas in the worst situation need more attention for sustaining the current environment as well as affordable housing. The research by (Malys et al., 2009) considered that housing is one of the key components for making communities sustainable. Sustainable housing should be well accessible, high quality, ecological, economical, aesthetical design, comfortable for the people living.

Another study focuses on the barrier in making the communities sustainable in the areas of Dublin. Another study found that the Barriers to attaining sustainable housing comprise the absence of a joint vision of sustainable housing, insufficient building rules and non-compliance with current regulations, lack of knowledge and proficiency in green building methods, adverse insights of advanced density housing, poor quality designs, undesirable attitudes to social mix, focus on demolition, a letdown to distinguish the requirement for social renewal and inadequate resources (Winston, 2010). The article concludes that it is vital to aim resources at enforcing building principles, providing adequate social and inexpensive housing as well as the social substructure mandatory for sustainable communities, suitable management and maintenance, and retrofitting the unmaintainable housing built in the past.

The research on From Informal Settlements to sustainable communities by (Sayed, 2018) analyzed that Sustainable efforts everlastingly develop living circumstances, additional significantly, they start an enduring expansion process. Consequently, it is demand to detect the resident's needs, voice their requirements, and helps them establish themselves to recover their living with the

assistance of the monetary, practical, and human resources presented by development projects, as well as their personal. Development is multidisciplinary teamwork. All appropriate investors must be encompassed in the expansion of an urban sustainable idea and they must be correct a voice in the definite design, execution, and ranking of urban investments. The part of deliberate and assistance associations are also very significant to contribution people to participate into an urban routine and share expansion experience.

This study conducted by (Wang et al., 2017) explored the role of the cohousing model in the UK and deliberated the assistances and restrictions of the cohousing model by discovering cohousing tenants' motivation and daily living. Therefore, the case studies in the UK, semi-structured talks carried out to create environmental and social sustainability in cohousing and comprehend inhabitants' intellectual and behavior. This study originates that cohousing can profit numerous age groups, and encourage residents' thinking and behavior change towards sustainable living. The study also institutes that the monetary constraint and new member's enrollment are the top two problems in cohousing expansion.

The author (Hancock, 2000) analyzed that healthy communities must be both environmentally and socially sustainable, specified that health is based on the superiority of the constructed and natural environments, and that worldwide change causing by the industrial economy is distressing the network of life. He disputes that wastes limited resources and suspiciously places those resources in the hands of suburban dwellers. Urban areas can made more environmentally sustainable, especially concerning energy consumption, which will help decrease air pollution and climate change and contribute in other ways to improved health.

3.3.   National literature

Housing affordability in Pakistan

Housing affordability and get access to sufficient land is one of the major issues that are rising rapidly in Pakistan. According to the (Pakistan Bureau of statistics 2017), 20.7 million is the total population of Pakistan and about 32.2 million people (household) involve in it. In Pakistan every year about 270,000 housing shortage is rising. About half of the population is below the poverty line and two-third of them are unable to afford housing without any financial assistance ("Global Report on Human Settlements 2011: Cities and Climate Change | UN-Habitat," 2011).

There are many studies (Malys et al., 2009; Maliene, 2011; Mulliner et al., 2013) on housing affordability and sustainable communities in the case of developed countries but in developing countries, the factors of housing affordability researched but factors of sustainable communities are almost negligible. A considerable effort in the literature has made to find out estimation techniques that can better explain the relationship between housing affordability and its determinants and sustainable communities with its determinants. Previous studies (Akhanova et al., 2020; E. Mulliner et al., 2013; Maliene, 2012; Quigley et al., 2004; Razali et al., 2016) indicates the major factors includes in housing affordability are housing prices, rental cost, interest rate, and mortgage availability subsidized rent and housing expenditures. The factors for sustainability are access to employment opportunities, shops; public places, health and childcare, leisure facilities, and open green public spaces.

Housing affordability as studied by (Ali et al., 2020) in Pakistan identified different factors including housing design, cost of construction, material neighborhood design, and financial assistance. Results of the study demonstrated that shortage of housing and too much rise in housing prices cause unaffordability of housing in Pakistan. It is the problem mostly in developing

countries because in it half of the population of the country is below the poverty line. It is a great challenge for poor people to purchase and build a house.

(Tariq et al., 2018) worked on the perspective of developing countries on housing affordability and give their recommendations for Pakistan. In their study, they identified that design, efficiency, location, financial assistance, infrastructure services, a material used for the construction, and neighborhood design are the most relevant factors while measuring housing affordability in Pakistan. Housing units prices are raising rapidly in Pakistan the major reason behind this is the high cost of land and buildings. This causes difficulty for the low-income group to afford housing at affordable prices.

Sustainability situation in Pakistan

In (Shahmoradi et al., 2014) research done in Lahore on green building is one of the solutions for sustainable housing in Pakistan. They tried to connect the concept of sustainable housing with the construction of housing and buildings. Maximum efficiency can be gain by using green material in the construction of buildings. Most of the factors that are responsible for unsustainable communities are population growth, urbanization, climate change, the impact of natural disasters, lack of innovative technology, and economic uncertainties.

Naya housing Pakistan scheme is one of the biggest challenges for Pakistan to achieve because the construction of 5 million housing just looks like a dream. (Akhanova et al., 2020) researched on that and identified some realistic factors that should be considered while working on this scheme are major housing need, vacancy rates, the start of rental housing, social assistance gap, rate of the effective property tax rate, distortions in the prices of cement, control of land development and many more.

Another study analyzed by (Siddiqui et al., 2018) that the price of housing does not remain the same for all time periods it changes with the internal as well as external factors. Firstly, the prices vary with the rise and decline in the prices of property. Secondly, it changes based on facility of electricity, gas, water, the number of rooms in a house, close to market, availability of medical health care system, access to school, offices and many more. These factors cannot ignore while calculating the prices of houses.

Sustainable development is very crucial for the urban as well as for the rural areas of Pakistan. A study was conducted (Hameed et al, 2018) just to analyze the sustainable development in the rural areas of Pakistan. They consider the factor like agricultural and nonagricultural assets, housing, education, energy, sanitation, and access to clean drinking water and found that about 44% of the population of Pakistan does not have access to clean water, sanitation facilities, poor housing condition, polluted energy sources.

Affordable housing for low-income people is problematic in the areas of Punjab, the main province of Pakistan, due to the too difficult institutional framework and overlying parts of government authorities at federal, provincial, and local levels. This research by (Tariq et al., 2018) is a study that includes a wider aspect of the Housing system of Punjabi, conclude a framework of presently institutional measures in exercise for affordable housing establishment. The research results found that for restructuring the federal, provincial, and local governments to deliver a better environment to deal with affordable housing policy and establishment issues by reconsidering the corresponding institutional structures.

3.4. Empirical literature

Some of the studies (Dang et al., 2020; Mulliner et al., 2015; Quigley et al., 2004) in the previous time about housing affordability and creating sustainable communities used different methodologies and they end up with different results. Like in the case of developed countries like the US, UK and China used HUD, MCDM, and COPRAS respectively. The developing countries including Iran, Kazakhstan, Ghana, and Pakistan used H+T Affordability analysis, Stepwise weight assessment ratio analysis (SWARA) method, fuzzy synthetic evaluation (FSE) technique, and hierarchical Bayesian model of adaptive choice-based conjoint analysis respectively. Methodological debate is in the routine it is very difficult to reach out on a conclusion and to identify the best methodological approach.

Another research conducted in the UK (Heffernan et al., 2020) about the Group self-build housing a bottom-up approach to environmentally and socially sustainable housing. The objective of this paper was to analyze the detailed discussion with the expert about the self-build of housing a development model for the zero carbon homes. Secondary data research conducted in South wales England results showed that this development would be beneficial for affordability, quality, innovation, energy efficiency, and sustainable communities.

Social housing contributes to the transition of the circular economy in cities. Research conducted (Marchesi et al., 2021) analyzed the social housing consumption patterns, people's behavior. These findings also highlighted a complementary role that SI (Social Innovation) can play in the CE (Circular Economy) implementation in cities. Therefore, the project suggested the introduction of emerging SI concepts into the current CE approach to support development.

In Pakistan, research on sustainable communities is very rare but on housing affordability, researchers are working for past many years now. So these studies concluded that government, public authorities, and existing institutions need to reexamine their housing policies (Amin et al., 2019). In Pakistan in 2001, housing policies made and they are still the same without any amendments in it. The paper demonstrates that the 'model' project in Pakistan, as designed, is not affordable. The study (Rauf et al., 2021) found that residents prefer to invest in real estate to achieve a return on investment, rather than to build a house and to live in. study (Khan et al., 2020) results showed that demographical factors of age, gender, and literacy level positively correlate with willingness to pay whereas environmental knowledge and income level negatively correlate with willingness to pay.

Unfortunately, urban inhabitants in Pakistan are living in solemn social, physical, and economic hardships. Despite being economic engines, cities in Pakistan suffer from stresses like climate change, haphazard and unregulated expansion, housing shortage, and a lack of basic civic amenities. While using systematic review methodology, (Hameed et al., 2018) collected published and grey data from national and international sources. Literature shows that successive governments in Pakistan gave sample space to urban development in most of the policy documents. However, urban resilience and community engagement were given scant attention. This major gap, both in policy and practice, needs to bridge to promote resilient and sustainable urbanization in Pakistan.

Conclusion

The Studies that has conducted in the past focused on creating housing affordability but do not focus on creating the sustainable communities. Housing policies and schemes generated many times but it does not work even for the short period. The major issues analyzed from the past research were poor governance, old housing policies; low level of income, people do not focus on sustainability and many more. The present study including the major component of creating sustainable communities and would provide a comparative analysis of all the provinces of Pakistan.

3.5. Research gap

- Previous studies (as mentioned in the literature review section) address the issues of housing affordability and sustainable communities in isolation without considering the dire need to address the issue with a more holistic approach. So the present study will incorporate both the factors of housing affordability and sustainable communities.

- In addition, this study will provide a comparative analysis of all the provinces of Pakistan that will reflect how far the communities are sustainable among provinces.

- Moreover, most of the studies strands that address the issues of affordable housing and sustainable communities used traditional approaches such as ANOVA (analysis of variance), Logit probit, Correlation analysis but ignore the multiple criteria decision making approaches (MCDM) which appeared to be appropriate based on an assessment tool for sustainable housing affordability.

Chapter 4
Data sources & Methodology

Introduction

The current chapter explains about the data sources taken from different surveys conducted in Pakistan, secondly the conceptual framework that showed the relationship among variables thirdly elaborate about the description of variables and lastly the detail discussion about the econometric model and methodology.

4.1   Data Sources

The research based on two domains the one is housing affordability and the second is sustainability. Therefore, the variables that are under affordability are measure through the expenditure and revenue of households. The variables that are under sustainability are measure through the accessibility of comforts for a household. In the current study, two different sources are used for the data collection including PSLM (Pakistan Social Living Measurement), and HIES (Household Integrated Economic Survey) conducted by the PBS (Pakistan Bureau of Statistics) in (2018-19). The data taken from both surveys based on different units so for that MCDM (multiple criteria decision-making) is use to normalize the data. MCDM is appropriate for that topic as it can counter the several quantitative and qualitative criteria that distress both Sustainability and housing affordability, all of which can combine into a single estimation process.

4.2   Conceptual framework
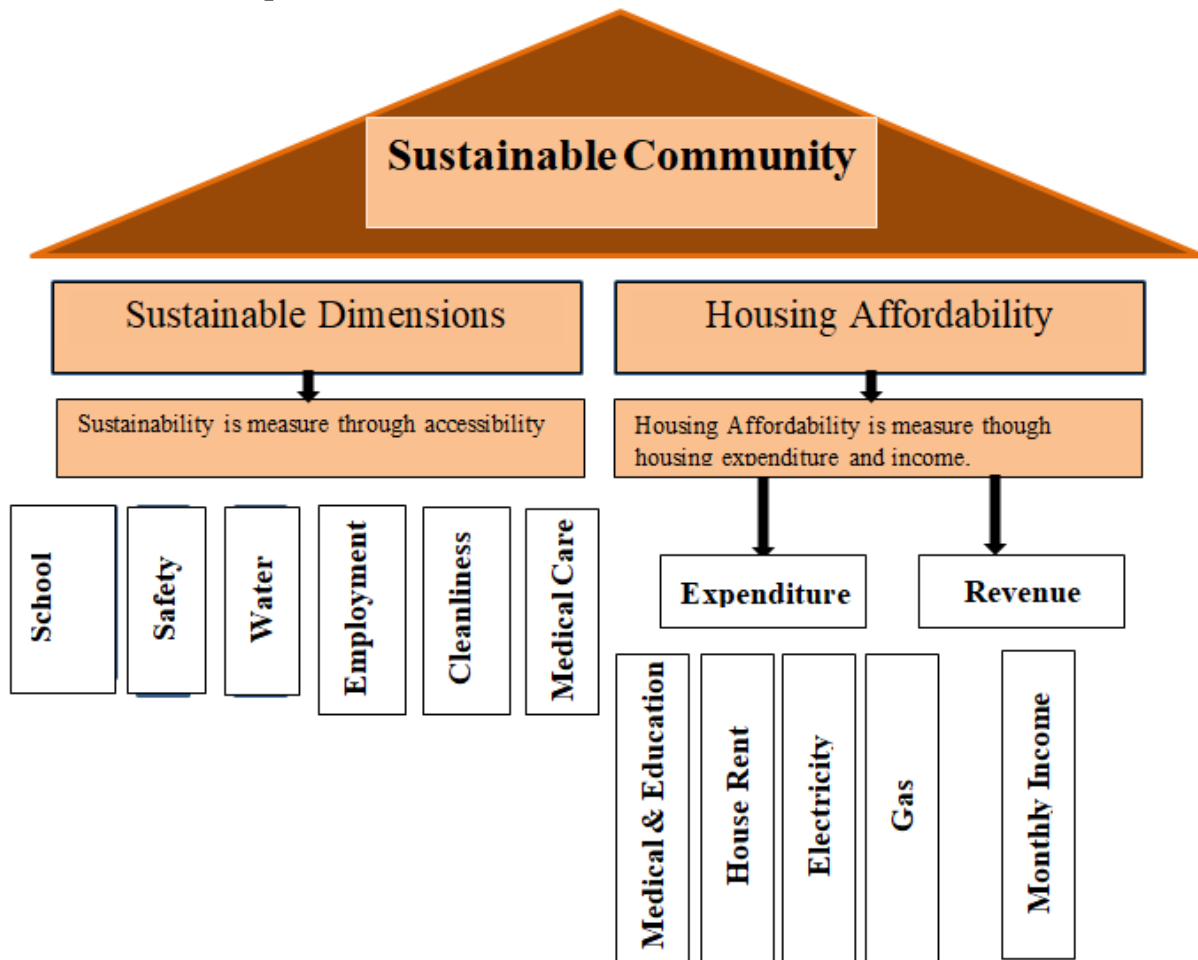
Figure: 3.1 conceptual framework

The housing amenities mentioned in the above diagram show the full objective of this research. These sustainable dimensions and the concept of housing affordability both combine and create sustainable communities. According to the previous literature, housing affordability is measure through income and expenditure (Mulline, 2013). If income is greater than expenditure, then housing is affordable and on the other side of the expenditure is greater than income then housing is not affordable (Power, 2004).

The study conducted by (Akhanova et al., 2020; E. Mulliner et al., 2013; Mulliner et al., 2012; Raphael et al., 2004; Said et al., 2016) indicate the major factors includes in housing affordability are housing prices, rental cost, interest rate, and mortgage availability subsidized rent and housing expenditures. So present study includes the percentage of income a household spent on medical and education, on the construction of houses, for paying the house rent, for paying the bills of electricity and gas. Whereas monthly income that people earn from different sources is use as revenue.

Sustainability means having access to housing amenities (Padda et al., 2018) used education, energy, sanitation, and access to clean drinking water just to analyze the sustainable development in the rural areas of Pakistan. Therefore, current study measures access to school through the literacy rate of that province. Second, the employment opportunities are measure through the number of people employed in that particular province. Thirdly, medical care is measure through the availability of hospitals in the province. Water is measure through the access to clean drinking water in homes through tabs, safety is measure through the crime rate in that area, and cleanliness is measure through the garbage collection systems.

4.3   Variables Description

Table: 3.1 Variable descriptions

Variable	Description
School	Access to the school is measure through the literacy rate of people in each province.
Safety	It is measure by the total crime rate that occurred during a year in each province.
Water	It is measure through the Percentage of Households with Improved Sources of Drinking Water.
Employment opportunities	Percentage distribution of employed person by industry, employment status, occupation, and sex.
Cleanliness	It is measure through the availability of garbage collection system in the province.
Medical care	Medical care is measure through the number of hospitals present in each province.
Housing affordability	
Rent	Percentage distribution of monthly expenditure per household on house rent.
Gas	Percentage of monthly income spent by a household on the expenditure of gas.
Electricity	Percentage of monthly income spent by a household on the expenditure of electricity.

| Medical and education | Percentage distribution of monthly expenditure per household on medical and education. |
| Monthly income | Average monthly income |

Source: PSLM (Pakistan social and living standard measurement), HIES (Household integrated survey), PBS (Pakistan bureau of statistics).

4.4   Econometric Model

Firstly, the MCDM (Multiple Criteria Decision making Approach) used to select the best option among all the alternatives. In 1950 Herbert Simon was introduced this technique. Then the other four methods WSM (Weighted Sum Method), WPM (Weighted Product Method), Zavadskas, Kaklauskas, and Sarka in 1994 introduced COPRAS (Complex proportion Assessment), in 1981 Yoon and Hwang developed TOPSIS (technique for order preferences by similarity to an ideal solution) are used for the confirmation of more appropriate results and the selection of the best alternative among all provinces. The previous literature showed that (Emma Mulliner, 2013; Maline V, 2012; Smallbone, 2011) used this technique in their research for ranking the best city in United Kingdom.

4.4.1   MCDM (Multiple Criteria Decision Making Approach)

MCDM (Multiple Criteria Decision Making) studied as a complicated decision-making tool that can involve both quantitative as well as qualitative factors. It includes variables like sustainability, energy, environment, and many more. MCDM is appropriate for that topic as it can counter the several quantitative and qualitative criteria that distress both Sustainability and housing affordability, all of which can combined into a single estimation process.

All MCDM techniques follow three steps.

1. Decide relevant criteria and alternatives.

2. Attach numerical values to the comparative most important criteria and the impacts of the alternative on these criteria.

3. Develop the numerical values to find a ranking of every alternative.

The present study is considering 12 alternatives including all four provinces Punjab, Sindh, Baluchistan, and Khyber-Pakhtunkhwa, and the urban, rural situation of the provinces. The most important approach adopted to determine the criteria system and to authenticate weight such criteria. Then extensive literature review used to select the most important criteria defining the housing affordability and sustainable communities for the people of Pakistan. An overall 12 criteria identified. Criterion values are determined by secondary sources like publications by the government (PBS), HIES, PSLM, surveys. After selecting the alternatives and criteria the next most subsequent thing is to provide weights to each criterion that which amenity is more important for living as compared to another one. Therefore, for the weight assigning entropy method will use it. Entropy acted as a measure of dispersion between the original and the destination. Weights collected from this method also called objective weights.

The other four methods of MCDM used for the more appropriate results including TOPSIS (Technique of order preferences similar to an ideal solution) , COPRAS (Complex Proportional Assessment), WSM (Weighted Sum Model) and WPM (Weighted Product Model).

CHAPTER 5
RESULTS

Introduction

This chapter based on the results that get from the above methodological approach that includes a comparative analysis of provinces based on their different components. Secondly it showed the ranking of results both in the form of mathematical and graphically. Lastly, it involves the results of correlation matrix related to all methods used in the research.

5.1 Results Discussion

5.2 Comparative analysis of MCDM methods

MCDM involves several methods but a single method cannot consider as best for selecting the best among all alternatives. Another problem with MCDM is that no method does give the same result when applied to different methods. Therefore, it is not a simple thing to consider anyone's method best. In the literature, most of the authors give different guidelines in selecting the best method among all. However, it has recognized that numerous methods can be possibly valid for a particular choice-making situation there is not always a devastating reason to accept one.

Table 5.1: (Beneficial / Non-Beneficial) Criteria

Criteria	Beneficial/ Non-beneficial	Measurement
Average monthly expenditure on house rent per household	-	Rupees
Expenditure on gas	-	%
Expenditure on electricity	-	%

Criteria	Sign	Unit
Expenditure on medical & Education	-	Rupees
Average monthly income	+	Rupees
Access to medical care	+	Points
Safety (Crime rate)	-	Points
Access to clean drinking water	+	Points
Access to employment opportunities (2)	+	%
Access to Schools	+	%
Waste management in the area	-	Points

*The signs (+/-) indicate the beneficial and non-beneficial criteria respectively.

The above table is showing the 12 criteria approach including both the beneficial and non-beneficial criteria and their different units. Beneficial criteria are those whose highest value is desirable that is denoting by positive signs like access to schools, medical care, employment opportunities etc. Whereas non-beneficial criteria are those whose lowest value is desirable and that is denoting by a negative sign like expenditure on gas, electricity, housing expenditure, etc. every criterion is measure by different units so for that Normalization process every MCDM techniques involve its process.

Table 5.2: weights of alternatives

Criteria	Weights (q)
Average monthly expenditure on house rent per household	9.31
Expenditure on gas	8.12
Expenditure on electricity	7.98
Expenditure on medical & Education	9.35
Average monthly income	8.42
Access to water	8.39
Total recorded crime	7.71
Access to medical care	8.2
Municipality Garbage collection system	7.83
access to schools	8.41
Access to employment opportunities (male)	8.44
access to employment opportunities (female)	8.35

The second table assigns weights to 12 criteria. The current research based on secondary data so the weight assigning process done through the entropy method. All the methods involve in MCDM

including TOPSIS, COPRAS, WSM, and, WPM need to create a weighted normalized decision matrix so for that weights computation for every criterion is necessary. Therefore, the weight varies from 7 to 9 points. The Entropy methods firstly normalized the decision matrix then compute the entropy value and it used to calculate the value of dispersion among the decision matrix. The Entropy method assigns the objective weights to each criterion, which means that higher objective weights will have more effect on the performance of the criteria.

The method selected for the comparative analysis vary based on their principles the way to normalize the data and every method have to combine criteria weights and values differently. Every criterion involves in MCDM has different measurements like points, prices, ratio, etc. so for that the normalization process is necessary. The WSM, WPM, and COPRAS methods are similar in their normalization procedure, although TOPSIS is somewhat different.

Table 5.3: Results of all methods

MCDM	WPM	TOPSIS	WSM	COPRAS
0.680702	13.94898	0.686776	0.119288	100
0.556199	13.47654	0.468019	0.0727	70.67715
0.650731	13.89946	0.5438	0.116347	85.05633
0.598758	13.78152	0.532821	0.098159	80.17412
0.524227	13.11964	0.436602	0.050696	65.70805
0.642955	13.79463	0.419557	0.11026	73.66201
0.547159	13.64426	0.485422	0.080792	73.04813
0.482235	13.27422	0.406073	0.060691	60.55723
0.588465	13.76321	0.447268	0.101904	73.26186
0.487026	13.37595	0.408956	0.063158	61.42004
0.439213	13.09961	0.341084	0.054894	48.69917
0.532772	13.41046	0.427756	0.071109	67.41589

Table 5.4: Ranking of provinces

Ranking	Punjab	Punjab Rural	Punjab urban	Sindh	Sindh rural	Sindh urban	KP	KP RURAL	KP urban	Baluchistan	Baluchistan rural	Baluchistan urban
MCDM	1	6	2	4	9	3	7	11	5	10	12	8
WSM	1	7	2	4	12	3	6	10	5	9	11	8
WPM	1	7	2	4	11	3	6	10	5	9	12	8
COPRAS	1	7	2	3	9	4	6	11	5	10	12	8
TOPSIS	1	5	2	3	7	9	4	11	6	10	12	8

The above table is representing the ranking matrix among all 12 alternatives including rural and urban areas. The shading with different colors demonstrates that where all the methods respond in the same way concerning all the alternatives. As all the methods like MCDM, WSM, WPM COPRAS, and TOPSIS considered that Punjab is the best province as compare to all other alternatives. Then Punjab urban is on the second number. Then three of the methods including MCDM, WSM, and WPM considered that Sindh urban is in the third number. The same three methods satisfy that Sindh is on the fourth number. Then KP urban is on the fifth number according to all methods except topsis.

KP is on the sixth number according to WSM, WPM, COPRAS and the same three methods found that Punjab rural is on the seventh number. All the five methods agree that Baluchistan urban is on the eighth number. MCDM and COPRAS found that Sindh rural is in the ninth number. According to MCDM, COPRAS and TOPSIS Baluchistan are on 10 numbers and KP rural is on 11 numbers. According to all methods except WSM Baluchistan rural is no last twelve numbers.

Table 5.5: Total Ranking

Ranking	MCDM	WSM	WPM	COPRAS	TOPSIS	TOTAL
1	P	P	P	P	P	P
2	PU	PU	PU	PU	PU	PU
3	SU	SU	SU	S	S	SU
4	S	S	S	SU	KP	S
5	KPU	KPU	KPU	KPU	PR	KPU
6	PR	KP	KP	KP	KPU	KP
7	KP	PR	PR	PR	SR	PR
8	BU	BU	BU	BU	BU	BU
9	SR	B	B	SR	SU	SR
10	B	KPR	KPR	B	B	B
11	KPR	BR	SR	KPR	KPR	KPR
12	BR	SR	BR	BR	BR	BR

*P=Punjab, PU=Punjab Urban, SU=Sindh Urban, S=Sindh, KPU=KP Urban, KP= Khyber pakhtunkhawn,

PR=Punjab Rural, BU=Baluchistan Urban, B=Baluchistan, SR= Sindh Rural, KPR=KP Rural, BR= Baluchistan Rural

The above table is representing the overall picture of all provinces that which one is better and which is worst. So the analysis based on two components the one is affordability and the second is sustainability these two components merge and make a sustainable community. The table is representing the overall ranking according to all methods and showed the results in the last column.

All of the five methods support that Punjab, Punjab urban and Baluchistan urban are on first, second and eighth number respectively. Out of the five four methods supports that KP Urban and Baluchistan Rural is on 5 and 12 number respectively. All of the five three methods support that Sindh Urban, Sindh, KP, Punjab Rural, Baluchistan, and KP rural are on 3,4, 6,7,10, and 12 numbers respectively. In the last, only two of the methods support that Sindh Rural is on nine numbers.

<p align="center">**Table 5.6: Criteria Comparison**</p>

Criteria	P	PR	PU	S	SR	SU	KP	KPR	KPU	B	BR	BU
Average monthly exp on house rent per household (RS)	6	11	2	5	12	1	8	9	4	7	10	3
Percentage exp on gas	9	11	5	10	12	1	6	8	3	4	2	7
Percentage exp on electricity	3	5	1	2	7	12	9	11	4	8	6	10
Exp on medical & Education	6	8	2	7	11	3	4	5	1	10	12	9
Average monthly income (rs)	5	10	1	8	12	3	6	7	2	9	11	4
Access to water	6	5	8	11	12	3	4	7	1	9	10	2
Total recorded crime	1	4	2	6	9	8	3	7	5	10	12	11
Access to medical care	2	9	5	1	6	4	3	10	7	8	12	11
Municipality Garbage collection system	5	9	2	4	9	2	7	12	1	8	9	5
Access to schools	4	5	1	5	11	2	5	9	3	10	12	8

*P=Punjab, PU=Punjab Urban, SU=Sindh Urban, S=Sindh, KPU=KP Urban, KP= Khyber pakhtunkhawn, PR=Punjab Rural, BU=Baluchistan Urban, B=Baluchistan, SR= Sindh Rural, KPR=KP Rural, BR= Baluchistan Rural

The above table is explaining the whole result in the form of a table based on the original data. So in the case of sustainability, it shows that the 1 means the availability of that amenity in the particular province is the more as compared to the other one, while the highest number showed that that availability is worst in that area and vice versa. As far as affordability is concerned so that one means the expenditure is highest in that province while in the case of revenue it is the same 1 indicates that the particular province is earning higher incomes as compared to others.
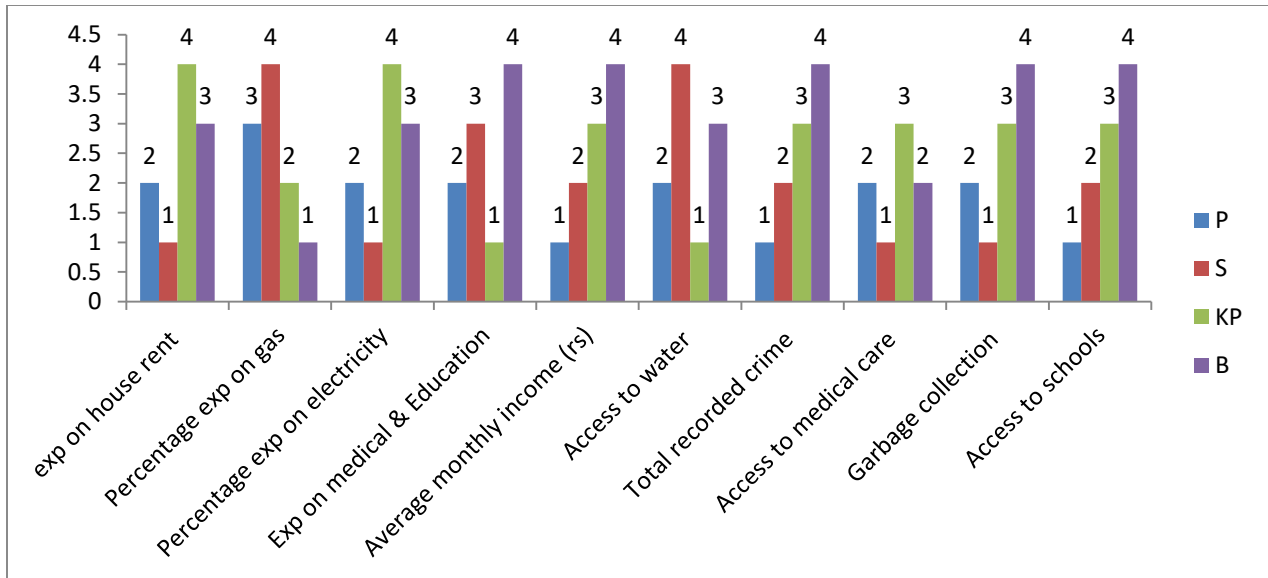
Figure 5.1: **Comparative analysis of the main province**

The above table is representing the comparative analysis of all four provinces excluding the figures of rural and urban areas. In income and expenditure approach five criteria's come under it like expenditure on gas, electricity, medical and education, rent, and monthly income. In all of the above mentioned five criteria.

In case of housing affordability, which includes two domains the one is expenditure in which Punjab is on the second number except expenditure on gas and on the revenue side Punjab receives the highest incomes. On the other side that is sustainability so access to water, medical care, cleanliness Punjab is on second number, access to schools is highest in Punjab. Lastly, the situation of crime rate is worst in it.

In case of Sindh expenditure on house rent, electricity is more than Punjab but the expenditure on gas, medical and education is less than Punjab. People of Sindh receive lowest incomes as compare to Punjab. In terms of sustainability, only access to medical care is better in Sindh all the other indicators are better in Punjab as compare to Sindh except crime rate.

Lastly, in KP and Baluchistan, expenditures are less than Punjab and Sindh but the expenditures in KP are more than Baluchistan but the income distribution in Baluchistan is lowest as compare to KP. In KP, access to water, cleanliness and school is better than Baluchistan. However, in case of safety Baluchistan is on the top as compare to all provinces.

It concluded from the above results that Punjab best based on revenue collection and in terms of sustainability the only dimension that is expenditure side so KP and Baluchistan are better than Punjab. Sindh is better than KP, Baluchistan based on sustainability, revenue collection, and expenditure like electricity and house rent is highest in Sindh. KP is better than Baluchistan based on sustainability and revenue collection. The only dimension that is better in Baluchistan is the expenditure side the situation of income distribution and sustainability is worst in it.

5.3 Correlation matrix

The results of the correlation matrix are just analyzed to check that which method is most appropriate and all of five methods which method has more correlation among all.

Table 5.7: correlation Matrix

	MCDM	WPM	TOPSIS	WSM	COPRAS
MCDM	1	0.91995	0.797307	0.939709	0.930424
WPM	0.91995	1	0.750704	0.974743	0.876529
TOPSIS	0.797307	0.750704	1	0.715669	0.958083
WSM	0.939709	0.974743	0.715669	1	0.854477
COPRAS	0.930424	0.876529	0.958083	0.854477	1

The analysis of different methods showed the result of ranking it further demonstrated by pairwise correlation matrix. Pairwise correlation between the MCDM methods and the other four methods

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shows that MCDM is more similar to the COPRAS and WSM. Whereas WSM and WPM are highly correlated. In last COPRAS is also highly correlated with WSM. Interestingly, TOPSIS, which differs significantly from other MCDM methods on the basis that the optimal alternative should have the shortest distance from the ideal solution and the farthest distance from the negative ideal solution, showed very high similarity to COPRAS (Pearson correlation coefficient of 0.95).

All methods produced somewhat different ranking results. COPRAS, TOPSIS, WSM, MCDM, and WPM showed the most consistency amongst themselves. Although none of these five methods outclassed others considerably, the correlation analysis showed that COPRAS would be an optimal choice if one method used for the alternative were ranking purpose. The reason behind this is that this method is most similar to all the other four methods.

The COPRAS method is clear, simple, and easy to use and takes very little time in contrast with other MCDM methods, such as the and TOPSIS. A key feature that makes the COPRAS method important to other available MCDM methods is that it estimates the utility degree of alternatives, showing, as a percentage, the extent to which one alternative is better or worse than other alternatives taken for comparison.

CHAPTER 6

CONCLUSION

The study based on the analysis of all provinces of Pakistan including the urban rural areas in terms of housing affordability and sustainable communities. So for that different criteria used to analyze the 12 alternatives approach. In which some of the factors taken from the housing affordability side and some of them taken from the sustainability. Different MCDM methods like WSM, WPM, COPRAS, and TOPSIS used to analyze that which province is better than the other one. In this method, opinion is required for the ranking of different criteria's. The current study based on secondary data so for the weight assigning entropy method used to make it more authentic and viable.

The five MCDM methods were used every method is analyzed in its way and provides different results of the ranking. The reason behind applying the five methods is that that it demonstrates that none of the five methods can considered ideally best so for that it is necessary to apply more than one method to the same problem to get the best and worst alternatives. In last, the correlation matrix results and other characteristics showed the results of COPRAS and that method is more superior among all other methods of MCDM.

It has concluded from both the mathematical and theoretical analysis that overall Punjab in terms of both rural and urban areas is better than all three provinces. The reason behind is that in housing affordability in Punjab is not a lowest bearing expenditure area in which some expenditure are lower in Punjab and some are high but the revenue earning in Punjab rural as well as in the urban areas is highest. Secondly, accessibility to amenities is better in Punjab among all provinces.

Baluchistan is the worst province in terms of living here expenditure is lower but people are receiving the lowest incomes and access to amenities is also very poor in Baluchistan. Sindh is better than KP in terms of both housing affordability and sustainability. Therefore, KP is on the third number.

6.1 Policy Implications:

Based on the finding we suggest that, there is a need to counter all the issues present in all the provinces. Housing affordability is the key issue but without sustainable measures, affordability is also useless. Government should also focus to design such polices that encounter both the issues simultaneously.

Through research, showed that Punjab is best because of overall amenities and income distribution is strong in it as compared to other provinces but it is not up to the mark. In sustainability, Punjab has a highest crime rate so for that reason behind is law and order is not following in Pakistan properly.

- Therefore, government should introduce hidden cameras in the areas where crime rate is high.
- Secondly, need to encounter all the criminals and punish them according to the law.
- Government should introduce a department named 24 hours street sitting. So that street crimes can avoid, proper training and equipment should provide to those employs. Then Introduce security alarms in every street that will help people to alert the surrounding in such situation of robbery.

In case Baluchistan, expenditures are less but people are receiving the lowest incomes.

- Therefore, government should allocate more developmental budgets to this province for improving the living standards of people.

- Secondly, access to amenities is poor in this area. Access to amenities as medical care, and schools are very low comparatively other provinces. To counter these issues the increased budget will help to develop hospitals, schools that must provide quality services.

Sindh government introduced many policies to improve the cleanliness in the city. But they were failed and did not implement as per plan. Government and residents both are responsible for the failure of policies. Access to clean water and garbage collection system is worst in Sindh. The reason is that people through waste material in sea, wells, ponds. That is the reason of poor sanitation condition in the city.

- Every person is itself responsible to keep clean the environment. So for that create a garbage corner systems in their street ends and hire the garbage collectors for intermittent to maintain the cleanliness in the area.

The situation of KP is better than only Baluchistan.

- In KP, the expenditure on medical and education is highest among all. The reason behind high expenditure is that province is in it developmental phase. So due to that people have low access to schools government introduced schools in the province but the issue is that about 65.2% population does not go school due to poverty, 3.7% avoids due to health issues, and 12.1% involve in the child labor. So the basic objective is to alleviate poverty by allocating more budget to province, create awareness through parent teacher councils, provide scholarships to bright students can reduce expenses on education. Therefore, the poor people can easily afford that.

Qualitative analysis

Pakistan developed its first National Housing Policy in 2001 but the implementation and success of this policy is still debatable from past many years.

Presently, Pakistan follows National Housing Policy (NHP) 2001, which emphases on elementary necessities of creating a constructive environment in order to encourage and accelerate housing sector. The policy aims to back the new ideas and their execution in order to guarantee livable and acceptable housing for all its citizens. This policy objectives is to recognize chunks of land, be it state land or private land, in rural and urban areas to develop it for housing purposes. Therefore, the routine holdup laws in the procurements practice will be removed and amended in order to reduce litigation.

Main Objectives of Housing Policy

- Land record correction and up-to-date information system shall be developed using digital, remote sensing methods, GIS mapping, satellite imageries, etc.

- House financing organizations shall be encouraged to stimulate savings and start micro financing for lowincome people using community organization such as NGOs and CBOs.

- Subsidized loans will be provided for development and construction of rural housing as well. The key accomplishments of National Housing Policy 2001, were regularization of Katchi Abadis, provisions for low incoming housing, development of new towns and regularization of housing taxes.

On 29th March 2008, a special program started for housing sector which aimed to construct one million housing units annually to deliver housing facility to the public. The policy, however, was deferred to be reviewed in 2015, which was not held uptill today. Housing policy proposed in 2001

focuses on aspects such as katchi abadis, urban regeneration and slum up-gradation and puts forward a set of policy actions referring to planning rules, regulatory authorities and resettlement plans. However, there are a number of factors which led to ineffective and unproductive execution of the measures advised by the said housing policy.

Hurdles in implementing the Housing policy

1. The low-income group was not even able to afford the cheapest housing unit built by any public or private developer.
2. Failure to collect revenue is another main hurdle.
3. Gap between supply and demand curves is constantly increasing.
4. The housing programs lacked community participation and delivered units turned out to be not only expensive but against the needs and desires of the people.
5. Due to high maintenance and other costs of housing, the owners fulfil their need by selling homes. Owing to the above-mentioned factors and due to improper implementation of this housing policy, it was unable to deliver up to the expectations and the housing conditions in country got worse with passage of time.

These are the problems that people of Pakistan facing from past many years. Government of different eras introduced many schemes to meet the gap between the supply and demand of housing like Nawaz sharif introduced Apna ghar housing scheme, low cost housing scheme. As per the Apna Ghar Scheme, the provinces will provide the land free of charge and the federal government will construct 500,000 housing units around Pakistan in five years. The housing ministry, prior to the 2016-17 budget asked for Rs350 million for the scheme, including Rs35 million for the project's secretariat in Islamabad. But unfortunately these schemes

were failed and not implemented as per plain. The reason behind that was short of budgeting, huge debt crisis in Pakistan, low demand and many more.

Imran Khan launched the Naya Pakistan Housing Scheme in 2020. The objective of this policy is to provide five million houses in all the provinces of Pakistan including Punjab, Sindh, Baluchistan and Khyber Pakhtunkhwa. This policy also aimed at strengthening the poor and low-income segments of society by giving them an opportunity to buy their own house at an affordable price, provided they are employed and capable of repaying housing loans.

Large number of people showed interest in borrowing under this newly launched scheme. But survey showed couple of problem and reservations from consumer's perception regarding validation of this scheme. Some respondents showed dissatisfaction with the banking staff as there was a little knowledge about this scheme others might worry about the bank processing fees what if their loan for house financing was not approved, all would go into the vein. Some people might have addressed the uncertainties between the non-alignment of federal and provincial government and other state departments on one page as they might have seen in the past. Beside, change in governments often lead to non-accomplishment of previous project is also very common.

Problems such as bank documentation, as most of the people are not educated and they are unable to understand the processing. Secondly too much documentation creates problems for the people. Thirdly buying a house/flat for the poor people is also very problematic under this scheme because about half of the population is below poverty line and they are daily earners and live from hand to mouth. So they cannot fulfil the requirement of monthly wages. So government should make some relaxation for the lower class and introduced more easy terms and conditions so that they can able to afford house through this scheme.

These were the schemes that introduced by previous and current government. On the other side government should focusing on renew the housing policy of Pakistan according to the new figures, terms and condition, demand and supply of housing. Firstly the government should increase the housing supply secondly government should involve directly to know about the housing transaction. Along with the enlarged supply, the government should focus to increase the demand ability of housing, among the citizens. Government should introduce opportunities such as mortgage programs, equity loans and shared ownership to ensure maximum people are able to get hold of a housing unit. Thirdly government should reduce taxation on the small houses and charge more taxes from the villas and commercial projects and amount earned from these taxes used to subsidize small scale projects.

There is a dire need to redo the housing policy of Pakistan on the above mentioned parameters and the revised policy must be implemented in a neutral way keeping aside all political, regional and cultural differences. This true implementation of this policy can go a long way in ensuring adequate and cheap housing for all the sectors of the society. Through strict monitoring and periodic assessments the government can easily shape up the policies in future as per the conditions and the needs of its people.

Appendix

Steps involve in MCDM (Multiple Criteria Decision Making Approach)

Step 1:

The First step is to normalize the data by dividing the criteria into beneficial and non-beneficial. Non-Beneficial criteria are those criteria whose lower value is desirable like expenditure on gas, electricity, house rent, expenditure on repair and improvement, etc. beneficial criteria are those whose highest value is desirable like availability of clean drinking water, modes of transportation, availability of hospitals, access to schools, employment opportunities, etc.

$$Non\ benificial = \frac{Min\ (x_{ij})}{X_{ij}} \quad (1) \qquad Benificial\ Criteria = \frac{x_{ij}}{Max(x_{ij})} \quad (2)$$

Where X_{ij} is the performance value of ith alternative over j^{th} criteria.

Step 2:

The second step is to assign weights to each criterion according to their importance. In the case of primary data, weights assigned as per the preferences of people. However, the present study is based on secondary data so the weight assigning entropy method will use.

Step 3:

In step, three get the weighted normalized decision matrixes by multiplying the normalized matrix with assigned weights, get the performance score, and select the best alternative among all.

Entropy method

Entropy acted as a measure of dispersion between the original and the destination. Weights collected from this method also called objective weights.

Step 1:

Firstly, in the entropy method, have to normalize the decision matrix so that all data should represent in the same units.

$$r_{ij} = \frac{x_{ij}}{\varepsilon_{i=1}^{m} x_{ij}} \qquad (1)$$

The above formula will use for the normalization of the matrix where X_{ij} is the performance value of ith alternative over j^{th} criteria. $\varepsilon_{i=1}^{m}$ is the sum value of each criterion of all the alternatives.

Step 2

The second step is to compute the entropy value.

$$e_j = -h\varepsilon_{i=1}^{m} r_{ij} ln r_{ij} \qquad (2)$$

Where, $h = \frac{1}{\ln(m)}$ and "m" is the number of alternatives.

Step 3:

In the third step compute the weight vector firstly find the degree of diversification with the help of entropy value that is d_j.

Where, the formula of

$$d_j = 1 - e_j \qquad (3)$$

The Formula used for computing final weights is.

$$w_j = \frac{1-e_j}{\varepsilon_{j=1}^m (1-e_j)} \qquad (4)$$

Now the resultant values can use as an objective weight of criteria.

6.1.1 COPRAS

The COPRAS (Complex Proportional Assessment) method assumes direct and proportional dependence of significance and priority of investigated replacements on a system of traits. The importance of the relative alternatives is determined based on explaining the positive and negative characteristics of the alternatives. The method estimates the priority order and utility degree of the alternatives.

The COPRAS method is a five-stage procedure

Step 1:

The first step involves in any MCDM criteria is to normalize the data because the current data is measured in different units including points, percentages, etc. so for the normalization process following formula will use.

$$d_{ij} = \frac{q_i}{\varepsilon_{j=1}^n x_{ij}} x_{ij} \qquad (1)$$

Where q_i represents the weight of the ith criteria and x_{ij} is the value of the ith criteria and j[th] alternative.

Step 2:

After calculating weights and get, the normalized decision matrix next step is to maximize and minimize the matrix. For the positive alternatives that maximize the individual satisfaction

calculated by $S + j$. The alternatives that are negative and minimize the individual satisfaction are calculated by $S - j$. Positive alternatives include housing quality, access to clean water, a cleanliness system, and many more. A negative alternative means expenditure on rent, housing expenditure, and expenses occurred on electricity, gas, and many more.

Formulas for calculating the sums are as follows.

$$S_j^+ = \sum_{z_{i=+}} d_{ij} \qquad (3)$$

$$S_j^- = \sum_{z_{i=-}} d_{ij} \qquad (4)$$

Step 3:

The importance of the relative alternatives is examined based on describing positive and negative qualities that characterize the alternative residential areas. The alternative significance Qj of every alternative Aj is determined according to the following formulas.

$$Q_J = \frac{S_j^+ + \epsilon_{j=1}^n S_j^-}{S_j^- \ \epsilon_{j=1}^n = 1 \frac{1}{S_j^-}} \qquad (5)$$

From the above-mentioned formula, where the negative sign shows the least value of S_j^-. The initial term of Qj rises for greater positive criteria S_j^+, whereas the second term of Qj upturns with lesser negative criteria S_j^- . Thus a higher value corresponds to more sustainable housing affordability.

Step 4: The prioritization Qj of the alternative residential areas under concern is determined in the fourth stage. The highest the value of Qj, the greater the priority (importance) given to that alternative. In this situation, the significance Qmax of the best alternative will always be the highest.

$$Q_j = S_j^+ + S_j^- \qquad \textbf{(6)}$$

Step 5:

It is the last stage that selects the best alternative among all. The area that should be considered best and satisfies all the components of sustainable housing affordability would rank the highest degree of utility N_J that is 100%.

6.1.2 TOPSIS

TOPSIS defines as a technique for order preferences by similarity to ideal solution. it is mostly used to deal with the multiple criteria decision making techniques. The concept behind the method showed that the alternative chosen through this method has less distance from the positive ideal solution and a far distance from the negative solution. There are five steps involve in the TOPSIS method.

Step 1:

This step firstly normalized the decision matrix because the variables contain different units. So for that normalization is necessary following formula is used for normalization.

$$Xij = \frac{X_{ij}}{\sqrt{\Sigma_{j=1}^{n} x_{ij}^2}} \qquad \textbf{(1)}$$

Step 2:

After getting the normalized decision matrix the second step is to assign weights that we get through the entropy method and to assign weights to each criterion and get weighted normalized decision matrix.

Step 3:

Now indicates the ideal best solution and denotes with v_j^+ the indicates the ideal worst solution and denotes with v_j^- from all the criteria. The ideal best solution means selecting the value that is more desirable like if by considering the housing expenditures so its lowest value will be ideal so select the minimum value from all the alternatives. On the other side, the ideal worst value is that which is not desirable like if by considering the housing expenditure so its highest value will not be desirable to select the maximum value among all alternatives in it.

Step 4

This step involves the calculation of the euclidean distance from the ideal best and the ideal worst and the following formula will use for it.

Euclidean distance from ideal best

$$S_i^+ = \left[\sum_{j=1}^m (V_{ij} - V_j^+) \right]^{0.5} \qquad (2)$$

Euclidean distance from ideal Worst

$$S_i^- = \left[\sum_{j=1}^m (V_{ij} - V_j^-) \right]^{0.5} \qquad (3)$$

Step 5:

Now after getting the Euclidean distance the last step is to calculate the performance score of each alternative by the following formula. Lastly, just rank the preferences and get the best alternative.

$$P_i = \frac{S_i^-}{S_i^+ + S_i^-} \qquad (4)$$

6.1.3   WSM & WPM

These two methods used to solve the Multiple Criteria Decision Matrix.

Step 1

In both the methods weighted sum model and weighted product model, the basic step is to normalize the decision matrix as mentioned before in MCDM.

Step 2 for WSM

The second step is to calculate the weighted decision matrix by using different formulas for both methods. The preference score denoted by A_i after getting the weighted normalized decision matrix the last step is to add the values in each alternative and get the best one through ranking.

$$A_i^{WSM} = \sum_{j=1}^{n} W_i X_{ij} \qquad \textbf{(1)}$$

Step 2 for WPM

The same as with the WPM weighted product model to calculate the weighted decision matrix. Now the weight kept in the power of the performance value. After getting the weighted normalized matrix, the next step that differentiates both methods is to take the product of each alternative and get the preference score. Lastly, rank them and get the best one.

$$A_i^{WPM} = \prod_{j=1}^{n} X_{ij}^{W} \qquad \textbf{(2)}$$

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