NON – AGRICULTURAL DETERMINANTS OF ARABLE LAND OF PAKISTAN; AN EMPIRICAL EVIDENCE

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NON – AGRICULTURAL DETERMINANTS OF ARABLE LAND OF PAKISTAN; AN EMPIRICAL EVIDENCE

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Candidate of **Master of Philosophy** at the National University of Modern Languages do hereby declare that the thesis **Non-agricultural Determinants of Arable land of Pakistan: An Empirical Evidence** submitted by me in partial fulfillment of MPhil degree, is my original work, and has not been submitted or published earlier. I also solemnly declare that it shall not, in future, be submitted by me for obtaining any other degree from this or any other university or institution. I also understand that if evidence of plagiarism is found in my thesis/dissertation at any stage, even after the award of a degree, the work may be cancelled and the degree revoked.

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ABSTRACT

Rapid urbanization and infrastructure development has transformed the arable land into soil sealing activities (Permanent conversion of arable land into immoveable material such as buildings, infrastructural development). It also takes more land away from agricultural production, threatening Pakistan's capability to feed itself. The basic aim of this study is to empirically analyze the impact of industrialization, urbanization, and infrastructure development on the arable land of Pakistan. Thus, this study is an attempt to highlight the importance of the arable land of Pakistan. There are few studies available internationally but not that much work had been done at national level and fewer studies are available for Pakistan's economy because some of the scholars are working on this area only at the provincial level. This study attempts to analyze the impact of non-agricultural use of land such as soil sealing activates on arable land of Pakistan. Study analyzes the determinants of land use by modeling arable land as a dependent variable and urbanization, industrialization and infrastructure development as an independent variables. For empirical analysis standard methodology of Logit has been employed. The results show that urbanization and infrastructure developments are the key drivers of the conversion of farm land into non-agricultural use. The results suggest that due to urbanization, industrialization and infrastructure development arable reduces day by day and there is negative relationship of arable land with urbanization and infrastructure development and our results are consistent with the other studies (Zhang 2004). The results also shows that urbanization and grain deficit are the main sources that effect the arable land and urbanization is the main driving force that convert the arable land into nonagricultural use. The study also suggest some policies as, first there should be vertical integration, for example, the development of the housing societies expand vertically instead of horizontally. Second, before the installation of any industry on the arable land cost and benefit analysis should be require. If the cost of installing industry is greater than agricultural production then agriculture production should be preferred. Last but not least, the decision of Sell and purchase of the arable land must be under control of the government.

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DEDICATION

This thesis is dedicated to my Parents for their love, endless support and encouragement.

CHAPTER 1

1. INTRODUCTION

1.1 Background of Study

It is an identified factor that arable-land is the most important part of the land for countries to maintain strong economic positions. Crops grown on arable land are served for two purposes, first they feed the country's people and secondly it will contribute to the country's economic development by exporting their products (Dixon, 2015). In addition the agricultural sector promotes the country's economic development in two different ways firstly, it grows crops to provide people's essential food requirements by reducing food imports and saving money. Secondly this vital sector of the economy provides the raw materials to the industrial sector of the country. According to UN statistics land resources particularly arable land are extremely important for a country (Zhou et al 2017).

Land resources provide food and raw materials to industrial sector as well as it regulate and support the ecosystem activities (Tan et al, 2005). Demand of global land resource is increasing in lockstep with the world's population and wealth even as land health and productivity is deteriorating and valuable agricultural land is lost to urbanization (Montanarella et al 2016). Increased in competition for land resources would intensify food insecurity, poverty, violence, and migration adding to social and political instability (Habitat et al 2016).Land degradation management will help with climatic change adaptation and mitigation, natural resource conservation, food security, and sustainable livelihoods in addition to increasing food security and livelihoods. Currently the use of arable land is in jeopardy. The huge spike in urbanization and population expansion has changed the world. Much of what used to be is now gone. The total area of the arable land of the world has fallen by one-third in the previous four decades according to (Cameron et al, (2015)) because of the soil erosion physical and chemical degradation, desertion, and increasing human colonization (Hubacek et al, 2001, Lasanta et al., 2017).

Land scarcity is the main increasing issue all over the world because of the soil sealing (Zhang, 2000). Human activities such as urbanization, infrastructure development cause significant loss of arable land around the world during the past few decades (Chen et al 2016). Land is the basic and scarce source of human society which is fixed naturally and doesn't increase with increase in population. The rapid increase in urbanization, industrialization need

for more land and the use of land for these purposes exert the pressure on agriculture land (Nayab et al, 2013).

Thus urbanization is emerging all across the world, particularly in developing countries, as a result of massive population expansion and economic development (Liu et.al 2008). In developing countries between 2000-2030, it is expected that the urban population will become double if this trend will continues then the buildup territories are projected to be triple (Wang, 2000). In this process, various issues may emerge such as loss of arable land. The most persistent and often irreversible impact of human engagement with the natural environment is the change of land from its original state to human use (Jolly et al, 2003). Many countries have experienced similar issues. Despite Europe's declining population, soil sealing and land use have on the rising tendency (Artmann. 2014). In Austria, soil sealing is projected to be applied on 15–25 hectares of land per day (Nestroy 2006). China's land policy which aims to limit building land development while also preventing arable land loss was a duel failure according to (Liu et al, 2015).

Arable land loss is not being managed during China's National General Land Use Plan's midterm period (2006–2020). 1 647 868.92 hectors of arable land had been lost as a result of the in-effectiveness of the aforementioned plan (Xu et al, 2015). In the Czech Republic soil sealing is one of the most significant issues. Because many landowners are looking for a fast buck the soil is permanently degraded. The huge discrepancy between farmland and residential plots allows a quick return from the land. Many brown fields in urban and rural areas are not used for construction purpose and are ignored while new structures are built on "Greenfields" since reclaiming Brownfield sites are more expensive.

Additionally the world population increased fourfold throughout the 20thcentury and it has doubled to around 7 billion people (Wang et al, 2003). It is expected that it will reach over 9 billion people by 2050. The world's entire land area is 13.2 billion ha from this 12 present (1.64 billion hectares) of the 13.2 ha of land is utilized for the crops 28 %(3.7 billion hectares) of the global land area is covered by the Forrest (Sheng, 2001) 35 %(4.56 billion hectares) of the world's land is made up of meadows and woodland ecosystems. Over the last 50 years the world's agricultural land has increased by 12%.On average 0.24 hectares of land are cultivated per person in the world (Wang, 2012). In 1960 however it was 0.5 hectares per capita. Land-use change is mirrored in land-cover change which is a key part of global changes in the

environment that has a significant impact on climate, ecosystems, and biodiversity. All of these elements have an impact on land-use decisions. Changes in land use are always the consequence of a complex interplay of factors (Chen et.al 2000). One of the most important elements that determine land use is a demographic element such as population growth or decline. Similarly migration has a major impact on land use as well as the urban and rural environment (Kanianska, 2016).

Furthermore, in developing countries during the last few centuries urbanization has become a global phenomenon. Urban population growth in Asia has been 2.9% according to the United Nation report 2006 in between (2000-2030).Urbanization may have played a role in urban poverty and urban food insecurity (Hadd et. all 2005). Urbanization is accelerating at an extraordinary pace all over the world particularly in under developed countries due to rapid economic progress and population growth (Liu, 2010). It is estimated that approximately one-quarter of the developing world poor live in urban areas (Zezza, 2010). Arable land is considered to be most essential of production and also provide many other necessities for the living society (Khan et al. 2020).It also has been founded from the study analyzed by (Oberstenia et. al, 2016) that the use and development of resources reacted to the land are inextricably linked to social development.

According to recent research by the United Nations Convention to combat deforestation between 2000 and 2030, urbanization is expected to result in the loss of between 1.6 and 3.3 million hectares of productive agricultural land each year. The proportion of the world's population living in cities will have risen by 2.5 billion people by 2050. According to the Global Land Outlook study 2009 urban sprawl is common with built-in land spilling over into fertile soils and farms in some cases resulting in irreparable loss of arable land. As expansion takes place on valuable agricultural land the impact of these losses becomes more apparent. According to the United Nations report 2010, 30 million hectares of croplands were forecast to be urbanized by 2030 in 2000 (Xang, 1990). According to the report total agricultural loss is approximately 2%, from Asia and Africa accounting for 80% of world’s cropland loss is due to urbanization. The loss of these productive croplands results in a 6% decrease in Asian production and a 9% decrease in African production. In 2014, 453 million people lived in 28 megacities according to the research and 13 more megacities are expected to emerge in less

developed countries by 2030.It warns that between 2000 and 2030 urbanization will result in a more than 200 percent rise in worldwide urban land cover in biodiversity hotspots. (Shagun, 2019).

While an increase in population growth all over the world implies an increase in the demand for roads, industries, housing society and recreations due to all transformations cropped area is being lost (Does et. al 2002). In general the transformation of land from its natural state is the most irreversible and often permanent effect on natural enhancement (Jelly et al. 1993). The main driving force behind the conversion of arable land into constructed areas is identified as rapid infrastructure transformation and economic development (Xu et al. 2001). Agriculture is also essential for Pakistan's socio-economic development because it is also depend upon on the other sectors of the economy either directly or indirectly. Farmers in Pakistan are abandoning agriculture as a profession at an alarming rate (Rajpar, 2019). Arable lands are those areas of land that can be ploughed and hence are vital for cereal production in many countries so preserving a specific amount of arable land is thus the foundation and assurance of food security (Tan et al, 2018). China has witnessed massive urbanization during the previous three decades which has had a substantial influence on food security and the country's ecological health (Yung et al 2013). Arable land has been referred to as "mother" (Long, 2014). Keynesian economists like Franois and Quesnay have regarded arable land as the sole source of national prosperity in various western countries.

Similarly, economic development and urban expansion also resulting labor force shortage in the agriculture sector (Wu et al 2011). Urban expansion is also an ongoing threat for the farmlands (Gardner et al 2001). Various factors influence the food production and supply such as agriculture government policies, land distribution patterns, and agricultural profitability but the availability of arable land is one of the most important factors (Engelmann et al 1997). Arable land is reducing at a remarkable rate due to the rapid urbanization individualization as well due to land degradation this is especially evident in case of China (Li and Sun 1996).

Since agriculture is the art of cultivating crops and this sector plays a vital role in the economies of developing countries. In Pakistan agriculture sector is considered to be a key driver of economic growth. At the time of independence agricultural share in GDP was around 53% and approximately 65 % of the labor force is directly or indirectly depending upon the agriculture sector (Leang et al 2007). These figures altered dramatically over the last seven

decades due to various reasons such as social, political, climate, and environmental changes (Raza, 2012).

Currently, this sector Contributes around 24.05% to GDP and the Labor force is employed in this sector is approximately 35.9% (World Bank, 2020).The rural population of Pakistan was 63.09 percent in 2019 (World Bank Report, 2019), Agriculture provides a source of income for the vast majority of Pakistan's rural population as the people who live in rural areas are either directly or indirectly involved in agricultural. It also supplies raw materials to the country's many industrial sectors and is a significant importer of the agricultural products such as fertilizers and tractors. Because this sector employs a large portion of the people we must understand its impact on Pakistan's economy and the issues it faces today (Zainab, 2021). Pakistan is the main importer of agricultural products with yearly imports of about 2 billion dollars for wheat, vegetable oils, cereal, and dietary supplements.

Historically, Punjab has focused on a wheat green revolution. State investments in market development and irrigation canals were also part of Pakistan's Green Revolution in the 1960s (Renkow et al, 2000). The rural society and wheat production had been transformed and starvation was no longer a worry (Hazell, 2010). Despite this much-applauded progress. Pakistan's populace remains focused on the long-term cultivation of wheat. Government of Pakistan still need to boost wheat output in several types. Wheat was grown on an estimated one million hectares of land in Pakistan in 1997 accounting for 51% of the country's total wheat acreage (Smale et al., 2002).

Furthermore, Pakistan is one of a major rice exporter with annual exports of approximately 2.0 million tones accounting for 10% of global trades (Drake et al.2008). Pakistan sells more than a 1/4 of all Basmati rice to the world. Rice exports are Pakistan's second-largest revenue source. Rice grains feed almost 60% of Pakistan's people and rice is also a possible winter food source for the animals all over the world (Drake et al.2008). In Pakistan rice is a staple food for the citizen of Pakistan.

Therefore Pakistan is considered to be the most urbanized country in Asia. The population has increased from 32.5% in 1998 to 40% in 2014, and if the trend of moving from remote areas to cities continues then it will surpass 50% by 2025 so the basic reasons for urbanization are dramatic migration from urban to rural areas (Ahmed et.al 2018). As Pakistan is one of the biggest producers of major crops such as wheat, rice, and cotton and their

contribution in GDP and agriculture sector is around 35% and 21.73% respectively (Economic Survey of Pakistan 2020) but to climate change and development projects, to boost the economic condition of Pakistan and other developing countries arable land is utilized for urbanization, infrastructure development and industrialization (kaniansk,2016) and it is projected that due to climate change wheat production of Pakistan will reduce by 50% in 2050 (Zainab et. al2021).

Similarly, Pakistan is the largest exporter of mangoes as well and due to climate change mango production is also affected due to the construction projects as the formation of DHA societies. According to a report DHA Multan had cut approximately 6000 acres of mango orchards to construct housing society between 2013 and 2020. Approximately $1/3^{rd}$ of Pakistan's population lives below the poverty line and by a report approximately 49% of Pakistani people have food insecurity (Benin, 2009). The food insecurity issue may resolve by urban agriculture the production of crops within cities and towns is referred to as urban agriculture (UNDP 1996).Due to everyday population expansion and urbanization arable land is rapidly shrinking and with the loss of natural resources major food security challenges may arise.(Gardiet. et al 2016). Pakistan is already facing a food shortage so it cannot afford more losses of arable land. According to the world's experts Pakistan is on a list of 36 countries that faces serious food crisis.

According to World Bank Pakistan is the 6th most populous country in the world Pakistan's total land area is $796{,}095km^2$(WDI), and only 21.1 million areas are cultivated (Zainab,2021) the total arable land area is 30,400,000 hectares in 2018, This is less than comparatively than 2013 which was 30,470,000 hectares (WDI). The area of arable land is being devoured by the process of urbanization gradual rise in housing demand and infrastructure build-up is directly reducing the area of arable land (Anwar 2018). Like other developing countries Pakistan is also facing challenges to cope with massive urban population growth (Zaman 2012).

As Pakistan is an agro-based economy where more than 65% population directly or indirectly depends on agriculture and this vital sector contributes 22.96% of GDP (Economic Survey of Pakistan 2021-22), the present study analyzed the impact of urbanization, industrialization, and infrastructures development on the arable land. It is hoped that the result

will be helpful for the policymakers and for the researcher in understanding the impact of urbanization, industrialization, and infrastructure development on arable land. Pakistan like other developing countries in the region has experienced a rapid urbanization process. The country's urban population exploded dramatically. As a result the country's urban land and infrastructure have been severely strained.

In Pakistan urbanization does not simply refer to the expansion of major cities. It's also about more densely populated rural areas which aren't formally defined as city space but contains many traces of urban life. According to Qadeer, (2013) expanding urban space is changing Pakistan's socioeconomic situation. Agriculture's contribution to the GDP has declined whereas the service and construction sectors have expanded in importance in terms of GDP and employment. Other areas like Baluchistan and KPK require significant devotion for two main reasons first their farming problems are far more complex and intractable and second there is a severe lack of awareness and data on these issues (Mahmood Hassan Khan 1991).
The main purpose of this study is to conduct an empirical analysis of the impact of urbanization, industrialization, and infrastructures development on the arable land of Pakistan.

There are few studies available internationally but not that much work had been done at a national level. This study will add to existing literature for Pakistan's economy because some of the scholars are working on this area only at the provincial level but this study will provide the results for the overall Pakistan’s economy. The current study will analyze the impact of non-agricultural use of land such as soil sealing activates (the permanent covering of the land surface by buildings, infrastructures development or other permeable artificial substance) on the arable land of Pakistan due to which base of the arable land reduces day by day for agriculture production.

1.2 Problem Statement

Permanent conversion of arable land into immoveable material such as buildings, infrastructural development is known as soil sealing which is a main increasing issue all over the world especially in under developed countries. Due to the massive flow of population from remote areas to urban areas arable land is dramatically being shrinking on the daily basis. It is predicted that in between 2000- 2030 the urban population becomes doubled and if this trend continues then it is expected that buildup areas in cities became triple (Lu et al 2008). Urge on

urbanization leads to higher demand for constructed areas such as houses which cause loss of arable land (Ahmed, 2021). Agriculture sector plays an important role for the development of a country same as for Pakistan this sector plays a vital role in the subject of development because arable land is responsible for two most important thing, first of all it is required for the food supply and the second one is it is essential for the growth of an economy Pakistan is an agro-based economy but still arable land drastically reduces in Pakistan because of non-agriculture use of arable land such as urbanization infrastructure development etc. There are numerous studies available that examine the arable land uses in Pakistan but they worked on a provincial level. The basic aim of this study is to empirically analyze the impact of industrialization, urbanization, and infrastructure development on the arable land of Pakistan. Thus, this is the study that highlights the importance of the arable land of Pakistan.

1.3 Significance of the Study:

The goal of this research is to conduct an empirical analysis of the impact of urbanization, industrialization, and infrastructures development on the arable land of Pakistan. Land scarcity is the main increasing issue all over the world because of the soil sealing activities such as urbanization, infrastructure development cause significant loss of arable land around the world during the past few decades (Chen et al 2016). Land is the basic and scarce source of human society which is fixed naturally and doesn't increase with increase in population. The rapid increase in urbanization, industrialization need for more land and the use of land for these purposes exert the pressure on agriculture land. There are few studies available internationally but not much work had been done at a national level this is a fewest study for Pakistan's economy because some of the scholars are working on this area only at the provincial level. Sustainable growth of the agriculture sector stands vital for food security and rural development in Pakistan. It is a major contributor to the employment and foreign exchange earnings. In addition to that it provides industrial raw material, hence growth in this sector has multiple linkages with the overall economy. According to the economic survey of Pakistan agriculture sector contributes 22.7 percent to the GDP and provides employment to around 37.4 percent of the labor force, Pakistan is an agro-based economy but still arable land drastically reduces in Pakistan because of non-agriculture use of arable land such as urbanization infrastructure development etc. This sector needs more attention as it seems the way out to solve many serious

issues of Pakistan's economy such as the food crisis, urban poverty and environmental degradation as well.

1.4 Research Question:

Arable land is responsible for two most important thing first of all it is required for the food supply and the second one is it is essential for the growth of an economy. Land scarcity is the main increasing issue all around the world especially for developing countries because most of the arable land is utilized by soil sealing activates such construction projects etc. And transformation of arable land for other purposes mainly including for industrialization, urbanization and infrastructure development are decreases the availability of arable land over the time which leads to decreases the agriculture production resulting lower economic growth. So the issue needs detailed explanation.

a. Does industrialization, urbanization, and infrastructure development affect the arable land of Pakistan?

1.5 Objectives:

Objectives of the underpin studies are

a. The primary objective of the study is to empirically analyze the impact of non-agricultural use of arable lands such as industrialization, urbanization, and infrastructure development on the arable land of Pakistan.

1.6 Hypotheses:

Hypothesis # 1

H_0: The effect of urbanization on arable land is insignificant.

H_1: The effect of urbanization on arable land is significant.

Hypothesis # 2

H_0: The effect of industrialization on arable land is insignificant.

H_1: The effect of industrialization on arable land is significant.

Hypothesis # 3

H_0: The effect of infrastructure development on arable land is insignificant.

H_1: The effect of infrastructure development on arable land is significant.

1.7 Structure of the Study:

The study consists of 6 chapters. Chapter # 1 introduction unveils the introduction of the studies in which the importance of the arable land and how arable is hunted by the non-agricultural use of arable land is mentioned, the significance of the study problem statement, objectives, and research question are discussed. Chapter #2 literature review reveals the brief review of the past literature it includes past published articles of different countries most of the work done on the arable land had been in China. Chapter # 3 represent the theoretical framework of this underpin study, while in the Chapter # 4 data and methodology is discussed along with the variables Econometric technique variables, description are mentioned as well. Alike in Chapter # 5 results and discussion has been discussed which is the most impotent section of underpinning study which consists of graphical representation of all the variables then descriptive statistics are computed and run our model by the use of Logit model because our dependent variable has binary nature and at the end interpret the results, Chapter # 6 consist of conclusion, policy recommendation. And finally, references are arranged at the end of the study.

CHAPTER 2

2. LITERATURE REVIEW

2.1 Introduction:

This section covers the review of past literature that how arable land is hunted by urban population and Improper land-use policies some scholars are of the view that the loss of arable land is caused by the increase in housing demand, industrialization, urbanization, infrastructure development, and farmer's greedy nature to prefer immediate profit by selling their agricultural land to the investors for the infrastructure development such as the construction of residential buildings markets malls etc. On the other hand, increase in population and migrants in the urban areas are caused to increased urban poverty and food insecurity.

All over the world population has been increasing day by day and the main challenge for developing countries like Pakistan than developed nations because the increase in population is the initial issue that creates demand for houses and demand for the final good and services which put the pressure on the producers to make more and more products and they demand more place to install their plants of production and caused to acquire a huge area of arable land. Below is given a brief review of the literature of those studies which were being in this regard.

2.2 International Level Studies:

Some of the scholars have been determined the protection policies of arable land such as (Analysis of Arable Land Protection Policies of China) suggests the following protection policies of land use contract laws are very beneficial for the country as well as for the farmers. They also suggested some policies like the prohibition of the construction of housing on agricultural land, Secondly prohibition of the development of any industrial plant on the arable land. They analyzed data by the use of OLS and the results showed that farmers should get some portion of the profit earned from the crop export but, in order to safeguard arable land, I believe that houses should be built vertically and that ruralization should be promoted.

There are numerous studies available in the literature that shows the dramatic shift of agricultural land towards industrialization and urbanization which caused high food demand, and homogeneity in the food production which caused loss of biodiversity similarly (Splangler,

2020) are discussed several objectives which are necessary for the sustainability of agricultural system. These are (1) improvement of environmental quality and resource (2) sustenance economic viability of agriculture (3) Farmers, laborers, and the community as a whole will have a better quality of life. From my side here multiple cropping is missing there should be focus towards multi-cropping production to prevent biodiversity losses and to meet increasing food demand.

Many studies have been available on food insecurity because of inefficient utilization of arable land and for the most reason similar in several studies is urbanization or a massive increase in population that is the main reason for food shortage in all over the world similarly (Tan, 2018) are analyzed the Chinese policy named the requisition–compensation balance of farmlands (RCBF) this policy aims to secure food shortage They also devised two units, the land equivalent unit (ALEU) and the food equivalent unit (FEU) based on the notion of food and nutrition security. Study took the data from 2009-2015 results show that grain production decreased due to increase in the population but weaknesses of this study are that they just focused on food shortage and discussed only one determinant of it which is increasing population insofar there are a lot of reasons of food insecurity such as inefficient choices of croups urbanization and industrialization and many more.

There are many studies available in the literature regarding land transformation from agriculture to industrialization to achieve development process thus Sabyasachi and Chetana (2017) are of the opinion that agriculture's impact on urbanization in India's economy. They suggested in their study that a higher level of urbanization is achieved with the help of higher development in agriculture. Agricultural technologies and higher-level rural education are required to achieve this goal. For India's rural-urban transformation Finlay believes that there must be a balance between rural and urban policy. They considered 15 main Indian states. They took the data from the period of (1981 to 2015). They used Fixed effect and Random effect panel data model and the results show that the explanatory variables such as the amount of arable land area and rural (HSAGGDP), (MEAG) have had adverse impact on urbanization in India and (HCFER), (SGVTEX) on agriculture major crop production (rice, wheat and bajra), (RFEM) in agriculture, and (RLITR) have a positive impact on urbanization. From my viewpoint as India is in a developing phase so urbanization may be creating a problematic

situation for her such as she may face a future mass of food insecurity and dramatic loss of arable land, as India is the second-largest populated country so there is a clear threat of food shortage.

Some scholars are of the view that agricultural land has been shrinking day by day because of many reasons such as an increase in population, rainfall deficiency, and real estate many more so(maharni, 2017) are of the view that cropping intensity was increased safely They also used data from 1950 to 2010. Except for a few years, annual percentage growth rates for net area planted, total cropped area and cultivated land was all positive. High yielding cost-cutting and profit-maximizing output levels have been achieved as a result of modern technological advancements resulting in increased cropping intensity. At the same time agricultural land has been shrinking due to population growth, housing demand and a lack of rain, among other factors. As a result, in my opinion the Indian government should be responsible for making decisions to address these issues. There should be a vertical development policy and the government should be in charge of agricultural land decisions.

Some scholars are of the view that food crops depend on pollinators face various problems such as pesticides, diseases, and poor nutrition. Pollinators may benefit from environments higher-quality foraging settings (pollen and nectar sources) and illustrates the differences in demands between managed honey bees and native (uncontrolled) pollinators say the study.(Hellerstein, 2017) And they also investigated the economics of increasing pollinator forage such as granting property rights for colony location and voluntary government conservation programmers. They used data from the period (1982 – 2012) a period during which land-use policies aimed at improving pollinator health could be beneficial. Setting aside space for pollinators as part of an agricultural enterprise is similar to supplying a semi-public good, in that nearby benefit from pollination services (if needed) without having to pay the landlords for pollinator habitat.

There are lots of studies present about the agriculture land loss causes are same in every study such as urbanization is the main cause of land loss and many scholars talk about the initials of urbanization which is defiantly housing demand in the cities equivalently (Shi, 2016) examined that agriculture land shrinking and due to the loss of agro-land grain production has been declined they have some objectives in this paper, firstly use nighttime stable light (NSL)

to the map of urban expansion secondly the land cover data and geographic data has been using to monitor the area of land loss. So according to me china should strictly take account of the agricultural land because it is the world's number one populous country there are high chances for her of grain insecurity.

As we know that being a human being everyone wants to get immediate benefit from any activity (Janku, 2016) analyzed the decreasing pattern in agricultural land acreage from (1966–2013) They highlighted the biggest issue is land prevention in the Czech Republic is soil sealing and land taking they discussed many possible reasons but the economic factor is dominated on all other factors because mostly people want immediate benefits so they prefer building than waiting for yield.

As agriculture is a major sector for a country sustainable utilization of agricultural land is essential for economic growth. Thus (Hamidov, 2015)For this research review the agriculture land Use Functions framework was used to delve the sustainability concerns connected to agricultural land usage in Central Asia. They used data from the previous six years (2008-2013) The methodology was created to examine changes in land use in Europe. Only one study in Central Asia used the Global Land Project analytical framework to examine the state of research on sustainable land management in Kyrgyzstan and Tajikistan. Hamidov et al.(2015) included scientific publications that.

Some of the scholars are of the view that urbanization is the key issue of agricultural land correspondently Liu et a, (2014) analyzed the current key issues which are arises in china when lots of villagers migrated towards cities many issues emerged at that time the first issue was HRS (household registration system) restrictions, and the second obstacle was balancing land demand.

A lot of studies available about the decline in agricultural land and reasons are almost the same everywhere either in developed nations or developing nations such increasing population and urbanization similarly, Yang et al. (2013) are of the opinion that China's growing urbanization has a significant impact on its food ecological health and food security. Similarly, Jiang et al. (2013) are of the view that urban expansion impacts land-use intensity and their results show that due to urbanization agricultural land intensity has been declined and cultivated land per capita is adversely correlated with land-use intensity.

Some scholars are of the view that conversion of arable lands in to urban land should be dependent upon the cost and benefits either it would be better or not in future most of the conversion of arable land has been done for the development of rural areas if rural development impact is negatively affect the economy then it is not better for any economy Beside, Liu et al. (2010) analyzed the impact of use of arable land changes on the development of rural areas and eco-environment in China firstly determination of geographical pattern resources of arable land at different time period secondly quantification of the scale and the rate of arable land and finally impact of arable land loses on rural development, low arable land depletion high rates of economic development that is the ideal situation but problem arises whenever high arable land depletion and low rates of economic development according to me rural settlement should be controlled or it should be accordance with the cost and benefits analysis similarly there should be minimal impact on eco-environment.

Agriculture plays a very important role in the growth of every economy since it creates jobs and meets inhabitants' grain needs correspondently Zezza et al.2010 analyzed the relevance of urban agriculture as well rather than not only rural agriculture for poor people of the urban area also and food insecure. The result indicates that agriculture is a significant part of the urban economy.

As rapid urbanization and industrialization reduce the more and more arable land, "Malthusianism" is the belief that population growth can be exponential while food availability and other resources expand linearly." Thus Zhang et al. (2004) are of the view that the determinants of land usage model sown area and the and arable land and after that shows an inverted U sapped relationship between industrialization land-usage intensity the empirical evidence shows that urbanization and industrialization are key contributors for the transformation of cropland.

There are lots of studies present in the past literature that cropland has diminishing trend because of transformation of land. Doos B. R (2002) estimated that with the ongoing land transformation of land induced by expanding population and socio-economic development he also predicted that farmland will be reduced for production in emerging countries in the future decade due to increasing demands for space and other than food production.

Agriculture is a vital part of any country's economy most importantly it engaged a lot of work in rural areas of the economy and if research takes place in that sector it helps to boost the production which reduces the food prices similarly it also helps to reduce the urban poverty as well Fan (2002)and Fan(2001) is of the view that the urban poverty reduces if they invest in the agriculture research and his findings show that agricultural research had played a vital role to mitigate the urban poverty.

Many studies available on losing the agrarian due to increasing population and urban expansion alike Fazal (2000) analyzed the reduction in arable land due to the rapid urbanization in Saharanpur City between the years 1988- 1998 by the use of remote sensing (aerial photographs and satellite images technique he said that the urban expansion of the city has damaged fertility of agricultural land that cannot be recouped is also losing agrarian characteristics.

Some scholars are of the view the land-use change then as well Bergeron and Pender (1999) used community, household, and plot histories to investigate the micro-determinants of land-use change by the use of panel data from 1975-1995. Land-use changes are examined by the use of transition analysis and multinomial logit analysis. They concluded that the plot history technique could be a useful tool for determining the fundamental reasons for land-use change at the micro-level.

Industrialization is one of the most important contributing factors in the development phase of the country which caused an increasing trend of the population in the respective area or a city. The result is urbanization so industrialization is one of the major cause of the loss of agriculture land similarly Haltami et .al (2018) considered in their study the impact of industrialization on agriculture land use change and the transformation from an agrarian to an industrial society.

Conversion of arable land and farmland into the physical development occurs due to the population growth consequences of the increase in the number of residents are needed for the better lifestyle Hasrni et.al (2012) are of the view that conversion of arable land in a macro aspect is due to demographic and transformation issues in developing countries arable land is shrinking because of a shift in the structure of the economy the shift is agriculture towards the

non-agriculture sector. The shift is the construction of industrial zones. Farmers sell their farmland to the investors at high to get immediate benefits and these investors utilized this farmland for non-agricultural use such as constructing shops and shopping malls (Summerante et al.1995)

Deng et al (2006) wanted to know how far China's urbanization had spread and what reasons were driving it from the late 1980s to the year 2000 there was a period called the "Golden Age They employ a three-period system that is unique to them. High-resolution satellite imaging data set in a panel data set and for the entire area of coterminous China socioeconomic data has been collected. This is in line with a number of the important theories that were developed. The results show that the monocentric model works. Income increase has played a tremendous impact on economic growth the growth of China's cities. The results of certain empirical models are as follows: in the monocentric model population, other important factors the cost of transportation as well as the value of agricultural land matter number one (Deng, Huang, Rozelle, & uchida, 2006)

Suu (2009) investigates and discusses how, in what way, and to what extent agricultural land conversions have impacted rural life in a peri-urban Hanoi community in his study. Accuse the government of appropriating agricultural land use rights, claiming that this has had disastrous socioeconomic implications for farmers whose land has been taken over for industrialization and urbanization. While the state's vocational training and job creation policies have had limited success in dealing with the new situation, lots of farmers in this case study rely on their natural capital Not just to eliminate poverty but also to transition to new livelihood approaches which comes in the form of residential land use rights.

In their article, Heinz et al (2008) give a detailed and systematic assessment of countries carbon budgets which includes both socioeconomic and ecological carbon flows through time. Changes in socioeconomic metabolism are inextricably linked to changes in land use patterns and natural carbon flows throughout the agrarian–industrial transition as illustrated by the instance of Austria from 1830 to 2000.The expansion of agricultural areas during Austria's preindustrial agrarian colonization (thousands of years before 1830) resulted in massive carbon emissions.

From 1955 to 2003, Schwarzlmuller (2009) examines the evolution of aboveground human appropriation of net primary production in Spain. Spain's agriculture witnessed a transformation from a primarily pre-industrial to a highly intensive production structure throughout this time. A drop in farmland area and an increase in forest area are among the changes in land-use patterns. According to the findings, has decreased from 67 percent of potential in 1955 to 61 percent in 2003.

Wang et.al (2011) investigated the physical, social, and economic drivers of such changes to better understand land-use trends and the effects of land regulations as well as to develop strategies for agricultural land protection and sustainable usage. Although the total shift in land use was not considerable the data showed that cultivated land had decreased dramatically whereas developed areas had increased rapidly. A large quantity of high quality farm land has been transformed to developed land with low quality farmland land resulting from underutilized land posing a danger to China's food supply.

Lautenbach et .al(2011) examined indicators for ecosystem services such as (1) riparian buffer strip water filtration, (2) pollination, (3) agricultural production, and (4) outdoor recreation. Each indicator was tested for sensitivity and robustness in terms of features that had to be estimated based on expert knowledge and were based on data on land use configuration and composition. They've demonstrated that the composition of land use has a major impact on ecosystem services. Our research region witnessed a maximum land-use shift of 11 % in the major land use classifications between 1964 and 2004 whereas ecosystem function indicators fell by up to 23 %.

There are several studies available regarding the loss of arable land due to the industrial revolution, urbanization, and constructed areas. Similarly, Li et al., (1997) are of the view that conversation of agricultural land into non-agricultural land is due to some major driving forces. They found that driving forces such as degradation of arable land and industrialization are equal reasons to reduce the quantity of arable land and they also identify that residential building construction also plays an essential role to affect the arable land. And construction of the residential building is not only due to population and urbanization but also due to income-induced improvement which causes rural development and increases the urban areas. They used

the data from (1978-1995) to analyze the impact of non-agriculture use of arable land on agricultural land. They used a graphic technique based on geographic information systems (GIS) and an econometric approach.

Agriculture has become the most important sort of land management all around the world as a result of global population growth, according to Kanianska (2016). And the interaction of human activities is reflected in the pattern of land use on earth land scarcity is caused by an increase in the human population and competitive land use. He investigated the human-environment system's interacting processes using the DPSIR model which can portray the economic, social, and environmental sectors interactions in terms of cause and effect. This model was used to evaluate the nature of the interplay between various driving forces such as pressure, states, impacts, and reactions in order to examine agriculture and its impact on land use the environment and ecosystem services.

Yang et al (2020) are of the view that urban-rural transformation is a complicated task migrant from the remote to urban areas demand more places to live and to produce the urban-rural transformation observing the increase in the Construction land in the city and residential land in the remote areas (Lambin et al, 2001) thus urban-rural transmission can be described as the process of increase in the urban population growth, industrialization, and development of infrastructure (yang 2003) they took the data from 1990 to 2017. The results show that the urban-rural transformation had switched from rapid to stagnant growth. Whereas the intensity of the conversion of the arable land into constructed land had been increasing.

The fundamental factor in Lewis's (1954) and Harris's and Todaro's (1970) models is the urban/rural pay disparity. Rural-to-urban migration is propelled by this factor. The improvement raises rural earnings and deters rural people from migrating to cities. This impact is analogous to the "Dutch Disease" resource movement effect (Corden and Neary 1982). On the other side adverse rural conditions (such as a low wage rate) motivate rural residents to migrate to cities. Regions (Kamerschen 1969; Pandey 1977; Firebaugh, 1979). The survey also discovered that rural poverty exists is one of the primary causes of increasing urbanization (Barrios et al., 2006).This suggests that rather being a prospering agriculture industry, it is a depressed one that will eventually lead to disaster.

Wheat, rice, maize, pulses, roots and tubers, sugar, and cotton are the seven major crops that account for the majority of the world's farmed land. Their significance is demonstrated by the fact that they contribute significantly to the world's energy in taking. Some people (Spedding, 2012). According to Ten Napel et al. (2011), agriculture is a good thing to do begin some 10,000 years ago, when humans sought to manufacture food, feed, and other necessities.

Desertification and deterioration across the country. The problem is compounded by Pakistan's highly complex and diverse agro-ecological and socio-economic structure, which makes controlling various types of land degradation challenges .The main sources of such devastation are water erosion, wind erosion, soil fertility degradation, deforestation, unsustainable animal grazing and water logging operations (little recharge and overexploitation).Water scarcity frequent droughts, and misuse of land resources exacerbate Pakistan's land degradation concerns contributing to lower productivity and greater rural poverty (khan et.al)

Fitton et al, (2019) believe that rapidly growing populations combined with rising food demand necessitate either agricultural area expansion or significant production gains from existing resources. The differences in modeling methodologies that the main methodology utilized in this study While the findings show that dietary changes are the most effective way to protect against land loss and food insecurity. The purpose of this research was to see how vulnerable agricultural land is to future water supply and scarcity changes. Two multi-model ensembles i.e., several GCMs have their outputs integrated.

(Doso et al,2016) studies and describes the effects of farm land loss owing to large scale gold mining in Ghana. The effectiveness of large-scale gold mining corporations' agro-based alternative living programmers (ALPs) for its stakeholder communities was hampered by expensive start-up costs, low earnings, and a lack of proper engagement. The agro-based ALPs were likewise seen to be primarily concerned with the development of cash crops at the expense of traditional food crops. A case study in the Western Region's Tarkwa Nsuaem Municipality demonstrated a pattern of declining arable land on mining concessions as mining activity grew. This resulted in unemployment and a shift of labor from agriculture to other forms of employment in mining areas.

Wu et al, (2018) are of the view that by paying equal attention to agriculture land use embodied in intermediate and primary inputs the world economy's arable land use may be tracked from source to sink through regional and international trade. Liberalization strengthens regional links resulting in substantial land displacement globally. Over 40% of worldwide arable land exploitation is transferred regionally and internationally. Meanwhile the use of arable land has resulted in the depletion of arable land supplies around the world. The period of regions establishing overseas colonies to exploit foreign arable land resources is ended. In today's global economy this is no longer the case.

Jones, (2003) investigated that mechanisms by which urbanization impacts energy use are explored in this research. Industrialization and urbanization go hand in hand as the economy progresses but urbanization has its own set of energy-related implications. Allows for the same economies of scale in production but it necessitates greater transportation. Food must be moved to metropolitan populations and smaller farm communities must modernize resulting in significant increases in agricultural energy use. In cities a number of domestically produced production activities that previously relied on human or animal energy are changing to sources outside the home and utilizing modern energy sources. The single major driver of energy-use change is personal mobility. A regression study of 59 developing countries is conducted for the year 1980. In the case of steady per capita income and modernization the elasticity of energy consumption per capita and GDP dollar ranges between 0.35 and 0.48.

Land Conversion Drivers in Agriculture In terms of severity and trend, the ALC phenomenon varies greatly among countries. Internal and external factors both contribute to ALC, according to (Lichtenberg and Ding, 2008). Deforestation, development, and industrialization are all factors that contribute to land degradation. Land degradation is driven by internal factors such as location and land potential as well as ownership patterns such is the area of the land the number of people in the home, and their income. This category includes urbanization, socioeconomic factors, and government policy. Industrialization is a driving force from the outside. Industrialization is usually regarded as a driving force behind economic development. China's rapid economic expansion according to (Ho and Lin, 2004).The growth of China's rural nonagricultural sector particularly the establishment of township village firms run by rural communities has been a significant factor in the country's development (TVEs). In

China rural industries are concentrated in areas with excellent agricultural development and close to urban centers. Because 62 percent of TVEs were located in coastal provinces rural industries put far more pressure on rural residents to convert agricultural land to non-agricultural uses. Firman (1999) discovered that the development of ALC in Indonesia was mostly caused by the growth of industrial estates notably in the districts surrounding Jakarta. Other changes occurred as a result of the land conversion. Some areas such as the periphery, have made the transition from agrarian to industrial and service-based economies. The employment structure reflects this transformation as well. The employment structure converges as one move from a primary economy to secondary and tertiary businesses. Furthermore, the majority of houses engaged in agricultural operations were decreasing. Attracting foreign direct investment is a policy. As a result of investments and efforts to boost international competitiveness Indonesia's industrial sector is experiencing fast ALC.

ALC is influenced by two key factors urbanization and rural-urban migration both of which have been extensively researched. (Han et al 1999) investigated the pattern of agriculture land loss in several Chinese cities as well as the relationship between urbanization and agricultural transformation. They identified a significant positive connection between urban population growth (as a main indicator of urbanization) and agricultural conversion in coastal cities. According to research by Ho and Lin (2004), development causes agricultural conversion in China's coastal cities. They concluded that China's industrialization development is routinely linked with urbanization resulting in agricultural conversion. Rapid population increase has an impact on ALC because more people require more housing which necessitates the extension of developed areas. India (Fazal et al 2001) discusses how urbanization affects ALC. He claimed that the pattern of urbanization and high population increase in developing and poor countries. Pressure on land is caused by countries. This urbanization is encroaching on agricultural fields. India is a country that has Rapid urbanization and the expansion of metropolitan areas resulted in a large loss of agricultural land. Paired with an increase in population Housing development, according to (Firman, 1997) is one of the most important activities. That have resulted in ALC in Indonesia over the last two decades Housing construction has progressed at a rapid pace. Intensively in Jakarta's outskirts. (Han et al 1999) also mentioned real estate speculation as a source of income. A new phenomenon in China is a key contributor to the rapid loss of cropland.

They suggested that wasteful usage of converted lands is another real estate development challenge that directly affects farmland conversion.

Changes in the national population occupant's food consumption, grain output per unit area, self-sufficiency ratio multiple cropping index and grain to crop sown area ratio were all examined by (Chen et al 2019). In addition, we generated forecasts for the future. We predicted the need for arable land in nine scenarios based on this concept. According to the findings, the population would peak in 2030 and then begin to drop in 2040. The yield per unit area will gradually grow as agricultural research and technology advances. As a result, the demand for arable land in 2030 will be higher than in 2040. Because of the shrinking population and increased production capacity the pressure may ease after 2030. It is also beneficial in reducing the pressure on people to follow directions. According to the findings, the demand to maintain adequate amounts of arable land in 2030 may be greater than in 2040. There is increasing strain due to a growing population and limited production capacity. To ensure domestic production and self-sufficiency in China we insist on maintaining 120 million hectares of arable land, the "red line" for food security and enhancing arable land productivity. To lower per capita grain demand residents should be encouraged to acquire healthy eating habits. Finally, to lessen the strain on domestic resources and ecosystems we should make full use of international resources and markets.

In developed countries which suffer from urbanization and aging populations developing countries face significant repercussions on food security as a result of these issues. (Liu et al 2021) are of the view that the previous research on the implications of rapid urbanization and an aging population on food security in developing nations was primarily qualitative focusing on specific aspects of consumption. We use data from rural household surveys and statistical data to examine and show the impact of these two factors on food security in developing nations in this research. They have both detrimental and beneficial effects on food security. For example, in China every family's grain yield will improve by 26.0 and 9.4 kg for every 1% increase in these two components. Regional food consumption will grow by 0.07 percent and 0.089 percent for every 1% increase in urban and senior populations, respectively. The negative effects of urbanization on the agricultural labor force and farmers' ardor for grain production are rapidly becoming more pronounced. From 2000 to 2016 food consumption of

urban and senior populations increased by 1.33 and 0.50 times respectively as a result of urbanization. The per capita food demand continues to rise, owing to urban inhabitants' predilection for animal-based food products posing food security issues. This article suggests that urbanization's economic benefits be used to feedback to remote areas by improving technical awareness training farmers, and investing in machinery and equipment to promote the development of smart agriculture as well as increasing and refining agricultural subsidy policies to ensure the long-term sustainability of grain production. The research can be used as a model for other underdeveloped countries, helping to ensure the world's food security.

2.3. National Level Studies

As Pakistan is an Agro-based nation unfortunately there are lots of issues and threats in this major sector one of the main reasons like other developing is the rapidly increasing population which reduces the per capita land as well as food shortage. Similarly, Zafer et. al(2016) are of the view that the agriculture sector is the major sector of Pakistan and has many issues such as the absence of land reforms less provision of electricity power expensive fertilizers and non-utilization of cultivable land etc. They also suggested some policies to overcome these challenges such as the new government of Pakistan thinking about the ecological zones of agro production for example Putohar as an olive zone.

Pakistan has limited studies related to land-use policies like hour building in farmland. Like other developing countries Pakistan has also a growing trend of urbanization and increasing population it had been found that over the last 40 years 11, 4620 hectares of farmland have been transforming for urban use with 252 housing schemes accounting for 18% of the converted area. It was also discovered that in 49 percent of the schemes, 50% of the plots have not yet been built on and 75% of these plots are in the hands of professional speculators raising the cost of plots and house construction beyond the low middle-income group (Zaman, 2012).

Like other developing countries Pakistan is also facing the challenge of uncontrollable pressure of population growth rate. It is predicted that if this trend continues then in between (2000- 2050) millions of hectares of arable land is eaten by physical infrastructure development such as road construction (Burchell et al 2005). The loss of arable land and green belt on the cost of the built area is common practice all over the world (Parveen et.al2020, Fischel 1982).

Therefore, shortly arable land is not enough to fulfill the required need of diet to overall the populated world (Zhang 2007).

There are a lot of studies available in the literature that shows the impact of the agriculture sector on the economic growth of Pakistan. The sub-sectors of the agricultural sector also plays a important role in the economic growth of the country similarly Zainab 2021 is the view that the agriculture sector plays a vital role in the development phase of Pakistan she split the agricultural sector into different subsector such as crops livestock etc and discusses the impact separately on the economic growth of Pakistan by using last 21 year data and estimate the results based on results she concludes that the agriculture sector has a significant impact on the development of Pakistan.

Many scholars are of the view that agriculture is the most important part of the Pakistan economy similarly Rahman et at (2015) are of the view that the agriculture sector mostly relies on many major crops such as sheet and rice and there is a large gap between the desired and actual output due to the following reasons such as the lake of the availability of water, lake of the knowledge about the technology and improper time for input to measure the shortfall of actual production they analyze the impact of major croups on the agricultural GDP. They use data about 60 years from (1950 – 2015). They collected data from the economic survey of Pakistan using the ordinary least squares technique to estimate their result.

Anam (2017) analyzed the impact of the agricultural sector on Pakistan's economy. She has taken time series data and she divided the agricultural sector into various sectors and discussed the issues that have been faced by the economy Pakistan and the results of the study show that variation in the GDP of Pakistan is due to the problems in the agricultural sector, therefore, economic growth of Pakistan is slowing down.

Raza, (2012) analyzed the impact of the agriculture sector on the GDP of Pakistan he took the data from the state bank of Pakistan from the year 1998-2006 and used the econometric technique such as ordinary least squares regression analysis to estimate his model. He analysis the impact of the different sectors in agriculture separately on the overall agriculture and conclude that livestock contributes 90% in the agricultural and he also concludes the result that there is a positive relationship between economic growth and agriculture.

Housing is a significant industry that contributes to the entire economy. Better more economical, accessible, and sanitary housing helps the health of the labor force and as a result improves an economy's economic growth. Similarly (Ahmed et .al 2020) Housing costs have risen dramatically in Pakistan for a variety of causes including uncontrolled urbanization and a rapidly expanding population. This study attempts to examine the impact of foreign capital inflow and some domestic factors on housing prices to determine the causes of this price increase. It has been transformed to a monthly, quarterly, and yearly basis to take full advantage of high-frequency data. The unit root is used to determine stationarity the Johansen test is used to determine co-integration and the coefficients are calculated using the ordinary least squares method. The Chow breakpoint test is used to discover structural breaks and dynamic ordinary least squares are used to assess the results' robustness. The cost of housing has risen over time as evidenced by all of the data sets examined. The country has seen significant population increase and urbanization which has had a negative impact on nearly every aspect of city life. Foreign money intake has a beneficial impact on the rise in housing prices. Such foreign cash must be diverted to the housing industry so that artificial price increases cannot occur.

Rajpar et al (2019) are of the view that Pakistan's economy relies heavily on agriculture. Farmers on the other hand have been observed abandoning agriculture in favor of non-agricultural pursuits. The research was carried out in the Sind province's Khairpur area which is located on Pakistan's Indus Plains. The study's major goal was to look into existing and prospective land-use change (LUC) trends as well as farmers' perspectives of the causes and effects of LUC and ALA in the study area. Field survey data, as well as secondary data from government sources were employed in this study. The findings suggest that in the last two decades agricultural land in the region has declined by around 9%. More than 80% of farmers say the area's agricultural acreage has declined over time according to survey data analysis. Furthermore, farmers feel that LUC and ALA are mostly caused by socioeconomic and environmental changes. We used a logistic regression model to see what factors influence farmers' decisions to sell agricultural land for other use. Farmers' decisions to sell agricultural lands are driven by age, income, land ownership, farm inheritance by successor’s social networks, and a lack of basic infrastructure in the studied area according to the findings. Farmers' social integration as well as the expectation that the farm will be passed down to heirs reduce the likelihood of land sales.

2.4. Conclusion of Literature Review:

According to the above literature review it is identified that total area of the land scars and land can be used only for two purposes either for agriculture or for non-agriculture purpose such as industrialization urbanization or for infrastructure development. Food is the basic necessity and most prioritized element for every country either for developed or developing country. We conclude that, there are lots of studies available in the utilization of arable land in the world wide but specifically for Pakistan there is some studies available province wise but yet I have never seen any study for country wise. Arable land reduces day by day due to the various reasons mainly because of rapid urbanization and industrialization, and that causes food insecurity threats for both the developed and for the developing nations as well. And research and development are needed for mitigate the impact of urbanization, because controlling population is difficult, if we can utilize this growing population for development purposes by engaged them in research and development. This may help to eradicate the poverty of urban as well as rural areas. Literature provides number of policy measure to eradicate the issues such as R&D and horizontal development.

Table 1.1. **Summary of Literature Review**

S#	Author name	Year	Title of the article	Variables	Econometric technique	Conclusion
1	Zhang	2004	Urbanization, industrialization and land use in china	Arable land Urban population Urbanization Industrialization	Logit modelling	. The causes of land use, as well as an inversion U-shaped link between industrialization and land use intensity, can be revealed by modelling arable land and sown area.
2	Fan et al.	2001	How agricultural research affect urban poverty in developing countries: a case study of china	Urban poverty Agriculture research food procurement (FP)	Ordinary least square (OLS)	The causal relationships between agricultural research investments and increased production in agriculture are shown, as well as how this affects food costs and the incidence of urban poverty.

3	Bergeron and pender	1999	Evidence from a Honduran community study on the determinants of land use change	slope, altitude, distance to road, quality ranking of the parcel relative to the other parcels operated by the household, soil fertility status, perception of severe erosion	Transition analysis	According to the findings, the plot history technique is the most effective. is a potentially useful tool for understanding the underlying reasons of micro-scale changes in land use. The approach is especially well suited to situations with limited data availability.
4	Balaganesh and maharani	2017	Agricultural Land Utilization in India, Indian Farmer	Cultivated land Net area sown Total cropped area	Percent Growth Rate:	Agriculture lands are also reducing day by day due to population growth, bifurcation of agricultural areas, real estate development, rainfall shortages, financial, production, and marketing issues.

5	Hellerstein et al.	2017	Land Use, Land Cover, and Pollinator Health: A Review and Trend Analysis	Corn Soybeans grazed forestland marshland pasture	Meta analysis	Pollinators, such as honey bees under control, are required for the reproduction of around 35% of the world's food crops. This study used 30 years of data on US land usage to develop a pollinator foraging appropriateness index. This research also looks at the economics of enhancing pollinator forage, such as awarding property rights for colony placement and using voluntary government conservation programmers to promote pollinator forage.
6	Hamidov et al.	2015	A review of the impact of agricultural land usage in Central Asia	A biotic, biotic ecosystem processes; economic: land-based production, market, infrastructure, social employment, health, And culture.	Mathematical modeling	These findings revealed significant gaps in our understanding of the role of agricultural land use in Central Asia's long-term development. The study only looked at peer-reviewed international journals that were indexed in Web of Science between 2008 and 2013.

7	Spangler et al.	2020	The influence of agricultural land use in Central Asia is examined.	acres planted percent planted Average acreage per farm Crop land acreage Agriculture input use	visualization	In order to meet growing demand for food and commodities, agricultural land use in the United States has shifted dramatically, resulting in very simplified agricultural landscapes in many locations. The overwhelming evidence shows that this simplification has a negative impact on the long-term provision of essential ecosystem services to and from agriculture.
8	Fan	2002	India's agricultural research and urban development	% of irrigated cropped area in total cropped area literacy rate of the rural population road density percentage of villages	OLS	This study calculated the impact of agricultural research investments on urban poverty in India using time series and cross-state data and an econometric modeling method. The model investigates the causal linkages between agricultural research investments and subsequent increases in agricultural production, as well as how this influences food prices and the incidence of urban poverty. The findings imply that agricultural research has made a considerable contribution to India's urban poverty reduction.

				electrified capital stocks of government investments in health rural development soil and water conservation and annual rainfall		
9	Zezza and Tasciotti	2010	Empirical evidence from a sample of developing nations on urban agriculture, poverty, and food security.	Urban production	OLS	he goal of this article was to address two specific research questions, first off all the importance and size of agricultural activities for urban families, and secondly . the relationship between urban agriculture engagement and household food security. Our data show that agriculture is a significant part of the urban economy, accounting for 10–70% of all urban families.
10	Shi et al.	2016	China's Urbanization	1 area of land 2 urban land	Using (night time stable	The findings show that China's urban area has grown but its arable land area has shrunk substantially.

			and Agricultural Land Loss: A Multiscale View	3 total area of land lose	lighting) NSL mapping technique	
11	Tan et al.	2018	Is Arable Land Enough to Ensure The food Security? The Implications of the Concept of Arable Land Equivalent Unit in Zhoushan, China	1 arable land 2 types of seawater aquaculture areas 3 The crop planting area	arable land equivalent unit (ALEU) food equivalent unit (FEU)	Grain output has declined as the population has grown.
12	Leonard	2020	Analysis of China's Arable Land	Arable land	OLS	The study used a non-probability technique to examine China's land protection legislation, and the results reveal that contract rules are better for farmers and the country.

			Protection Policies	Land Conversion Policy Land Tickets Contract Law		
13	Liu et al.	2010	In China's southern Jiangsu region, an analysis of arable land loss and its influence on rural sustainability was conducted.	Urban settlement Rural settlement Industry mine transport land grained	TM images through screen digitization	The effect of land use change on the environment and rural development was examined in this article.
14	Liu et al.	2014	Key issues of land use in china and implication	Arable land loss Built land vacancy	Requisition-compensation balance of arable land	The paper examined and interpreted China's present land use policies as well as the country's existing land use concerns in depth. Finally, the paper reviews existing land-use difficulties and offers a strategic

				Land-related livelihood		land-use policy structure to guide future sustainable land use.
15	Janku et al.	2016	Land Use Analysis in Terms of Farmland Protection in the Czech Republic	Acreage Years	OLS	The rapid and alarming decline in arable land acreage of 25 ha per day was examined in this article.
16	Yang et Al.	2013	Timely and accurate national-scale mapping of urban land in China using Defense Meteorological Satellite Program's Operational Linescan System		Satellite Map has been used to check urban land and also used The support vector machine (SVM) method	The OSVM technique is utilized to create an initial training set of urban and non-urban pixels in this article. Despite the fact that urban land constitutes just a small amount of the Earth's surface area, its rapid expansion has a disproportionate environmental impact. China has been a live urbanization laboratory in recent decades, with increasing urbanization.

			nighttime stable light data			
17	Tripathi, S., & Rani, C.	2018	The impact of agricultural activities on urbanization: Evidence and implications for India	Total urban population Share of agriculture in total GDP Total production (wheat maize etc) Average rain fall Employment agriculture sector Consumption of fertilizers Total cultivated land	OLS, Fixed effect and Random effect panel data model has been used	. This study looks at the impact of agricultural operations on urbanization in India. The findings of this investigation practically confirm Matsuyama's (1992) theoretical model.

				Rural literacy		
18	Jiang et Al.	2013	The impact of urban expansion on agriculture land use intensity in china	Multi cropping index Converted land Area of cultivated land GDP in industrial sector GDP per capita Highway Etc	LM test	The findings revealed that agricultural land intensity has decreased as a result of urbanization, and cultivated land per capita is inversely connected with land use intensity.
19	Shahab Fazal	2000	Urban expansion and loss of agricultural		remote sensing (aerial photographs and satellite images)	. According to this article, the city's urban growth has destroyed fertile agricultural land that cannot be recovered, and the metropolis is losing its agrarian qualities.

			land – a GIS based study of Saharanpur City, India			
20	Doos, B. R.	2002	Population growth and loss of arable land			.farmland will be pulled out of production in under developed countries over the next decade, according to this research, due to increased demands for space and for purposes other than food production.
21	Wei et al	2017	Urban land expansion and regional inequality in transitional China	Role of institution Urbanization spatial inequality	Spatial patterns	As an important aspect of urbanization, land urbanization in China is accelerating at the same rate as urban population expansion. Land has not only contributed considerably to China's rapid economic growth but has also become an increasingly scarce resource due to its massive population and limited resources
22	Nguyen Van Suu	2009	Industrialization and urbanization in Vietnam: How appropriation of agricultural	Urbanization Industrialization agriculture land	Sustainable livelihoods framework,	Since the 1990s, Vietnam's fast industrialization and urbanization has resulted in the conversion of a vast area of agricultural land to land used for non-agricultural purposes.

			land use rights transformer far.			
23	Erb et al	2008	Industrialization, Fossil Fuels, and the Transformation of Land Use	Industrialization Arable land	OLS	As fossil fuel consumption expanded, Austria's socioeconomic system added increasing amounts of carbon to the atmosphere each year. Simultaneously, gains in agro-ecosystem productivity fueled by fossil fuels facilitated the production of growing amounts of agricultural biomass on limited farmland.
24	Gizaw etsegenet	2021	Impact of land use policy change on farmers livelihood	House hold size Income Industrialization Crop production	Paired sample test	The change of agricultural land to these systems has effect on the farming households who may lose a part or all of their agricultural land.
25	Fitton et al	2019	The vulnerabilities of agricultural land and food	Agriculture land food production	Discrepancies in modeling approaches,	According to the findings, around 11 percent and 10% of current crop- and grasslands, respectively, are sensitive to water scarcity and may lose some productive potential as a result.

			production to future water scarcity	Availability of water		
26	Ahmed et al	2021	Foreign capital inflows and housing market in Pakistan	Urbanization growing population. Foreign capital inflow housing prices.	OLS	The country has experienced significant population growth and urbanization, which has negatively impacted practically every aspect of city life.. Foreign capital intake has a positive impact on property price appreciation.
27	Doso Jnr et al	2016	Effects of Loss of Agricultural Land Due to Large-Scale Gold Mining on Agriculture in Ghana: The Case of the Western Region"	agricultural land large-scale gold mining	Qualitative content analysis.	According to the findings, loss of arable land due to large-scale gold mining can have a major impact on food crop output in mining communities. This could have an impact on food crop production in Ghana in the long run, as mining settlements are also important food production centers.

28	Wang et al	2012	Global urbanization research from 1991 to 2009: A systematic research review	Urban population Urbanization	Bibliometric analysis	The United States and China were identified as "hotspots," confirming land-importance use's and revealing a considerable interest in ecological and environmental issues in urbanization studies. Although there were varied patterns and underlying processes in different nations, urbanization study was substantially connected with the rate of urbanization in general
29	Wu et al	2018	An overview of arable land use for the world economy: From source to sink via the global supply chain	Arable land Trade of intermediate goods	embodiment accounting model	The international economy's agriculture land use is traced from source to sink through inter regional commerce, with equal attention paid to agriculture land usage embodied in intermediate inputs as well as primary inputs.

30	Xu et,al	2015	Assessment on the effect of city arable land protection under the implementation of China's National General Land Use Plan (2006–2020)	Arable land Infrastructure development	Logit modeling	The "General Effect" result revealed that China's National General Land Use Plan (2006–2020) fails to manage arable land loss throughout its halfway period. The ineffectiveness of China's National General Land Use Plan (2006–2020) has resulted un the loss of 1657868.82 acres of arable land.

31	Jones	2003	How urbanization affects energy-use in developing countries	Energy consumption Urbanization Industrializati on	OLS	Industrialization and urbanization go hand in hand as the economy progresses, but urbanization has its own set of energy-related implications. Allows for production economies of scale as well, but requires more transportation.
32	Nasrabad et al	2015	Monitoring agriculture land conversion induced by urban sprawl and transportation in northeast Iran	Build up Agriculture land Rocky out crop Waste land	United States Geology Survey (USGS) CA-Markov model	From 1987 to 2013, the data revealed that remarkable increase in built-up regions has resulted in a large decline in the amount of agriculture, gardens, and wasteland. According to the relative entropy values obtained, the city of Qom has undergone rising urban sprawl over the last three decade
33	Chen et al	2019	A Study on the Arable Land Demand for Food Security in China”	Arable land	GMM	There is growing strain due to a growing population and limited production capacity. To ensure domestic production and self-sufficiency in China, we insist on maintaining 120 million hectares of arable land, the "red line" for food security, and enhancing arable land productivity.

34	Liu et al	2021	The impact of urbanization and aging on food security in developing countries: The view from Northwest China	Urbanization Ageing population Urban population senior population Per capita food demand	OLS	In developed countries, which suffer urbanization and ageing populations, developing countries face significant repercussions on food security as a result of these issues
35	Rajpar et al	2019	Agricultural Land Abandonment and Farmers' Perceptions of Land Use Change in the Indus Plains of	land use change (LUC) arable land use (ALU)	Logistic regressio n	The last two decades, arable land in the region has declined by around 9%.More than 80% of farmers say the area's agricultural acreage has declined over time, according to survey data analysis.

			Pakistan: A Case Study of Sindh Province			

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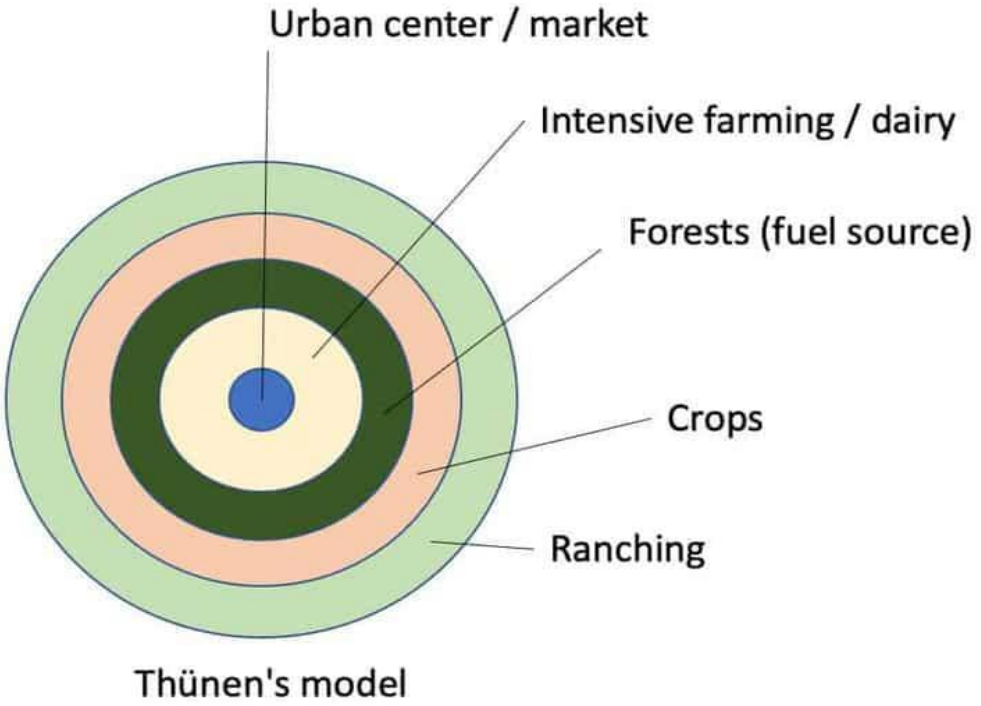
CHAPTER 3

3. CONCEPTUAL FRAMEWORK:

Agriculture is a type of economic activity that is conducted all over the World. Johann Heinrich Von Thunen a German geographer developed one of the first agricultural land-use models. In 1826, Von Thunen agricultural land use model was devised which was constructed before considerable industrialization in Europe and abroad. Von Thunen (1850) was a farmer landowner and economist who developed the first known spatial economic model on land rent based on his observations. Von Thunen established the first substantial treatment of spatial economics and economic geography relating it to the rent theory. In the first book of his dissertation The Isolated State (1826). Around the city four main rings include 1) intensive farming 2) forest lands 3) extensive farming and 4) grazing in order of proximity to a town and moving outwards. The land is expensive to rent near a city. The model explains the fluctuation in land rent and market activity in a region surrounding towns in general.



Thünen's model

Von Thunen Model is based on Von Thunen's book, “The Isolated State” which he published in 1826. He depicts a fictional country that is fully isolated from external influences. He claimed that the state had perfectly consistent soil and climatic conditions as well as only one city.

Von Thünen projected that agricultural land usage will be governed by a link between the cost of land and the cost of bringing agricultural products to market based on his study. Consider this: there is available land outside the city limits. What is the best way for people to use this land? Is it more likely that they will utilize it for fruit production ranching or wheat production or will they use it for timber? This can be predicted using Von Thünen's model. People will structure their land-use systems into four concentric circles extending outwards from the city according to Von Thünen's land-use model (where the markets are located and agricultural products are sold). Each zone has its personality which is determined by the cost of land and the expense of delivering goods to the city.

According to Von Thunen the first zone will be utilized to produce perishable products such as fresh fruit vegetables and dairy. Because they can't be carried very far they must be close to the market. The most expensive land is closest to the city yet these products also produce the greatest money. Because the expensive land necessitates a high-yield product, the cheap cost of transportation to the market allows for pricey spoilable products, the land in this zone is more likely to be used for produce and dairy. The second zone is located a bit further out of town past the point where spoilable goods are profitable. Von Thunen projected that most of the land in the second zone would be preserved as a forest and used for lumber and fuel. It's vital to keep in mind that this was a time when most people's homes were still heated by fireplaces and any new structure required readily available wood. The second zone is a little further out of town beyond the point where spoilable commodities are profitable. The majority of the land in the second zone according to Von Thunen would be retained as a forest and exploited for lumber and fuel. It's important to remember that this was a time when most people's homes were still heated by fires and any new structure needed to be built with easily available wood.

There are two things associated in agriculture, one is availability of arable and second is land use intensity. Study do not focus on land use intensity future studies will work on it. This study will focus only the factors that affect the availability of arable land.

So the second framework of underpinning study is as follows. According to our study this framework is suited more. As arable land area use is determined by various factors so we need to model them individually such as some explanatory variables and dependent variables for the sake of simplicity we assure here that total land is fixed and land can be used only for two purposes like either for non-agriculture or agriculture but our concern is in non-agricultural use of arable land. (Zhang, 2004)

Therefore, function can be written as follows

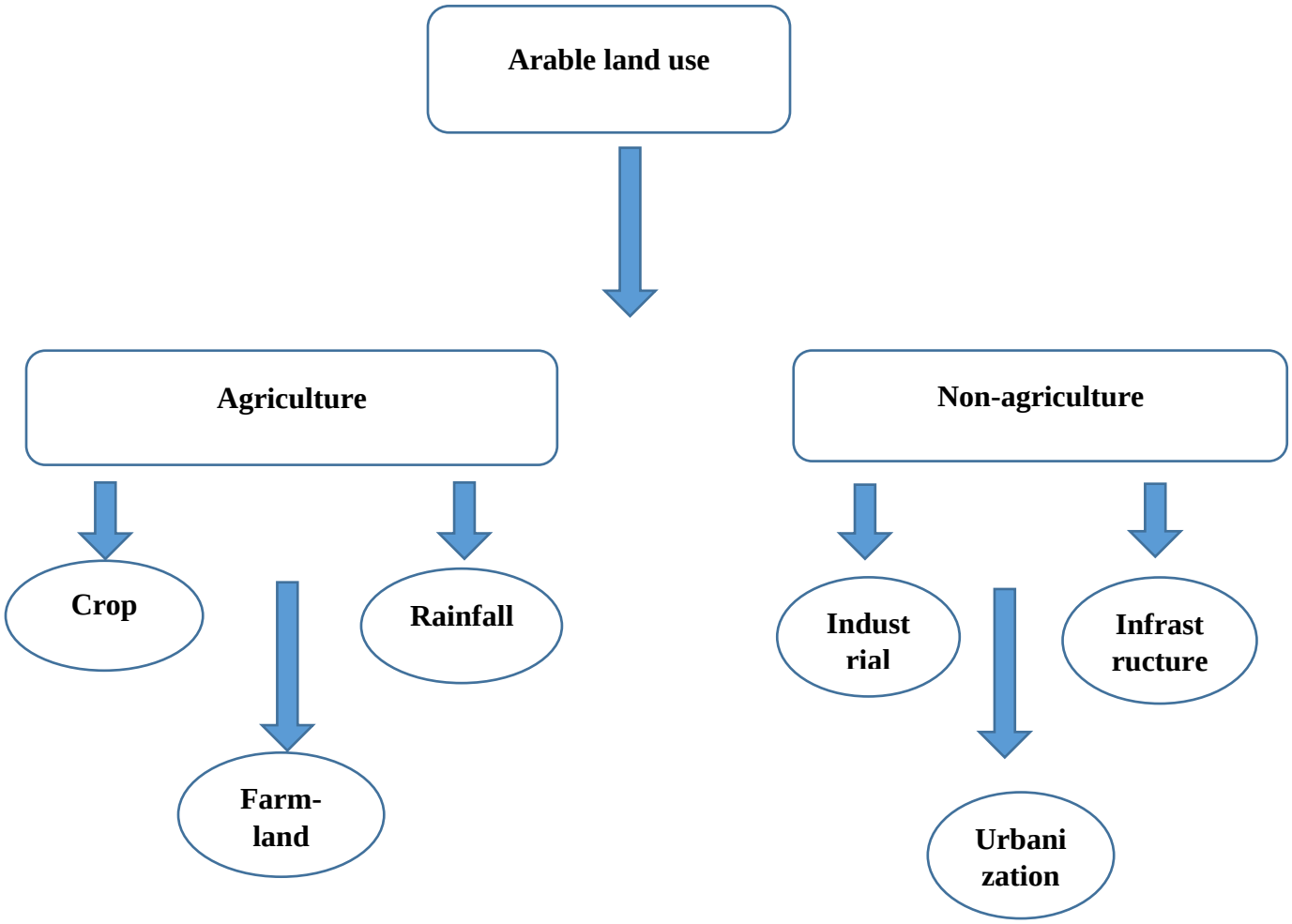
A_t = f (,urb_t,$indus_t$, $infrastr_t$,X_t ,e_t)

In the above function A_t is the arable land at time t and urb_t is urban share of the urban population. Manufacturing value-added % of GDP is used for the proxy of industrialization and road construction is used for the proxy of $infras_t$. X_t is the vector of control variables which includes grain deficit of rice grain deficit of wheat and total grain deficit and et is the overall error term with the assumption E (et) =0 . Since the main focus of this study is the impact of urbanization industrialization on arable land generally because the total land endowment is fixed if more land is used for urbanization industrialization and infrastructure development less land is left for agricultural use. As a result, we expect a negative relationship between agricultural land use and urbanization, industrialization, and infrastructure development. The first way we recommend is to employ Logit modelling. Because the demand for arable land cannot exceed a region's natural limit it makes sense to use a logit model to represent the proportion of arable land. The model can be written as follows:

$\frac{A_t}{\bar{A}}$= f (,urb_t,$indus_t$, $infrastr_t$,X_t ,e_t)

The schematic relationship can be represented as below,

Schematic Diagram



CHAPTER 4

4 DATA AND METHODOLOGY:

4.1. Data

Data is gathered by a wide range of organizations and institutions including governments and private organizations. The data is a set of predetermined steps for extracting the most relevant information. Data can come from both primary and secondary sources. The data set used in this study time series data of all the variables such as industrialization, urbanization and infrastructure development of Pakistan from 1975 to 2020. Industrialization, urbanization, and infrastructure development are our main focused variables. We use the proxies of some above variables such as instead of urbanization, we took a share of urban population and for infrastructure development we use road construction data as a proxy variable. We also include some control variables in our model such as grain deficit of rice and grain deficit of wheat.

The frequency of the data is a quarterly basis because of the lack of the availability of data and to secure the degree of freedom due to this reason we have to split the data into monthly bases. As dependent variable arable land is binary nature so that odd ratios have been calculated arable land is divided by the total land available and values that are greater than 0.5 considered as a 1 and less than 0.5 considered as 0. The data for this study was gathered from a variety of sources including the World Development Indicator (WDI) and the Pakistan Economic Survey.

4.2. Estimation Techniques:

The logistic model or logit model is used in statistics to model the probability of a specific event such as pass or fail win or lose or alive or dead existing. In its most basic form, logistic regression is a statistical model that represents a binary dependent variable using a logistic function however there are many more advanced forms. A type of regression analysis is logistic regression. A binary logistic model mathematically has a dependent variable with two possible values, for example pass or fail, which is represented by an indicator variable with the two values labeled "0" and "1." The log-odds (logarithm of the odds) for the value labeled "1" in the logistic model are a linear combination of one or more independent variables "predictors". Each of the independent variables can be either a binary or a continuous variable.

The corresponding likelihood of the value labeled "1" might fluctuate between 0 (definitely the value "0") and 1 (definitely the value "1") hence the labeling; the logistic function which transforms log-odds to probability is named after it. The logit or logistic unit is the unit of measurement for the log-odds scales hence the alternative names. Analogous models using a different sigmoid function than the logistic function, such as the probit model can also be utilized the logistic model's defining trait is that raising one of the independent variables increases the number of independent variables. With each independent variable having its parameter multiplicatively scales the probabilities of the given event at a consistent rate; for a binary dependent variable, this generalizes the odds ratio.

$$A_t = f\ (,urb_t, indus_t\ ,\ infrastr_t\ , X_t\ , e_t)$$

First, we will discuss the demand for land for a non-agriculture purpose such that land is used for urbanization, industrialization and infrastructures development in the above model at is arable land at time t and urban share of the urban population and manufacturing value-added % of GDP is used for the proxy of industrialization and road construction is used for the proxy of $infras_t$. X_t is the vector of control variables which includes grain deficit of rice grain deficit of wheat and total grain deficit and et is the overall error term with the assumption E(et)=0 and the main focus of this study is the impact of urbanization industrialization on arable land generally Because the total land endowment is fixed if more land is used for urbanization industrialization and infrastructure development less land is left for agricultural use. As a result, we expect a negative relationship between agricultural land use and urbanization, industrialization, and infrastructure development. The first way we recommend is to employ Logit modelling. Because the demand for arable land cannot exceed a region's natural limit it makes sense to use a logit model to represent the proportion of arable land. The model can be written as follows:

$$\frac{A_t}{\bar{A}} = f\ (urb_t, indus_t\ ,\ infrastr_t\ , X_t\ , e_t)$$

Where f is the Logit function of the form $\frac{1}{1+ exp^{-\beta Y}_{)}}$ and all the independent variables in

Y= f (A_{t-1},urb_t,$indus_t$, $infrastr_t$,X_t) are in log form and β is a vector of corresponding coefficients. The hypothesized signs of the coefficients since the land area $\bar{A}$ and land allocations for non-agricultural uses are generally unknown. By multiplying through by $\bar{A}$ and taking the logarithm of both sides

$$\ln (A_t)=\ln(\overline{A})-\ln(1+exp^{-\beta x})$$

4.3. Anticipated Linkages:

In this section of chapter number four anticipated linkages or relationship of independent variables with dependent variables are discussed separately such as how industrialization affect the availability of arable land how the massive flow of population towards urban areas degrade the arable land and similarly how infrastructure development such as road construction, increase in the residential societies such as the rapid formation of DHA Gulberg green and Bahria town etc. cover the arable land.

4.3.1. Effect of Industrialization on Arable Land:

Industrialization refers as a process where a particular country transforms its agricultural process into the manufacturing sector. Industrialization negatively affects the availability of arable land (Zhang et, al 2004) because producers installed their plants on the arable land so that this arable land is used for non-agriculture purposes. Which cause a low level of agricultural products or low production of crops in this region which also may create shortage Industrial Revolution in developing countries such as the United States of America, Japan, Germany and Europe countries are evident that arable land is reduced when industries develop in urban areas (Wang et al, 2006). Industrialization may cause the huge pressure of urbanization in industrial areas for example large industries are always installed in the big cities such as Karachi, Lahore, Islamabad, Multan etc. These industries attract the migrants from the rural areas for high wage rates. So there is an inverse relationship between arable land and urbanization (Zhang et al 2004).

4.3.2. Effect of Urbanization on Arable Land:

Urbanization refers to a massive flow of people towards developed areas such as in cities in search of better living standards from the remote areas. Urbanization has also an adverse effect on arable land. Urbanization is one of the biggest challenges for developing and as well as for developed countries. Population all over the world has been increasing at an

increasing rate but resources are fixed such as land. According to Malthusianism, population growth is potentially exponential on the other hand resources grow linearly. In many developing countries like Pakistan and India due to the betterment of the health sector fertility and mortality rate are reduced so this is also a reason for the increase in population. Cities have better infrastructure such as roads, schools, quality of education, and better employment opportunities compulsive the people to migrate from rural to urban areas. So that cities became overpopulated and it also creates urban unemployment big in cities. Migrants need space to live so that they demand more houses, schools, shopping centers, etc all of these are constructed on the arable land which causes the loss of the arable land. So urbanization and arable land have a negative relationship between them (Zhang et al 2004).

4.3.3. Effect of Infrastructure Development on Arable Land:

Infrastructure development is the process of the construction of buildings, roads, railways, airports, and ports in a country. Infrastructural development adversely affects the availability of the arable land (Zhang et al 2004), because all of above mentioned development project needs space or can say land, and land can be used for agricultural purpose or for nonagricultural purpose so construction projects are the non-agriculture use of arable land for example due to industrialization people migrate from urban to rural areas in order to get better lifestyle such as education and more opportunities for getting job so they demand more infrastructure such houses schools and roads etc when demand for more house increases investors build new societies as per their demand such as DHA, Bahria town etc similarly they demand more food , so in one side they built a infrastructure in a rapid speed on the cost of arable land, and on the other hand they demand food and land is scarce resource so that food insecurity may arise and food prices starts rising so it is clear that infrastructure development in cost of arable land has also adverse effect on the arable land.

4.3.4. Grain Deficit of Rice on Arable Land:

Grain deficit of rice is defined as the difference between the import and export of rice. Rice is a major crop in many nations, with cultivation ranging from the humid tropics to and southeast Australia and northeast China from sea level to more than 2500 m in Nepal and Bhutan's temperate areas. Although most of the rice is grown in Asia, rice is also grown in Oceania and Europe. Rice is grown in a variety of temperatures and on a variety of soils, with

vast variances in soil qualities, due to its extensive geographical distribution. Similarly for Pakistan rice is the one of the major crops, and Pakistan is the biggest producer of rice its contribution to GDP is around about 21.73%. Due to the land covered by industrialization urbanization and infrastructure development land for cultivation is reduced which causes the shortage of grain production.

4.3.5. Grain Deficit of Rice:

Grain deficit of wheat is defined as the difference between the import and export of wheat. Wheat is a crop that grows best in temperate regions of the world, and it is referred to as a Rabi crop since it is planted throughout the winter months. It is planted in October and November in locations where rain is the only source of irrigation and in November and December in areas with canal irrigation. Pakistan is one of the few countries that sows and harvests wheat in both rain-fed and canal-irrigated fields. Wheat is the major grain crop in many nations, and it is a staple diet in many of them. Similarly for Pakistan wheat is one of the major crops, and Pakistan is the biggest producer of rice its contribution to GDP is around about 35%. Due to the land covered by industrialization urbanization and infrastructure development land for cultivation is reduced which causes the shortage of grain production.

4.4. Conclusion:

Due to all non-agricultural use of land has an adverse effect on the availability of arable land. Every independent variable has negative impact on the arable land. Industrialization creates attraction for the rural people, and these migrants create urbanization they demand more infrastructure so all of the variables has a negative impact on the arable land theoretically.

4.5. Variables:

Variables are events, items, sentiments, periods, and anything else that can be measured during a scientific experiment or management science (Greene, 2003). Discrete, continuous, dependent, independent, control and moderate variables are the most commonly used variables in research (Gujarati, 2007). Only dependent and independent variables as well as some control factors are used in this study.

4.6. Independent variables:

Independent variables are variables that are not influenced by other controlled variables during the study process. During an experiment or any other type of study conducted by the researcher, independent variables cause changes in explanatory variables. The independent variable is also known as a predictor, controlled variable, manipulated variable, explanatory variable, exposure input, and variable risk factor

4.7. Variables Definition:

We choose different variables such as arable land which is our dependent variable and other independent variables including industrialization, urbanization, and infrastructure development are our main focused variables. We use the proxies of some above variables such as instead of industrialization, we took a share of urban population and for infrastructure development we use road construction data as a proxy variable. We also include some control variables in our model such as grain deficit of rice and grain deficit of wheat.

At =Arable land;

Any area of ground that can be cultivated and utilized to raise crops is referred to as arable land. The land is worked (tilled) regularly usually as part of a crop rotation system.

Arable land is the dependent variable we will take the data from world development indicator (WDI) in hectares since 1970-2020 arable land has been taken by many scholars in their studies such as (Zhang et al. 2004) and (Leonard 2020) that is the reason that the study took this variable.

$INDUST_t$= Industrialization;

Industrialization is the process through which an economy shifts from a primarily agrarian economy to one based on the manufacturing of goods. We used manufacturing value-added percentage of GDP as a proxy for industrialization and non-agriculture to agriculture GDP non-agriculture GDP consists of service sector manufacturing sector etc we took the data from world development indicator (WDI) since 1970-2020 this variable is used by many scholars in their studies such as (Zhang et Al. 2004) that's why study also took this variable.

$URBAN_t$= Urbanization;

The shift of population from rural to urban areas as well as the reduction in the number of people living in rural areas is all examined as well as how societies respond to this shift. It is the expansion and growth of towns and cities as more people choose to live and work in urban areas. We chose a share of the urban population as a proxy of urbanization. We took the data from world development indicator (WDI) since 1970-2020" this variable is used by many scholars in their studies such as (Zhang et Al. 2004, Ahmed et .al 2018) and (Shi et .al 2016) that's why study took this variable.

$INFRAST_t$ =Infrastructure development;

Is a set of basic amenities that immediately help an economy's the production and distribution processes Roads, trains, telephone systems, rivers, airways, financial institutions, energy, and water supply are all examples of transportation infrastructure. We used road construction data as a proxy of infrastructure development and took the from the world development indicator (WDI). This variable is used by many scholars in their studies such as (Zhang et Al. 2004), (Ahmed et .al 2018) and (Shi et .al 2016) that's why study took this variable.

$GDORIC_t$= grain deficit of rice;

Is referred to as a difference between imports and export of rice we use this variable as a control variable in our model. We took the data from the economic survey of Pakistan.

$GDOWHT_t$= grain deficit of wheat;

Is referred to as a difference between imports and export of wheat, we use this variable as a control variable in our model. Study took the data from the economic survey of Pakistan.

$TDOGR_t$= total deficit of grain;

The total deficit of grain is referred to as a whole deficit grain such as wheat and rice combined deficit. Study used this variable as a control variable.

Table 4.1: Description of the Variables and Data Sources:

Series	Variable Name	Symbol	Definition of variables and their respective proxies	Data Source	References of variables	Anticipated signs with arable land
1	Arable Land	At	Any area of ground that can be cultivated and utilized to raise crops.	World development indicator (WDI)	Zhang et .al (2004)	
2	Industrialization	$INDUTRI_t$	The process by which an economy transitions from a predominantly agrarian economy to one based on the production of goods is known as industrialization. We utilise manufacturing value-added percentage of GDP instead of industrialization, and non-agriculture GDP instead of agriculture GDP.	WDI	Zhang et .al (2004) and Liu et .al (2010)	Industrialization has negative impact on arable land (Zhang,2004)
3	Urbanization	$URBAN_t$	Refers to the demographic transition from rural to urban areas, instead of urbanization share of urban	WDI	Zhang et .al (2004) And Ahmed et .al (2018)	Urbanization has negative impact on arable land

			population is used as a proxy variable.			(Zhang, Wang 2004)
4	Infrastructure development	$INFRAS_t$	Is a set of basic amenities that immediately help an economy's production and distribution processes Roads, trains, highways, etc. similarly instead of infrastructure development road construction data is used as a proxy variable	WDI		Infrastructure development has negative impact on arable land (Zhang,2004)
5	Grain deficit of rice	$GDORIC_t$	Is referred to as a difference between imports and export of rice. Grain deficit of rice is used as a control variable.	Pakistan economic survey		Grain deficit of rice has negative impact on arable land
6	Grain deficit of wheat	$GDOWHT_t$	Is referred to as a difference between imports and export of wheat. Grain deficit of wheat is used as a control variable.	Pakistan economic survey		Grain deficit of wheat has negative impact on arable land

7	Total grain deficit	$TGDEF_t$	The total deficit of grain is referred to as a whole deficit grain such as wheat and rice combined deficit.	Pakistan economic survey		

4.8. Data Sources:

This empirical study is based upon time series secondary data set of past 50 years (1975-2020) quarterly basis. Data of all variables is collected from world development indicator (WDI) and Pakistan economic survey we will use the data for study of Pakistan because in Pakistan agriculture sector always ignored and the government hasn't put much attention towards this sector hope so the results of that particular study will suggest suitable policy recommendations for Pakistan.

CHAPTER 5

5. RESULTS AND DISCUSSION:

Figure 1: Trend Lines of Variables

Figure 1.1: Arable Land

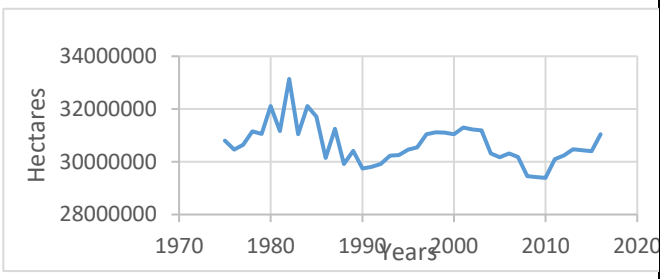


Figure 1.2 Urban Population

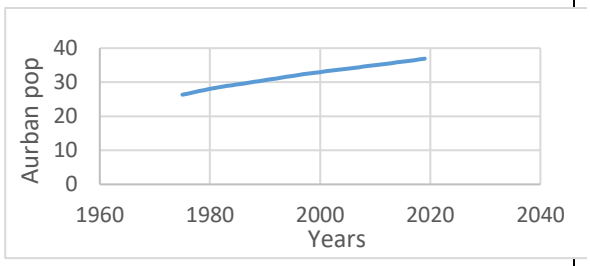


Figure 1.3: Grain Deficit of Rice

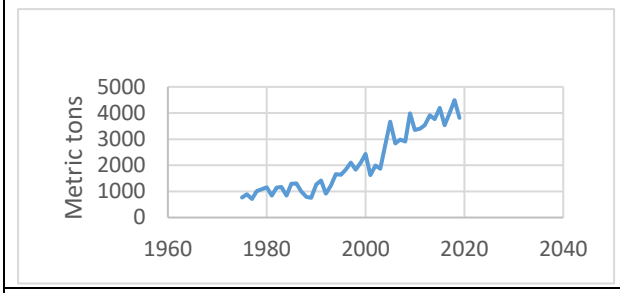


Figure1.4: Grain Deficit of Wheat

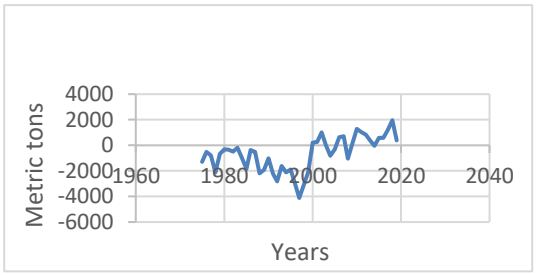


Figure1.5: Road Length

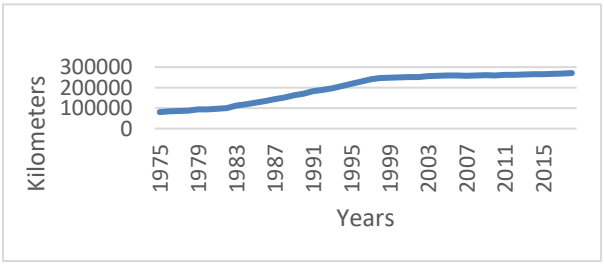


Figure 5.1: Arable land;

Pakistan is a country where the agriculture industry is considered a pillar of the economy with a contribution of over 46 percent of the total gross domestic product (GDP) in 1960. (Parveen et.al 2020). Agriculture's share of GDP fell to 21% in 2005 and it is expected to fall to 19% by the end of 2017 (World Bank 2017). The unplanned and uncontrolled expansion of the built environment has resulted in a decrease in the sector's contribution to GDP and a loss of employment opportunities. The fundamental reason for the loss in agriculture's contribution to GDP is the conversion of arable land to built-up space (Ali, 2013).

The loss of arable land and green belts (loss of grasses and trees) open spaces and barren land on the cost of the built area is a commonly practiced reported in different regions of the world (Fischel 1982 Miller and Werner 2018). In, 1975 total arable land of Pakistan was 3070 hectares (WDI) due to massive urban expansion infrastructures development and industrialization in the year 2010 it was 2939 hectares. Thus, from the year 1975 to 2010 the arable land is reduced day by day because of the non-agricultural use of arable lands such as urban population and infrastructures development.

At the time of independence in 1947 per capita cultivated area was 0.4 hectares reduced to smaller than 0.1 hectares in 2009 (Nasreen, 2000). According to World Bank Pakistan is the 6th most populous country in the world Pakistan's total land area is 796,095km2 (WDI) and the total arable land area is 30,400,000 hectares in 2015. Which is less than comparatively than 2013 which were 30,470,000 hectares (WDI)? The area of arable land is to be devoured by the process of urbanization gradual rise in housing demand and infrastructures build-up is a directly reducing area of arable land (Anwar, 2018).

Figure 5.2: Urban population

Pakistan is regarded as Asia's most under developed country (Ahmed et. al 2018). The urban population of Pakistan expanded from 26.391 percent in 1975 to 30.576 percent in 1990 due to many factors such as improved education, health, transportation, and work possibilities. As a result since 1975 Pakistan's urban population has been steadily increasing putting a strain on the country's arable land. The population has risen from 32.5 percent in 1998 to 40 percent in 2014 and if the trend of people relocating from rural areas to cities continues the population will exceed 50% by 2025.

As a result, one of the primary drivers of urbanization is the significant shift from rural to urban areas. Pakistan which is already suffering from a food shortfall cannot afford to lose any more fertile land. Furthermore, Pakistan's dynamic land use pattern is a result of rapid population growth a high urbanization ratio high land values and the arrival of modern industrialization. Pakistan like other developing countries faces urban issues as a result of its rapid population increase (Parveen et.al 2020). This rapid population increase is to blame for a slew of issues including agricultural land conversion overcrowding on the roads environmental contamination a scarcity of housing a lack of energy a lack of land-use strategies a scarcity of water and water pollution (Qadeer, 1996).

Figure 5.3: Grain deficit of rice

Rice is a major crop in many nations with cultivation ranging from the humid tropics to northeast China and southeast Australia and from sea level to more than 2500 m in Nepal and Bhutan's temperate areas. Although most rice is grown in Asia rice is also grown in Oceania and Europe. Rice is grown in a variety of temperatures and on a variety of soils with vast variances in soil qualities due to its extensive geographical distribution. Due to the characterization of rice soils early research in Asia focused on flooded rice production Breemen et al 1978.In 1975 rice deficit was736mt due to the massive floods and the lack of water availability it reached 3042mt in the year 2009. And the deficit is continued to increase it was 4493mt in the year 2018.

Figure 5.4: Grain deficit of wheat;

Wheat is a crop that grows best in temperate regions of the world and it is referred to as a Rabi crop since it is planted throughout the winter months. It is planted in October and November in locations where rain is the only source of irrigation and in November and December in areas with canal irrigation. Pakistan is one of the few countries that sows and harvests wheat in both rain-fed and canal-irrigated fields. Wheat is a main grain crop in many nations and it is a staple diet in many of them. Nothing is more vital than human needs, it is universally acknowledged. Sustainability and the Environment Food production stability are critical for long-term sustainability. production of crops Wheat production, supply of water and energy are all important factors that are vital and will continue to be important in ensuring the sustainability of agriculture and the reliability of food production. Water and energy conservation on the other hand are two issues that must be addressed significant concerns for academics to address to reduce the costs of

these two commodities without affecting production. Due to a lack of water the country began to overuse groundwater by pumping it out consuming a large quantity of available energy at a time when the country was already experiencing a shortage of this commodity (Pakistan, 2008 to 2009). Additionally water availability for agriculture is expected to decrease from 72 percent to 62 percent between 1995 and 2020 with a global dip from 86 percent to 73.0 percent in developing nations (Khan et. al.2006).

Figure 5.5. Road lengths

Motorways, National Highways, Expressways, Strategic Roads, Provincial roads Farm to Market Roads and urban roads are all part of Pakistan's road network. The total length of the road network is over 260,000 kilometers with a road density of 0.32 kilometers per square kilometer. The city roads are linked to district and provincial highways which end at National Highways forming a complete highway network for inter-and intra-country travel. Road transport now accounts for over 90% of passenger travel and 95% of freight traffic in Pakistan's transportation sector. Pakistan's National Highways are divided into two portions by the River Indus which flows through the country's center and provides connectivity to the population. In 1975 road length was separated by 80623 kilometers due to an increase in development projects such as urbanization, industrialization road length increased to 170823 kilometers in the year the 1990s. In the year 2019 it was 259463 kilometers. Thus from the year 1997 to 2019 the road length increased continuously on the agricultural land of Pakistan.

Table: 5.1 Descriptive Statistics

Variables	Mean	Median	Skewness	Kurtosis	Jarque-Bera	P value
Grain deficit of rice	2092.40	1745.27	0.5559	1.8874	54.4294	0.0000
Grain deficit of wheat	-681.75	-480.246	-0.3870	2.6180	16.3906	0.0002
Manufacturing value added	13.64	13.7818	-0.8000	3.0919	56.5165	0.0000
Non agri to agri GDP	3.38	3.0802	5.3242	33.5280	22997.6	0.0000
Road length	31.94	32.2215	-0.1872	1.8851	30.4325	0.0000
Urban pop	198890.8	235624.9	-0.5391	1.6464	65.8927	0.0000

The early stages of descriptive analysis are where discussion and interpretation of the data begin. Before embarking on any regression analysis it's essential to comprehend what the current study says about data. Outliers and the normality of the sample data are identified using descriptive analysis. Descriptive statistical analysis has ensured that the data available for the regression analysis is normally distributed. Central tendencies of the data are usually measured by statistical term namely mean median and mode. Values of the jarque-bera, skewness and kurtosis evident that the selected data for the empirical analysis is normally distributed. If the value of skewness is between -0.5 and 0.5 then it shows that data are fairly symmetrical. So in table 4.1 most of variables have normal distribution expect non agriculture to agriculture GDP Kurtosis discusses the tallness of a distribution or in other words, the probability distribution's tail. It actually measures the number of outliers in the distribution. Low kurtosis values indicate that data has light tails or fewer outliers thus low kurtosis values are regarded to be favorable for a given data collection. In this case p values are less than 0.05 at a 5% level of significance indicating that the null hypothesis is rejected and the data is normally distributed.

Table: 5.2 Correlation Table

Variables	Grain Def Rice	Grain Def wheat	Manu Value added	Non Agr to Agri	Road length	Urban pop
Grain Deficit of rice	1.00	0.58	-0.43	0.25	0.91	0.82
Grain Deficit of wheat	0.58	1.00	-0.63	-0.01	0.46	0.30
Manufacturing Value added	-0.43	-0.63	1.00	-0.01	-0.41	-0.40
Non Agri to Agri GDP	0.25	-0.01	-0.04	1.00	0.31	0.35
Road length	0.91	0.46	-0.41	0.31	1.00	0.96
Urban population	0.82	0.30	-0.40	0.35	0.96	1.00

The matrix of correlation determines the simultaneous dependence of many variables. The presence of multi-collinearity (Farra and Glauber, 19677) is indicated by a Pearson correlation value greater than 0.7.The following table's correlation matrix, or Pearson-type correlation provides a quick overview of the correlation between the explanatory variables employed in the current investigation. Namely: grain deficit of rice, grain deficit of wheat, manufacturing value added, non-agricultural to agricultural GDP, road length and urban population.

Similarly Correlation matrix that is given above implies that there is no substantial relationship between variables except road length and grain deficit of rice and urban population. The degree of relationship between road length and grain deficit of wheat and also between the road length and urban populations is strong as the value of correlation coefficient is 0.91 and 0.96 respectively. The correlation is between -1 and +1 as we all know. If the degree of correlation is perfectly negative the correlation value is -1 and if the correlation value is +1 the degree of link between two variables is perfectly positive. If the correlation coefficient is more than 0.5 the degree of association between variables is high. Whether the correlation coefficient is negative or positive depends on the sign of the correlation coefficient.

In Table 5.2 the diagonal elements (from top left to lower right) form a one-to-one relationship between one variable and itself that is always equal to 1 Number 1 in the upper left corner of the correlation matrix represents the pair wise correlation between the explanatory variables used in the current study whereas elements of the diagonal correlation matrix represent the pair wise correlation between the explanatory variables used in the current study. Most of the variable explanatory variables have low pair wise correlation, according to entries off the diagonal matrix. Pair wise correlation may be sufficient but it is not a necessary requirement for multicolleanirty to exist. (2009, D.N Gujarati)

5.2 Estimated Logit Results for Arable Land:

The empirical result of logit estimates presented in the tables below that shows how explanatory variables such as industrialization, urbanization and infrastructure development (along with their proxies such as for infrastructure development we took road length as a proxy similarly for industrialization we took non agriculture to agriculture GDP as a proxy) affect the arable land of Pakistan. We estimated three models separately by the change of explanatory variables and the results are presented as model 1 model 2 model 3 respectively. In the spite of some differences in their magnitudes the coefficient for all the explanatory variables of three models varies model to model. Here the study has interpreted all the explanatory variables impact on arable land in model. In model 1 we took grain deficit of rice urban population road length and non-agriculture to agriculture GDP as explanatory variables. Similarly in model 2 instead of grain deficit of rice we took grain deficit of wheat and urban population road length and non-agriculture to agriculture GDP are same as model1in model 3 we combine the deficit as a total grain deficit by adding them and create a single explanatory variable and take manufacturing value added as proxy of industrialization instead of non-agriculture to agriculture GD

Table: 5.3: Estimated Logit Model Results (Model 1)

Variables	Coefficients	Standard Error	Z-Stat	P-Value	Probabilities
Constant(c)	252.0150	105.3646	2.3918	0.0168	
Grain deficit rice	-0.0405**	0.0141	-2.8599	0.0042	0.49
Urbanization	-0.0019***	0.0007	-2.5543	0.0106	0.50
Infrastructure development	9.7537**	3.5678	2.7339	0.0046	0.99
Industrialization	23.731***	8.3775	2.8327	0.0006	1.00
Mc Fadeen R 0.871848			s	Log likelihood -11.69730	
Number of observation 408				Prob (LR statistic) 0.000000	

Note:

1. The dependent variable arable land is in binary form such as 0 &1, 0 indicates that the arable land is used for non-agriculture purpose and 1 indicate that arable land is used for agriculture purpose
2. *, **,***asterisks represent that the estimates are significant at 10%, 5% &1% level, respectively.
3. The urbanization variable is defined as the share of urban population; the industrialization variable is represented as non agriculture to agriculture GDP.
4. The estimated probabilities are computed using the following formula i.e. $Prob = \frac{1}{1+e^{-x}}$

Table 5.3 reports Logit estimates of model no 1. In this model arable land is dependent variable and industrialization (non-agriculture to agriculture GDP as proxy variable), urbanization (share of urban population as a proxy variable), infrastructure development (road length as a proxy variable) is dependent variable, and grain deficit of rice is used as a control variable is estimated. The results of the model show that the coefficient of urbanization and Grain deficit of rice (GDR) has significantly negative signs. The results show that urbanization and grain deficit are the main sources that affect the arable land and urbanization is the main driving force that converts the arable land in to nonagricultural use. And grain deficit of rice negative significant impact on arable land shows that our next biggest problem is the food insecurity. Infrastructure development and industrialization coefficient are not significant because Pakistan is an agro based economy like other underdeveloped countries such as India and it is estimated that approximately 65% of total population depend upon the agriculture sector and this sector

contribution in GDP is round about 24.5%. And Pakistan has comparative advantage in agriculture sector because of lack of technology. As the Logit estimates are binary so that results of binary estimates can better interprets in form of probabilities. If the grain deficit of rice is decreases by a metric ton then the probability of the land used for agriculture increases by 0.49 or 49%. Similarly if the urbanization increased by 1% then the probability of the land use for agriculture increases by 0.5 or 50%. If the infrastructure development increased by a kilometer then hen the probability of the land use for agriculture decreases by 0.99 or 99%.and a like if the industrialization increased by 1% then the probability of the land use for agriculture decreases by 1.00 or 1%.

Table: 5.4: Estimated Logit Model Results (Model 2)

Variables	Coefficients	Standard Error	Z Stat	P Value	Probabilities
Constant	110.4644	36.7139	3.0087	0.0026	
Grain deficit wheat	-0.0012***	0.0005	-2.3961	0.0166	0.50
Urbanization	-0.0007***	0.0002	-2.8440	0.0045	0.50
Infrastructure development	2.2838**	1.0217	2.2351	0.0254	0.90
Industrialization	0.8666	1.1275	0.7686	0.4421	0.70
Mc Fadeen R 0.523696			Log likelihood-43.47557		
Number of observation 408			Prob (LR statistic) 0.000000		

Note:

1. The dependent variable, arable land is in binary form such as 0 &1, 0 indicates that the arable land is used for non-agriculture purpose and 1 indicate that arable land is used for agriculture purpose
2. *, **, ***asterisks represent that the estimates are significant at 10%, 5% &1% level, `respectively.
3. The urbanization variable is defined as the share of urban population; the industrialization variable is represented as non-agriculture to agriculture GDP.

The estimated probabilities are computed using the following formula i.e. $Prob = \frac{1}{1+e^{-x}}$

In table 5.4 we have logit estimates of model#2 in this model arable land is dependent variable and industrialization (non-agriculture to agriculture GDP as proxy variable) ,urbanization (share of urban population as a proxy variable) infrastructure development (road length as a proxy variable) are dependent variable and grain deficit of wheat as control variable instead of grain deficit of rice because they both are the major crops of Pakistan so we want to check the impact of both

corps separately on the arable land. The coefficient of urbanization and grain deficit of wheat has significantly negative signs same as mode1 but if we compare the values of urbanization in both model and model 2 we have seen a significant difference, in this model urbanization coefficient is much better than model 1 coefficient of urbanization. As the logit estimates are binary so that results of binary estimates can better interprets in form of probabilities. If the grain deficit of wheat decreases by a metric ton then the probability of the land use for agriculture increases by 0.5 or 50%. And if the urbanization decreases by 1% then the probability of the land use for agriculture increases by 0.5 or 50%. If the infrastructure development is increased by a kilometer then the probability of the land use for agriculture decreases by 0.90 or 90%.similarly if the industrialization increased by 1% then the probability of the land use for agriculture decreases by 0.70 or 70%.

Table: 5.5: Estimated Logit Model Results (Model 3)

Variables	**Coefficient**	**Standard Error**	**Z Stat**	**P Value**	**Probabilities**
Constant(c)	1.3873	34.3159	0.0404	0.9678	
Total Grain deficit	-0.0025***	0.0007	-3.5210	0.0004	0.50
Urbanization	-0.0003***	0.0001	-1.7132	0.0867	0.50
Industrialization	0.3097	0.6698	0.4624	0.6438	0.57
Infrastructure development	2.7639***	0.8263	3.3448	0.0008	0.94
Mc Fadeen R 0.685393			Log likelihood -28.71636		
Number of observation 408			Prob (LR statistic) 0.000000		

In Table 5.5 we have logit estimates of model#3 in this model arable land is dependent variable and industrialization (nonagricultural to agriculture GDP as proxy variable) ,urbanization (share of urban population as a proxy variable) infrastructure development (road length as a proxy variable) are dependent variable and total grain deficit (grain deficit of rice +grain deficit of wheat) in this model we combine the both deficit of grain because both the corps are the major crops of Pakistan so we want to check the combine impact as a total grain deficit on arable land. The coefficient of urbanization and total grain deficit has significantly negative signs same as mode 1 and model 2 but if we compare the values of urbanization in both model

1 and model 2 we have seen a significant difference in this model. Urbanization coefficient is much better than model 1and model 2 coefficient of urbanization. And most prominent change in model 3 is that here industrialization coefficient is mild significant but in model 1 and model 2 industrialization coefficients are too large and insignificant. As the logit estimates are binary so that results of binary estimates can better interprets in form of probabilities. If the total grain deficit of decreases by a metric ton then the probability of the land use for agriculture increases by 0.5 or 50%. And if the urbanization decreases by 1% then the probability of the land use for agriculture increases by 0.5 or 50%. Similarly coefficient of infrastructure development is improved much more here than model 1 and model 2. The results shows that urbanization and industrialization are the main sources that effect the arable land and urbanization is the main driving force that convert the arable land in to nonagricultural use. Correspondently if the industrialization is increased by one percent then the log odd ratios of arable land has increased by 0.57 or 57% and if the infrastructure development increased by a unit then the log odd ratios of arable land has increased by 0.9 or 90%

CHAPTER 6

6. CONCLUSION:

This study develops a framework to model the main determinants of arable land of Pakistan, such determinants are industrialization, urbanization, and infrastructure development. As land rarity or scarcity is the most pressing issue all over the world. So, the main cause of the degradation of arable land is permanent conversion of land surface by construction projects such as buildings housing societies and for industries, this permanent conversion of land caused to reduce the availability of agricultural land. Human activity such as urbanization, infrastructure development caused significant loss of arable land around the world during the past few decades (Yen Chen et al,2016). The data set used in this study time series data of all the variables such as industrialization, urbanization, and infrastructure development of Pakistan from 1975 to 2020. The frequency of the data is a monthly basis because of the lack of the availability of data, and to secure the degree of freedom du e to this reason we have to split the data into monthly bases. As dependent variable arable land is binary nature so that odd ratios have been calculated arable land is divided by the total land available and values that are greater than 0.5 considered as a 1 and less than 0.5 considered as 0. The data for this study was gathered from a variety of sources, including the World Development Indicator (WDI) and the Pakistan Economic Survey. Empirical evidence in both three models shows that urbanization and infrastructure developments are the key drivers of the conversion of farm land into non-agricultural use we modeled three different models to notice the considerable change. We use logit molding as an econometric technique because our dependent variable is binary nature it can be used either for agriculture purposes or non-agriculture purpose.

As arable land is the most significant part for the development of the country most importantly for the agrarian economies such as for Pakistan, Arable lands are that kind of piece of land that can be ploughed and are consequently important for grain production. And arable land is responsible for two dignified things first of all it feeds the nation and it plays a significant role in the development of the particular country by exporting the output and earning foreign exchange. In Pakistan agriculture sector is considered to be a key driver of economic growth. At the time of independence agricultural share in GDP was around 53% and now this share is 22.96% of GDP.

Approximately 65 % of the labor force is directly or indirectly depending upon the agriculture sector. These fingers altered dramatically over the last seven decades due to various reasons such as social, political, climate, and environmental changes (Raza, 2012).

One of the main issues of land degradation is urbanization, and urbanization takes place due to various reasons such as rapidly growing population, migration, etc. An increase in population growth all over the world implies an increase in the demand for roads industries housing society and recreations etc. Because of all transformations cropped area is being lost (Does et. al 2002) urbanization is expected to result in the loss of between 1.6 and 3.3 million hectares of prime agricultural land each year between 2000 and 2030. By 2050, the huge proportion of the world's population living in cities is estimated to increase by roughly 2.5 billion people (Shagun, 2019).

6.1. Policy Recommendations:

Results of the underpin study reflect that the non-agricultural use of arable lands such as urbanization, and infrastructure development is the key driver of the loss of arable land.

Following are the policies suggested by the study

a. There should be vertical integration, for example, the development of the housing societies to be expand vertically instead of horizontally.
b. Before the installation of any industry on the arable land cost and benefit analysis should be require. If the cost of installing industry is greater than agricultural production then agriculture production should be preferred.
c. The decision of Sell and purchase of the arable land must be under control of the government.
d. Long term investment in agriculture research should be granted in order to further increase in per year yield
e. Pakistan should increasingly make use of international trade to exploit its comparative advantages by gradually augmenting the import of land intensive crops, such as grain, and paying for these with additional exports of labor-intensive commodities, such as fruits and vegetables.

REFRENCES

Zhang, X., Mount, T. D., & Boisvert, R. N. (2004). Industrialization, urbanization and land use in China. Journal of Chinese Economic and Business Studies, 2(3), 207-224.

Fan, S., Fang, C., & Zhang, X. (2001). How agricultural research affects urban poverty in developing countries: The case of China (No. 581-2016-39494).2(3)

Bergeron, G., & Pender, J. L. (1999). Determinants of land use change: evidence from a community study in Honduras (No. 581-2016-39440).2(3) 203-304

G. Balaganesh1, Gururaj Makarabbi2, S. Niranjan3 and S. Ashokkumar(2017) Agricultural Land Utilisation in India 37(1)

Hellerstein, D., Hitaj, C., Smith, D., & Davis, A. (2017). Land use, land cover, and pollinator health: A review and trend analysis (No. 1477-2017-4335).

Hamidov, A., Helming, K., & Balla, D. (2016). Impact of agricultural land use in Central Asia: a review. Agronomy for sustainable development, 36(1), 6.

Spangler, K., Burchfield, E. K., & Schumacher, B. (2020). Past and current dynamics of US agricultural land use and policy. Front. Sustain. Food Syst. 4: 98. doi: 10.3389/fsufs.s

Fan, S. (2002). Agricultural research and urban poverty in India (No. 581-2016-39466).

Zezza, A., & Tasciotti, L. (2010). Urban agriculture, poverty, and food security: Empirical evidence from a sample of developing countries. Food policy, 35(4), 265-273.

Shi, K., Chen, Y., Yu, B., Xu, T., Li, L., Huang, C., ... & Wu, J. (2016). Urban expansion and agricultural land loss in China: A multiscale perspective. Sustainability, 8(8), 790.

Tan, Y., He, J., Yu, Z., & Tan, Y. (2018). Can arable land alone ensure food security? The concept of arable land equivalent unit and its implications in Zhoushan City, China. Sustainability, 10(4), 1024.

Humayun Khan, 2Nsabimana Leonard. (2020) Analysis of Arable Land Protection Policies of China : Vol. 5(3), pp. 673-677,

Liu, Y. S., Wang, J. Y., & Long, H. L. (2010). Analysis of arable land loss and its impact on rural sustainability in Southern Jiangsu Province of China. Journal of Environmental Management, 91(3), 646-653.

Liu, Y., Fang, F., & Li, Y. (2014). Key issues of land use in China and implications for policy making. Land Use Policy, 40, 6-12.

Janků, J., Sekáč, P., Barakova, J., & Kozak, J. (2016). Land use analysis in terms of farmland protection in the Czech Republic. Soil and Water Research, 11(1), 20-28.

Yang, Y., He, C., Zhang, Q., Han, L., & Du, S. (2013). Timely and accurate national-scale mapping of urban land in China using Defense Meteorological Satellite Program's Operational Linescan System nighttime stable light data. Journal of Applied Remote Sensing, 7(1), 073535.

Tripathi, S., & Rani, C. (2018). The impact of agricultural activities on urbanization: Evidence and implications for India. International Journal of Urban Sciences, 22(1), 123-144.

Jiang, L., Deng, X., & Seto, K. C. (2013). The impact of urban expansion on agricultural land use intensity in China. Land use policy, 35, 33-39.

Fazal, S. (2000). Urban expansion and loss of agricultural land-a GIS based study of Saharanpur City, India. Environment and Urbanization, 12(2), 133-149.

Döös, B. R. (2002). Population growth and loss of arable land. Global Environmental Change, 12(4), 303-311.

Lua, Q., Liangb, F., Bia, X., Duffy, R., & Zhao, Z. (2011). Effects of urbanization and industrialization on agricultural land use in Shandong Peninsula of China. Ecological Indicators , 1710-1714.

Ghatak, M., & Mookherjee, D. (2013). Land acquisition for industrialization and compensation of displaced farmers. Journal of Development Economics

Wei, Y. D., Li, H., & Yue, W. (2017). Urban land expansion and regional inequality in transitional China. Landscape and Urban Planning, 163, 17-31.

Van Suu, N. (2009). Industrialization and Urbanization in Vietnam: How Appropriation of Agricultural Land Use Rights Transformed Farmers' Livelihoods in a Peri-Urban Hanoi

Village?. Final Report of an EADN Individual Research Grant Project, EADN Working Paper, 38.

Erb, K. H., Gingrich, S., Krausmann, F., & Haberl, H. (2008). Industrialization, fossil fuels, and the transformation of land use: an integrated analysis of carbon flows in Austria 1830–2000. Journal of Industrial Ecology, 12(5-6), 686-703.

Fitton, N., Alexander, P., Arnell, N., Bajzelj, B., Calvin, K., Doelman, J. & Smith, P. (2019). The vulnerabilities of agricultural land and food production to future water scarcity. Global Environmental Change, 58, 101944.

Ahmed, R., Jawaid, S. T., & Khalil, S. (2021). Foreign capital inflows and housing market in Pakistan. International Journal of Housing Markets and Analysis.

Jnr, S. D., Cieem, G., Ayensu-Ntim, A., Twumasi-Ankrah, B., & Barimah, P. T. (2016). Effects of loss of agricultural land due to large-scale gold mining on agriculture in Ghana: the case of the Western Region. Br. J. Res, 2(6).

Wang, H., He, Q., Liu, X., Zhuang, Y., & Hong, S. (2012). Global urbanization research from 1991 to 2009: A systematic research review. Landscape and urban planning, 104(3-4), 299-309.

Wu, X. D., Guo, J. L., Han, M. Y., & Chen, G. Q. (2018). An overview of arable land use for the world economy: from source to sink via the global supply chain. Land Use Policy, 76, 201-214. Chen, G. Q., & Han, M. Y. (2015). Global supply chain of arable land use: Production-based and consumption-based trade imbalance. Land Use Policy, 49, 118-130.

Xu, G., Huang, X., Zhong, T., Chen, Y., Wu, C., & Jin, Y. (2015). Assessment on the effect of city arable land protection under the implementation of China's National General Land Use Plan (2006–2020). Habitat International, 49, 466-473.

Jones, D. W. (1991). How urbanization affects energy-use in developing countries. Energy policy, 19(7), 621-630.

Nasrabad, H. A., & Witlox, F. (2015). Monitoring agricultural land conversion induced by urban sprawl and transportation in Northeast Iran (Monalisa-T).

Chen, A., He, H., Wang, J., Li, M., Guan, Q., & Hao, J. (2019). A study on the arable land demand for food security in China. Sustainability, 11(17), 4769.

Liu, X., Xu, Y., Engel, B. A., Sun, S., Zhao, X., Wu, P., & Wang, Y. (2021). The impact of urbanization and aging on food security in developing countries: The view from Northwest China. Journal of Cleaner Production, 292, 126067.

Rajpar, H., Zhang, A., Razzaq, A., Mehmood, K., Pirzado, M. B., & Hu, W. (2019). Agricultural Land Abandonment and Farmers' Perceptions of Land Use Change in the Indus Plains of Pakistan: A Case Study of Sindh Province. Sustainability, 11(17), 4663.

Appendix

Null Hypothesis: Arable land has a unit root stationary at level
Exogenous: Constant
Lag Length: 6 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.629064	0.0101
Test critical values:	1% level	-3.632900	
	5% level	-2.948404	
	10% level	-2.612874	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: urbanization has a unit stationary at 2nd difference
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.193512	0.0020
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: manufacturing value added has a unit root stationary at first difference
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.869612	0.0000
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: road length has a unit root stationary at 2nd difference
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
		-9.808536	0.0000
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

*MacKinnon (1996) one-sided p-values.

Exogenous: Constant
Lag Length: 6 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.629064	0.0101
Test critical values:	1% level	-3.632900	
	5% level	-2.948404	
	10% level	-2.612874	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(AGRGDP) has a unit root at first
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.665478	0.0000
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(NONAGG) has a unit root ststionary at first
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.925293	0.0000
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: NONAG has a unit root stationary at level
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.233258	0.0000
Test critical values:	1% level	-3.588509	
	5% level	-2.929734	
	10% level	-2.603064	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(DEFRICE) has a unit root stationary at first
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.225547	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(DEFWHEAT) has a unit root stationary at first
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.595391	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

*MacKinnon (1996) one-sided p-values.