IMPACT OF URBANIZATON ON ENVIRONMENT IN PAKISTAN

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CERTIFICATE

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ABSTRACT

The uprising urbanization significantly impacts the environment status of any country. This phenomenon commonly has been observed in developing countries, including Pakistan where it is in very fast track. Number of studies presented their particular theoretical and empirical models for the exploration of this relationship in case of Pakistan. These studies have two main flaws on theoretical and empirical grounds. First, all previous studies ignore some very important factors of urbanization, like cities land extension and reduction in agriculture land. Secondly, due to these missing relevant variables, their econometric models violated the axiom of the correct specification that is why all these models are mis-specified and their results are statistically invalid. This study made two contributions with this particular setup, first study explored the potential determinants of urbanization and environmental status by considering these missing variables. Second, by using these potential variables of urbanization and environmental status study developed a general model which contains almost of the relevant variables. This general model provides true impact of most of the variables. Study utilized time series data from the period of 1970 to 2017. The ARDL model and bound testing was employed for exploration of the long-run and short-run impacts of urbanization on environmental status. The study proved that in context of Pakistan, various determinants are responsible for urban expansion leading to ecological degradation in the long run. It is therefore, suggested to focus on the policies related to urban development to secure natural habitat. For this, concept of eco-friendly products, alternative modes of renewable energies and green revolution should be considered in order to safeguard ecology from futuristic point of view.

Keyword: *Urbanization, Environmental status, Misspecification, Cities land extension and Reduction in agriculture land.*

CHAPTER I

Introduction

1.1 Background

One of the most alarming issues of ongoing century is abruptly uprising urbanization and its penalties on ecological system. All the countries across the world are facing this issue to some extent. The drastic variation has been recorded in urbanization dynamics and ecological system since last three decades. The urbanization and ecological system shared a close bond with each other. This issue is becoming a frontline problem for the survival of civilization because of severe changes happening on daily basis. Urban and environmental factors have more severe impacts on Asian region than any other because mainstream population exists in this part of the world besides their existence/survival is in danger. The adverse effect of rising population over climatic disturbance made them the victim of various other catastrophes as well. The population and environment are the most significant drivers that lead the direction of an economy i.e. if carried in a proper pattern; it leads to prosperity and devastation in misleading pattern. Therefore, these two factors, directly related to and have implications on all socio-economic factors of economy (Alam *et al*., 2007; Azam and Khan, 2016; Cai *and* Zhang, 2011; Martínez *and* Maruotti, 2011; Ali and Nitivattananon, 2012; Sharif and Raza, 2016; Zhou., 2014).

The growing populace and atmospheric depletion is the supreme anxious and multidimensional matter of concern everywhere but keeping our focus particularly onto Pakistan, this is a burning cake. Population growth is probably having large-scale effects on the environmental deprivation of Pakistan. In respect to current study, these fluctuations in natural ecological system is having far-reaching implications on the anthropological, geographical, physical and economical activities. The ecological

alterations are not only confined to just human race but having adverse impact on various other species as well and their existence/survival is a question mark. Frank *et al.* (2017) research provides a strong foundation which helps other fields to join and collaborate together in order to construct a thoughtful approach and paradigm towards urban expansion and environmental pattern.

According to World Bank (2013) South Asian economies are at the forefront among 193 countries encountering meteorological hazards and grabbing top 20 positions overall in Asia. During the span of last four decades, nearly a million of people who lost their lives due to climatic alterations or environmental changes/degradation, while the monetary loss is over $80 billion dollars. Almost, one fourth of Asia's population has affected by one or more such calamities. Warming climate has slow down the reduction in poverty. As a result of urbanization this region is likely to suffer with climatic change, deterioration in generation of food, dry spells, highest degree of ascending water levels, reduction in iceberg, and rise in the number of tsunamis. Due to climate change, the life style of people has been altered. The poor and destitute members of the South Asian region came under the direct jolts of accelerated global warming. The utmost temperature metamorphosis and increased heat waves has upset the living pattern of poor and destitute class as they've come under the direct jolts of climatic alterations. According to Haines *et al*., (2006) research the climatic change has affected the lives of people i.e. both high and low income economies in a range of multiple ways but majority of them belongs to low income nations. The diseases which they've been suffered the most with are related to ecological i.e. heat waves, cold-related deaths, floods, droughts, vector-borne diseases, and malnutrition.

According to United Nation Development Program (UNDP, 2017) built-up portions of low and middle-income countries expected to host and home to majority of the

inhabitants in upcoming two decades. Relationship between economic activity and stress on ecosystem is indispensable in developing countries which increase both environmental challenges and economic activity. Majority of the developing economies rely on their natural resources for economic development and are vulnerable to water and food scarcity, and penalties of climatic variation.

Analysing the bearings of unplanned and unregulated urban growth, which appear in the form as a result of urban sprawl and leap frogging upon institutional inefficacies and institutional delinquencies. This advocates that a rise from agricultural to distributive professions and industrial services, it has created diverse opportunities and services that act as pull factor, which promote rural-urban migration (Jatoo *et al.,*2016; Li and Yeh., 2004).

According to Ministry of Climate Change (MOCC, 2015) the urbanization trend of Pakistan has passed through various spheres in the past three decades. The governments tried their best to bring all loops together i.e. urban, industrial, ecological to make their relation in a meaningful way but unfortunately due to financial and administrative issues, no proper working has taken place in a reasonable way.

According to the Minister of Punjab Food Authority (2016) today, the inhabitants of metropolis of Pakistan are consuming chemicalise diet. The material, processing and dumping system is unhygienic and below standard. This is severe for their survival and such transformation from natural resource to chemicalise is going with rapid pace and we need to halt this. The lives are at stake and it is going on due to mismanagement, poor governance and malfunctions. We are heading towards the processed items instead of green revolution. With the advancement in 21st century we are losing forests, green belts and facing climatic variations, increase in temperature, dryness and hotness in

weather, non-timely rainy-system, and water level shortage as well. According to De Schutter and Vanloqueren (2011) research the collective effect of environmental variations, energy and water issues, we are forced to rethink about our agronomic arrangement. The study conducted by Jabeen *et al.,* (2017), the issue of urbanization is a binary fold for Pakistan economy. If it could be handling under appropriate planning, proper channelling, well organization, and with reforms, it'll produce uncountable blessings. On the other hand, if it'll not tackle in a significant way and without care it could exert more pressure on the economy which is already in hot waters plus covered with burning issues like provision of basic necessities, accommodation, transportation , schooling , creation of employment, security, medical management, traffic burden, hygienic issues, food availability , energy crises etc. In this scenario, to cope up with this issue when the urban population will get almost half of the total population, this burden of urbanization will become enormously gigantic. With the advancement of 21st century, due to urbanization, our cities expanded, construction industry advanced, and thus changed the entire ecology. The heat waves have taken the lives of thousands of people. The study conducted by Rashid *and* Rasul (2011) due to alterations in milieu causing Pakistan to face problems like glaciers melting, floods, food deficiency, rising heat index and inadequate amount of water for its yields. Apart from it, due to the rapid development, the provision of the basic, infrastructural, organizational and physical, reforms started in the last government era. Such programs have been initiated under to China Pakistan Economic Corridor (CPEC) project but at the same time, they are also triggering ecological degradation and climatic variations and involve in contamination of atmosphere. Such ventures, no doubt, are in favour of country's economic boost but not at the cost of environment. It shows that Pakistan's urbanization has very strong correlation with environmental degradation. Because of urbanization and climatic

alterations, the level of greenhouse gases has risen which occurs due to addition of chemicalized elements, vicious amount of carbon, nitrogen and other substances as well, which has changed the course of rainwater and temperature change. It also bring adverse results regarding aquatic, land-living, over flow of water, dry-spells and food scarcity (Ali *et al.,* 2017). The environmental disturbances and industrial waste not only damage the ozone layers but also add other pollutants to destroy it. Indeed, owing to process of industrial development, upsurge in manufacturing, expansion in transportation, energy use-age, the issue of global warming erupts and as a result we are bearing the life threatening risks like food shortage, misplace of people, loss of land , over flows, and hot weather (Torriani *et al.,* 2007; Jacob *et al.,* 2014; Bucak *et al.,* 2017).

Similarly, Al Mamun *et al.,* (2017) noted the presence of gases that includes carbon dioxide, methane, nitrogen dioxide, layers of ozone, halocarbons, Chlorofluorocarbons and various others in our atmosphere and given the name of Green House Gases (GHGs) that surrounds our planet which plays their part as a protection shield and retains its warmth. If they get absenteeism, the temperature will get close to -18 °C and survival on the planet will be unimaginable. The anthropological exertion and enlargement in GHGs effects; due to human infiltration, causing rise in planet earth's temperature. The number of climatic incidents has risen over the years which lead to severe hydrometeorological hazards. It is alarming situation because the atmospheric conditions is regarded as the mother of all climatic destructions, it is also the main mission for the government of Pakistan. All governmental, semi-governmental and private institutions throughout the country are highly focused and strongly concerned about the alarming weather situation, they are well aware of the fact that atmospheric conditions is regarded as the mother of all climatic destructions. The CO_2 emission,

energy use and other waste not only disturbed pattern of rainfall, increased temperature, hotness, protected spherical layers around our sky which protected us from harmful sun emissions. The consumption of anti-environmental units by both i.e. through household and commercial activities are responsible for all types of climatic destructions and catastrophes (Paul and Sharif *et al*., 2018; Mustafa, 2011).

So, the main objective of the research is exploring the linkages between urbanization and environmental conditions. For this purpose, we adopted different methodology from all previous studies in case of Pakistan, first we explored the potential determinants of urbanization. Second, we discovered the potential determinants of environment. At third, by following correct specification axiom, the study contained most of the potential variables in one model to assess the true impact of urbanization and its determinants on environmental status. This generalized model provides more accurate results as compare to previous studies and will also tackle the main econometric problems like autocorrelation, misspecification and etc. All the previous studies used models with different variables except some common variables and not imposed any prior restriction on other models, that is why according to correct specification axiom all models are misspecified. After getting reliable results the study discuss how uprising urbanization and environment degradation affect economic conditions of Pakistan economy.

1.2 Objective of Study

The study has the following objectives:

- To explore the potential determinants of urbanization.

- To investigate the factors effecting the environment status.

- To examine the effect of urbanization on environment status.

- To inspect the effect of determinants of urbanization on the environment status.

1.3 Significance of Study

The significance of the study is to give the brief analysis of variables like land extension, environment status and cultivated agriculture land. The study helps all the development authorities in the country e.g. Capital Development Authority (CDA), Karachi Development Authority (KDA), Faisalabad Development Authority (FDA), etc. The research finding will be useful for these authorities while making policies and planning to settle a new city or urban area for the people coming to megapolis.

1.5 Organization of the Study

After this introduction, the rest of the study is organized as follows: Chapter two is based on comprehensive review of literature related to both the 'urbanization' and 'environment' affected due to various factors. The third chapter consists on the theoretical channels. Fourth chapter discusses data, variables and the econometric methodology which is being used for empirical analysis. Chapter 5 shows the results and discussions while chapter 6 concludes the study and policy recommendations.

CHAPTER II

Literature Review

Urbanization is a most debatable issue in all over world. Urbanization makes environment pollutant. All the economies of the world are facing this burning issue to some extent. The growing urbanization is a matter of high concern at the moment for all i.e. academia, governments, researchers, policy makers and think tanks. The ecosystem disturbances i.e. calamities which are happening throughout the world are the results of uneven urbanization, carbon emission, entrance of organic matters, gaseous particles and total greenhouse gas emissions (TGHGE) present in our atmosphere. The industrial, urban, carbon emission, temperature change, rainfall system, greenhouse effects, other gaseous emissions/radiations are some key factors which are diluting the balance of environment of Asian countries. The emissions of such lethal materials have adverse effects, which are not just confined to humans, but animals and other species survival are also in danger.

2.1 Literature Regarding Developed Nations

Guo *et al*., (2016) discovered that there is a strong kin exist between secretions secreted by manufacturing sector and urban expansion with measuring their affiliation vigilantly in China. According to them urban sprawl shares the directly relation with impurities added and its long-lasting implications. There is an enormous literature on urbanization and its impact on ecological degradation. Generally, the most up-to-date and authentic researches stresses on the three-way relationship of urban increment, economic development and environmental shifts. The contemporary researchers after statistical, mathematical and scientific reasoning are indisputable positive on the fact that urban growth has its footprint on ecology. Li and Ma (2014) explored the triangle between urban expansion, financial growth and atmospheric variations and implications in 30

administrative regions in China. They observed that during the period of urban progression and industrial evolution, it always shows an adverse effect on milieu. Angel *et al.*, (2010) pointed out the driving forces that are answerable for global phenomenon of urban development which are advancement in people, urban sprawl, increments per capita earning, better life opportunities, multiplication of non-formal community, etc. They recommended that there is a need of powerful metropolitan policy in order to manage the meet the estimated growth. Wei and Zhang (2017) estimated the long lasting bearings of urban factor and pointed the three key factors that are responsible for the disturbing behavior of rainfall in Chinese metropolitan areas i.e. utilisation of urban land, anthropogenic radiations and energy usage. They raised concern on the urban sprawl has more severe consequences in extreme cases than during ordinary climatic conditions. Cui and Shi (2012) inspected the numerous aspects of urban expansion and their strong bonding with the socioeconomic, inhabitants, transformation of land use-age and land cover (LULC) and its deep association with the atmospheric and bionomics factors in Shanghai region. They exposed the horticulture land has been ruined due to the construction factor. The rapid urban growth puts its severe threats on the ecological patterns and meteorological conditions. They suggested for strict policies and green urbanization in order to reduce pollution from metropolitan areas. Chan *et al.*, (2017) has established the fact that even though there are huge number of studies that are related to ultra-heat Island, still we show our less concern towards the global environment variations and urban development. They pointed these two key indicators have large scale implications. They found out numerous substances and anthropological factors usually remain unnoticed which lead to underrate of temperature in the thickest, warmest and tropical regions of metropolis. From futuristic point of view, the utmost attention should be given to urban expansion which leads to ecological degradation.

The future scientists should keep their eyes towards the regions which become the victim of heat radioactivity due to urban development and ecological destruction. Prioritise and extensive work will help us to decrease the effect of temperature and heat affect. Buhaug *and* Urdal (2013) discovered multiple factors related to urban social syndrome by using different techniques and variable operations. It has been suggested that we should develop a mechanism in order to differentiate natural population ratio and migration-induced. It's to recommend that we should clear ourselves from all kinds of doubts and ambiguity against social uncertainty and enlarge the vision.

Tuomisto *et al*., (2012) has exposed the fundamental objects that affect the conventional farming. They are of the view that we should develop strategies towards betterment of ground quality, lesson the amount of insect killer substance along with the methods of how to boost and safeguard ecology. They examined that how ecological system has impacted the organic and conventional agrobusiness patterns throughout Europe. Their thoughts are in favour of giving incentives, utilization of resources, productive use of agricultural land for productivity increase and for food production efficiently and effectively. Dong *et al*., (2015) highlighted few inadequacy through his studies and pointed out the inefficiencies present in the department related to agribusiness in United States of America. They disclosed that incapability of farmers, poor management, lack of concern, no productive use of energy and inefficiency, in competencies and technical expertise shortage are major flaws in controlling the effects of green house. They suggested that there is still room for improvement.

Ozturk and Acaravci (2013) has revealed the long-lasting bonding in essentials of ecology key and major elements of Turkish economy. They also unveiled this affinity for the both short and long term period. Their study exposed the presence of one sided relation from monetary side which on the other end connects with issues related income,

consumption, emissions and energy in the short time period. Shahbaz *et al*., (2017) estimated the coalition among energy use and over-all growth by adding vital segments like economic expansion, labor and money into it from Indian outlook. They explored that any disbalancing or disturbances in energy utilisation and monetary affairs will have adverse effect on economic spread. While, they observed hostile effects of economic advancement and rapid expansion on work force. They suggested that policy makers should work on boosting economic growth and eco-friendly practices with focusing on preserving of energy. Liddle *and* Lung (2010) had discovered that ecological changes occurred because of inhabitant's activities, radiations from automobiles, residential and power utilisation for a group of mature economies. Their study revealed that the residential power use-age and population growth are categorically and impressively connected. The strong evidence of over-all population, per capita utilization are linked and shared large scale kindred with filthy radiations.

Bargaoui *et al*., (2014) had revealed that anthropogenic activities resulted into climatic changes and green-house gas emissions and also affect negatively over peers. They highlighted few points on the basis of their study. They discovered that population contributes to increase in carbon dioxide emission and it has been proved true in almost all countries. Secondly, the upward GDP per capita is also a leading factor in growing of emission level. They also found that industrial activities, energy efficiency and use-age are also measured in terms of GDP. Also, use of advanced and up-to-date technology can help in overcome the causes of environmental degradation. They found the strong effects of urbanization on CO2 emission. They suggested that all the countries should contribute jointly for mutual cooperation, clean development mechanism and tradable emission permits.

Sharma (2011) has examined the topmost factors of carbon secretion in 69 countries. He studied them on the basis of net income and then ranked them accordingly as high, middle and low range economies. He also pointed out that overall output affects optimistically on ecological deterioration while mercantilism has shown pessimistic behavior with radioactivity. The study further explained the factors accountable for power utilisation showed clear-cut and positive behavior towards carbon emission. Kishtawal *et al*., (2010) identified the connexion among changes in land management and weather that forecast precipitation. Their study explain that changes in land utilisation and agricultural alterations are directly affiliated. The study showed deep concerns regarding the adversities of agronomic deterioration and how it affects course of precipitation on India. Their study has revealed that the areas which receives high rate rainfall during rainy season has a noteworthy rise in concentration of inhabitants which is a sign of urban expansion. They endorsed the idea of land-management should be priority from the future point of view/perspective. Riahi *et al.*, (2011) investigated the pivotal elements of the representative concentration pathways (RCP) scenarios. It has created strong alliance with population increase and weaker with increase in income pattern while moderate with technological alteration and energy concentration development. Their study exposed a long-lasting bond between high energy and releases of greenhouse vapours. They analysed that with advanced, up—to-date technological equipment and expertise, there is still possibility to lower the poisonous radiations caused by the pollutants. They proposed a strong policy in order to protect the health of entire ecosystem. Brander *et al*., (2012) has explained the outcomes on marshland due to disturbances in ecosystem. Their study throws light on both quantitative and qualitative factors that are relevant and in accordance with the environment yet they've been ignored. They explored the ecosystem via three angles

i.e. with respect to site-specific (which underline the key areas), study-specific (that highlighted the missing reasons of ecosystem) and context-specific (relates from economic point of view) which covers all spheres of biodiversity. The advocated for joint collaboration with effective practical policies in order to curb environmental deprivation. Arazmuradov (2011) investigated the nexus of carbon emission from the perspective of global warming context and environmental efficiency from fifteen (15) former Soviet Union (FSU) economies from the year 1992-2008. Their study showed optimistic behavior in regard to Kyoto protocol that favours of arresting of such ingredient(s) which contaminated the whole ecosystem. They observed that the national output and carbon emission are opposite in nature. Indeed, the reduction of poison elements costs huge financial strength. Though the pattern of radiations in FSU states has showed a positive trend yet the identical efforts have been made to control it. Their view point is, countries should be classified on the basis of serious measures taken to diminish out all the toxic matter. They suggested on to use-age of eco-friendly seeds, technological gadgets, recycling processes, formal and informal encouragement, socio-political awareness and strict policies to overcome this issue. Çetintaş and Sarikaya (2015) tested the triangle of carbon emissions, economic growth and energy consumption with inclusion of production of atomic energy, international trade and urban expansion in United States of America and United Kingdom from the period 1960-2004. All chief areas of economy showed constructive effect toward generation of venomous material in both short and long run. US is ahead than united Kingdom in consuming of energy in both spans. They suggested to keep eyes on protection of ecology and inhabitants health from all kinds of mishaps. Undoubtedly, a gigantic amount is required for this, yet they believed that rely on atomic power should be less and more on alternatives. Kaya *et al.,* (2017) observed that the national output volume,

free trade area and joint ventures influenced carbon emanation. In the long run, both business activities and investments showed positive effect on radiations releases in the long run while adverse in short span. The duplex has been noted in investment and radioactive discharge while simplex discovered among merchandising and carbon releases in case of turkey. Their study revealed that commercial activities and investments though bring advancement yet it boost the spread of noxious radiations towards the nations suffering from negligent behavior in ecological regulations. Evolution towards Green market, economy and environment should be installed on war basis. They suggested that the governments should collaborate together with actual emphasis on the industries which affect the ecosystem. Such mechanisms should be taken into account which are in accord with the policies of world trade organization (WTO), United Nations Conference on Trade and Development (UNCTAD), United Nations Environment Programme (UNEP) and Multilateral Environmental Agreements (MEAs) etc. Fan *et al*., (2017) analysed the consequence of urban-explosion on the value of ecological system. They observed that the major areas of Chinese economy are link with its ecology. They are of the view to maintain the balance, proper measures and rules should be followed with focusing on eco-friendly devices, economical green urban concept and sustainable market economy. They suggest the need of harmonies among all socioeconomic and futuristic policies with ecological conservation remain on top priority list. Lin *et al.*, (2017) studied the powerful instruments of environmental impact with keeping in mind the provincial variances. They found the adverse ecological impacts due to population expansion although did not find any noteworthy effect of suburbanization over ecology. They found variances in population expansion, land-dwelling suburbanisation because of differences in their socio-economic development position. Chuanglin (2017) has found urban increment as primary carrier

that boosts china's growth and ecological system. These three factors has turned china into global leading socio-political and business economics hub which captured the eyes of everyone. On the other hand expansion has applied tremendous pressure on municipal areas which has disturbed the ecology. They advocated for serious monitoring, collaborative efforts and eco-friendly technological advancements in order to protect habitat. Zhao *et al*., (2017) discussed the multifaceted kinship among urban spread, advance mechanization and aerial quality in china. They elaborated that effective past policies led china to grow its socioeconomic indicators with lowering contamination and help it to become a leading example of modern day revolution. No doubt , while keeping effective and efficient measure in focus, extension cum enlargement processes and utilisation of land has damaged the ecosystem of Chinese mega cities. They recommended intense policies, restriction of factors causing environmental degradation, less burdening on metropolises and environmental protection. Wei *and* Guanjun (2016) investigated the multifaceted factors affecting ecology by exerting pressure via numerous ways. They found that uprising of green agendas affect positively on majority of macroeconomic indicators plus on well-being factors while negative outcomes on literacy level, auto-mobiles, and pollution matters. They disclosed that today's world is a victim of severe climatic disasters, temperature issues and other catastrophic events. They preferred to set industries on green cyclic programs, safeguarded the ecology, resources, energy, health, and welfare of society as a whole. Srinivasan *et al.,* (2013) forecasted the addition of nearly three to five billion new inhabitants by the end of this century. According to their views, the answers to major obstacles of the upcoming era will be through Institutional, Infrastructural, financial and with the involvement of all stake holders. Their influence will eventually lead to promotion of sustainability, well-being and progression in all spheres of life to

maintain harmony in the world. They suggested to work collaboratively in areas of water management, urban development, ecosystem, energy resources, utilisation of scarce resources, energy use-age, agroindustry and land utilisation specifically. Fang *et al*., (2013) discovered a solid bonding between urban progression and ecosystem. They've drawn attention towards this duet in order to deal this technically from present and future point of view. Their study make researchers, think tanks, governments, policy makers to focus on opt of such rules and regulations which create harmony, peace and balance among all socioeconomic, demographical, ecological and political indicators. Uttara *et al*., (2012) highlighted the key factors involved in deterioration of bionetwork because of urban sprawl which are legislation, regulating agencies, poor governance etc. They want immediate actions on war basis to upgrade metropolis, effective and efficient resource management, control over toxin substances and generation of solid waste. They demanded attention towards different initiatives in order to curb down the ecology problems i.e. regulatory fee, impose of levy, formal and informal knowledge, voluntary and involuntary campaigns and social awareness programs to nurture masses. They suggested policy makers to proper standardise the magnitudes of metropolitan areas, eradicate the enlargement, and land management.

Shepherd *et al.,* (2010) has analyzed influence of urban growth on hefty precipitation throughout monsoon period in India. With the help of remote-sensing data and deep statistical examination, they discovered an upward trend of hefty precipitation receiving by those areas where tremendous changes occurred in land management due to urban sprawl. They also noted that pattern of precipitation is more inclined towards urban areas as compared to non-urban. Their study throws light on the fact that urban growth has completely transformed the course of environment and rain system. Deng *et al.,* (2015) has found out that industrialization and urbanization are main features to the

transformation of farmland to other practices in China. Their result too illustrate a solid adverse association in urbanization and land use concentration.

2.2 Literature Regarding Developing Nations

The following researchers have worked for under developed nations in which they explored the linkages between urban expansion and milieu. These are shown as follows.

Alege *et al*., (2015) underlying and specify the strong rapport among the Trinity of pollution emitting substances, energy utilisation and economic expansion in Nigeria. They pointed out that the factor due to which ecological deterioration is increased in the country and which also lead to increase in the level of carbon dioxide emission on regular intervals is solely the use of fossil fuel. While, electrical utilisation is negatively associated with carbon emissions. They also indicated that as far as embracing and utilisation of refined power resources are opted, the meteorological effects of carbon emission gets decline. Uttara *et al.,* (2012) estimated that government and legislation agencies are also involved in environmental degradation. They found that poor governance, informal settlements and slums are responsible for unnatural living and working atmosphere. They suggested that, to improve municipal areas, resource utilization and pollution emission, the flood of vehicles should be controlled in the metropolitan areas. Likewise, necessary steps must be taken in order to halt the production of solid waste, standards of proper health and safety, encouragement via monetary incentives, educating masses, different campaigns, by jointly agreement between state and informal institutions in order to promote hygienic atmosphere for all should be considered thoroughly. Patra *et al.,* (2018) has discovered that in the last four decades the urban land increased massively and the huge decline has been observed in water build up areas, vegetation, cultivated areas, wetlands respectively. They agreed that disorganised, unexpected and mishandled urban sprawl not only slow down the

sustainability method but also adversely affect the key ecological module like precipitation, temperature, ground water level. Narayan *and* Narayan (2010) analysed the strong kinship among economic advancement and ecological standards. Their calculation showed that carbon emission process gets low as far as national income is increased in the long run while keeping the impact as positive and narrowly behind than short run. They are of the view that strict tax and trading scheme should be used to curb carbon emission. Lim *et al.,* (2014) has uncovered a robust three-way association between oil utilisation, carbon dioxide emission and volume of output in Philippines. They also attained three significant conclusions from their study. They detected the three sided consanguinity among oil consumption pattern , output growth and carbon emission. Whereas one sided kin also found between economic sustainability and carbon dioxide emission which predicted that as long as advancement is taking place the discharge of industrial contamination gets decline. They strongly recommended to rely less on oil consumption, increase of efficiency to lower radiation. Bribian *et al*., (2011) has unmasked that with utilisation of most advanced, innovative equipment and technology we can minimise the effect of those material which are affecting our natural habitat. They are also of the view that standardised replacement, recycling and effective waste management policy should be kept in mind. Farhani *and* Rejeb (2012) inspected the triangle affiliation among carbon secretion, national output and energy utilization in middle east and north African (MENA) countries and they arrived with the fact that this troika travel altogether. They indicated that upsurge in energy pattern will give rise to national output and carbon discharge. They proposed to opt such methods which lead efficient and effective use of energy utilisation while on the other hand doesn't stagnant productivity and revenue generation.

2.3 Literature Regarding Pakistan

I also included literature from Pakistan's point of view. The purpose of including their work is to relate my work with them. Though, they used different techniques regarding urban and ecological degradation. The literature regarding Pakistan's urban upsurge and ecological disturbances is given as follows. Yasin *et al.,* (2012) estimated the association among increase in urban growth, ecology, atmospheric condition and different societal issues while having eyes particular on provision of hygienic and suitable environment that has been compromise due to unintentional and unexpected sea of people migrated to urban areas from rural areas. They revealed that unintentional and unsystematic urban expansion is creating a lot of hurdles for ecology. Qasim *et al*., (2014) estimated that the main part of GDP is connected with industrialization growth. According to him, in Pakistan, the GDP is predominantly the main cause throughout due to which alterations observed in carbon dioxide emission and energy utilization. They are of the view that, if we compare deeply the components related to ecological and large scale macro system of economics, it'll help us in getting exciting discoveries and factors that are promoting carbon dioxide emission.

So, all the studies which we have reviewed in this chapter shows that every researcher has come up with his own model along some with some common variables but none has set any zero prior condition on other models. Qasim *et al*., (2014) have estimated the influences of urbanization on environment degradation. They are of the view that lives of the citizens is at the risk due to numerous factors like poor air quality, transportation, unsafe water, environmental issues , poor sanitation and unhygienic situation. Urban sprawl has many implications on our natural habitat. It's foot prints can be observed universally and has produced havoc in every sphere. Their study will

eventually help us in designing the suitable guidelines and tactics which concerned about ecology and urban expansion. Malik *et al*., (2017) has discussed the diversified drawbacks which are responsible for urban expansion and branded them as key features which are socio-economic mess, natural processes and mechanization and administrative procedures. The fast urban enlargement is an integral part of world-wide proliferation which is creating headache in almost every area of life for emerging economies.

Sajjad and Iqbal (2012) explored that the uprising population is a significant cause of expansion of city areas, automobile increment and constructing habitations. They also explained that mishandling and uncontrollable population has triggered imbalances in natural environment process.

From developed world, we have observed systematic and dynamic involvement of researchers who have used their own specific ways and models in order to explain the link between urbanization expansion and ecology. The list includes Arazmuradov (2011) , Bargaoui *et al.,* (2014), Brander *et al.,* (2012), Buhaug *and* Urdal., (2013), Chan *et al*., (2017), Chuanglin *et al*., (2017), Civco *et al*., (2010), Cui and Shi (2012), Deng *et al*., (2015), Dong *et al*., (2015), Guo *et al*., (2016), Liddle and Lung *et al.,* (2010), Li *and* Ma (2014), Lin., (2017), Riahi *et al*., (2011), Shepherd *et al*., (2010), Sarikaya *et al*., (2015), Tuomisto *et al*., (2012), Vi and Vaupel *et al*., (1989), Wei *and* Guanjun (2016), Wei and Zhang (2017), Zhang *et al.,* (2017), Zhao *et al.,* (2017).

From under developing nations, we also included the work of few economists who tried to explain their point of view through their research work. Theses include Alege *et al*., (2015), Bribian *et al*., (2011), Uttara *et al*., (2012) ,Farhani *and* Rejeb *et al.,* (2012), Kishtawal *et al*., (2010), Lim *et al*., (2014), Narayan & Narayan (2010), Ozturk *et al*.,

(2013), Patra *et al*., (2018), Sajjad and Iqbal (2012), Shahbaz *et al*., (2017), Sharma *et al*., (2011), Srinivasan *et al*., (2013), Ulengin *et al*., (2017).

In case of Pakistan, after reviewing this chapter, the scholars who have shown their contribution through work are as follows. These include Qasim *et al*., (2014), Malik *et al*., (2017), Yasin *et al*., (2012) respectively.

All the studies which we have reviewed showed that urbanization is significantly and positively related to ecological degradation. Regarding this issues, it has been revealed that urbanization is one of the many dominant causes that is responsible for variations and alteration in atmosphere in the long run. Pakistan is one of the developing countries that are currently bearings of urbanity on ecosystem. Many researchers used their own models without explaining proper variables while some of the researchers used repeated variables like others to explain the same typical work. However, researchers were unable to find out any study which cover this problem and that's why we used the ARDL model in which we discussed those variables and factors that actually needed and haven't utilised earlier nor used by any previous studies.

Thus, this study take all the major determinants like urbanization, arable land, CO_2 emission, GDP growth, Accessss to electricity, secondary school enrolment, urban population growth, Industrial growth, population, energy production, temperature change, fossil fuel energy consumption, rainfall other gas emission, total greenhouse emissions, energy utilisation, arable land percentage of total land, forest area. We, then, applied general to specific methodology on it.

2.3: Research Gap

The important gap after studying the literature is that a lot of studies examined the impact of urbanization on environment. We come to know that the previous studies

have misspecification problem and not even a single study has been done previously that showed the true impact of urbanization on environment in case of Pakistan.

In regard to Pakistan context, the scholars who have shown their contribution through work are as follows. These include [Anees *et al*., (2014), Malik *et al*., (2018), Malik *et al*., (2017), Sharif *and* Raza ., (2016) Yasin *et al*., (2012), Qasim *et al*., (2014)]. These researchers examined various factors like Pollution, economic growth, energy use, urban population, deforestation, climate change, sanitation, Access to electricity etc. Though, their study showed positive relation between ecological degradation and urbanization in the long run. But still their study lacked some key and fundamental factors.

This study examine the relationship between urbanization and environmental degradation and used potential variables like arable land, Hospitals per bed, industrial growth, secondary school enrolment, Fossil fuel energy, urban population growth, energy use, temperature change, rainfall, greenhouse gases, other gases greenhouse emission, land loss etc. So, we found two gaps in literature. First, these studies did not include two potential variables i.e. cities land extension and reduction in cultivated agri land in their models. Second, All the previous studies used models with different variables except some common variables and not imposed any prior restriction on other models, that is why according to correct specification axiom all models are misspecified. That is why we will use generalized model with all potential and find found true impact of all variables. In this respect this study will be a greater addition in the existing literature.

CHAPTER III

Methodology

The chapter consists of theoretical framework and model specification. The theoretical framework explains the theories and models on which we have formulated our methodology and make it align to both academia and scholastic approach. By using various techniques and methodology, we try to cover the maximum factors which are responsible and somehow related to urban expansion and ecological reduction. Here, in this part, we named those scientists who has done some previous work by using different simulations and techniques to explore the linkages between urban sprawl and ecological degradation.

3.1 Theoretical Frame Work

Urban expansion and ecosystem are considered the two most imperative features related to entire humanity. There are multifaced factors and numerous opinions held by researchers that claimed urbanization has impact on environment. Our approach is matched both academically and scholastically in multidimensional styles and techniques exclusively.

Ehrlich and Holdren (1971) had first lodge their model "IPAT model". IPAT is a simple model that describes the kinship between technological advancement and ecological system. Mathematically. It explained that IPAT is a distinctive character which explains that ecological impact (I) is the combine creation of population (P), affluence(A), and Technology(T). They discussed ecological clash/jolts are actually incited by humans They also believed that forces behind such anthropogenic activities are population, materialistic mindset and technology that lead to deterioration of ecosystem. The key

point they highlighted through their research was that, we cannot held any variable accountable or blame for any ecological alteration.

Moreover, Dietz and Rosa (1997) has explored the consequences of dwellers on material comfort. They established a theoretical interpretation after modification of IPAT model and given it the name "STIRPAT" is a model that provides a strong, solid and flexible skeleton which not only diagnose problems regarding natural ecology but also open doors for fruitful futuristic implications. They added two more components which were absent in previous study. According to them, the internal forces are equally responsible as external forces for the anthropological affects affecting the ecosystem. They have discovered some inappropriate factors in the IPAT model and they bring about new changes in it. They estimated national carbon emissions as well as of other pollutants.

On one hand, according to Brundtland (1987) report the span of economic advancement hinge on policies, enlargement and sustenance of eco-conservation management while on the other hand, Birkin *et al*., (2002) share their viewpoint that, the economy that grows only in one direction and forgo other side profits/benefits and consequences, those economies will steadily going for disaster or face adversity in their growth in the future duration.

York *et al*., (2003) presented a diverse instrument and call it as plasticity which was used to quantify the possible powers and species that cause any variation in the pattern of folks, wealth status and technical knowledge. Plasticity constitutes on duo factors, one discussed the aptitude and scope of every operational constraint while the second one emphasized on assessing and evaluating the characteristics that leads to customize individual circumstances. York *et al*., (2003) analysed all the key tools and put forward

all the well-known factors affecting ecosystem due to anthropogenic activities. They have studied all the functionalities of IPAT model, the Impact model, and STIRPAT is a model which is their counterpart. They explored the trio between these three conceptual models along with their resemblances and dissimilarities. Waggoner and Ausubel (2002) has completely reshaped the "IPAT model" in order to detect the other key player's role. He used an army of variables like populace, income per capita, good's intensity in terms of GDP, effectiveness, parentages and workforce. They measured the combined intensities with keeping sustainable production and consumption patterns in foresight. They named their model as "IMPACT". This model interprets the relationship between STIRPAT model and drivers of IPAT model to make newer IMPACT. They are of the view that, through maintainable manufacture and ingesting processes we can achieve the moto of balance life with least influence on our ecosystem.

The model Impact variable explained as, parents has been referred as P, workers with A, consumers with C, and producers as T .

They evolving the STIRPAT model and adding the idea of ecological elasticity (EE) in it. To describe the bond of STIRPAT and EE, we try to take the sum total of all elasticities related to ecosystem i.e. population, affluence with numerous other factors related to it, secretions of carbon dioxide from petroleum ignition along with energy purposes from interethnic regions, a compound portion include the effects from petroleum products, geothermal power and atomic energy.

CHAPTER IV

Data and Methodology

This chapter discusses the models and their specifications that we used in our study. It consists of different models i.e. from general model to ARDL (Auto regressive remodel that we used to explain the impact of urbanization on environmental degradation. We used four different models to explain the impact of urbanization on environmental degradation in case of Pakistan. The ARDL model is a general model, in which the dependent variable depends on own lag values and current and lag values of independent variable. The ARDL is a general model which has ability to tackle the problem of misspecification even when there are limited information regarding any issue. For the purpose of understanding we are using two variables model.

4.1 Model Specifications

According to axiom of correct specification, study used general model, and which leads us to ARDL model. Autoregressive distributed lag model (ARDL) is a general model which have ability to tackle the problem of misspecification even when there are limited information regarding any issue. The main objective of the study is to estimate the effect of urbanization on environment status in Pakistan. To meet this objective study estimate four models. In this way we generate a more general unrestricted model which can cover the issue of misspecification.

4.2. What is Autoregressive Distributed Lag (ARDL) Model?

The ARDL model is a general model, in which the dependent variable depends on own lag values and current and lag values of independent variable. For the purpose of understanding we are using two variables model. The regression form of ARDL (1, 1) is following:

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 X_t + \beta_3 X_{t-1} + \varepsilon_t \hspace{2cm} \text{Eq. (4.1.1)}$$

The, Y_t is dependent variable X_t is an independent variable. The, ε_t is an error term which is showing the effect for other variables which are out of regression analysis. After fitting model the residual analysis also employs for the validation of regression results.

4.3. Model Specifications

The description of models is as follow. First model is to find out the potential determinants of urbanization. The second model is to explore the true determinants of environment status. The third model is to investigate the effect of urbanization on environment status along the determinants of environment status. The forth model is to estimate the effect of determinants of urbanization on environment status along the determinants of environment status.

4.3.1 MODEL 1: EXPLORING THE DETERMINANTS OF URBANIZATION

At first we make a model to find out the potential determinants of the urbanization in Pakistan. In this model we include all variable which are being used in previous studies separately (on which the data is easily assessable) but we are including all variables in one model. The econometric equation for urbanization model is given in following (Equation 4.3.1):

$$LURB_t = \alpha + \beta_1 \, ALPTL_t + \beta_2 \, CO_2E_t + \beta_3 \, GDPG_t + \beta_4 HB_t + \beta_5 LATEU_t +$$
$$\beta_6 \, LSES_t + \beta_7 \, UPG_t + \beta_8 \, IG_t + \beta_9 \, PG_t + \varepsilon_t \hspace{0.5cm} \text{................} \hspace{0.3cm} \text{Eq. (4.3.1)}$$

Table 1: Description of variables of model one: Exploring the determinants of urbanization

LURB	Urbanization (%total population)	LATEU	Access to electricity (% urban population)
ALPTL	Arable land (% total land)	LSES	Secondary schooling enrolment
CO_2E	CO_2 Carbon dioxide emission (metric ton per capita)	UPG	Urban population growth
GDPG	Gross Domestic Product Growth	IG	Industrial growth
HB	Hospital beds (per 1000 people)	PG	Population Growth

In order to Justify the model one variables, in this model relate all the potential factors in a filament. The Justification of variables of model one is as follows:

i. The dependent variable is urbanization while the independent variables are access to electricity percentage of urban population, arable land.

ii. Schooling enrolment, CO_2 Carbon dioxide emission, urban population growth, gross domestic product growth, industrial growth, hospitals per bed and population growth.

The urban population has been drawn from total population. It has been taken into account to calculate how much rise in percentage of population has increased . The inhabitants moved to metropolitan areas came for the reasons like access to basic necessities, high school education and above level, medical facilities, jobs and industrial needs. This will lead to rise in gross domestic product, industrial growth, population growth which is good for our economy yet at the same time it over burden our population, loss in arable land areas which can be utilised for agribusiness purposes and instead of relying and burdening our rural areas for production the fertile land

around cities can be used but due to urbanity we loss our agricultural land and it not only lead to increase in population but also prompts carbon emission and other pollutant material as well. In this way, all the potential factors joined together in a string.

4.2.2 Model Two: Exploring the Determinants of Environment

We use second model to explore the determinants of the environment status in Pakistan. In this model we include all variable which are being used in previous studies separately (on which the data is easily assessable) but we are including all variables in one model. The econometric equation for environment status model is following:

$$CO_2E_t = \beta_0 + \beta_1\ TCDC_t + \beta_2\ RFMM_t + \beta_3\ LTGHGE_t + \beta_4\ ARAL_t + \beta_5\ EP_t +$$

$$\beta_6 FFEC_t + \beta_6\ OGGHE_t + \beta_7\ EU_t + \beta_8\ FATL_t + \epsilon_t \quad \ldots\ldots\ldots Eq.\ (4.2.2)$$

Table 2: Description of variables of model two: Exploring the determinants of environment

CO_2E	carbon dioxide emission (metric ton per capita)	EP	Energy production (kilo tons of oil)
TCDC	Temperature change (degree Celsius)	FFEC	Fossil fuel energy consumption
RFMM	Rain fall (millimetre)	OGGHE	Other greenhouse gas emission (metric tons)
LTGHGE	Total greenhouse gas emission	EU	Energy use (kilo gram of oil)
ARAL	Arable land (% total land)	FATL	Forest area (% total land)

The Justification of variables of model two is as follows

    i.   The dependent variable is carbon dioxide emission while the independent variables are energy production, temperature change, rainfall, other greenhouse gas emission, total greenhouse gas emission, energy use, arable land and deforestation.

ii.   The carbon emission occurred because our economy is energy driven and as the amount of carbon increases as industrial efficiency increases. As majority of our economy run and depend on oil imports, the oil used is utilised by all areas of economy.

iii.   The energy demand and supply also fulfils by fossil fuel energy.

iv.   Also, due to commercial activities, greenhouse gases contaminated the environment which lead to increase in the amount of other greenhouse gases too. This leads to rise in temperature which automatically destroy the milieu. Due to placement of industrial and housing sectors which lead to increase in deforestation and altered the rainfall pattern but also the cause of loss of arable land as well. Hence, it is proved that all these reasons are justified and link to each other.

4.2.3 Model: Estimate the Effect of Urbanization on Environment

The third model estimates the effect of urbanization on environment status in Pakistan. This model includes urbanization variable along with all the potential determinants of environment status. The econometric equation for urbanization model is as following:

$$CO2E_t = \alpha_0 + \beta_1\ TCDC_t + \beta_2\ RFMM_t +\ \beta_3\ LTGHGE_t + \beta_4\ ARAL_t + \beta_5\ EP_t + \beta_6 FFEC_t +$$
$$\beta_6\ OGGHE_t + \beta_7\ EU_t + \beta_8\ FATL_t + +\beta_8\ LURB_t + \varepsilon_t\ \ldots\ldots\ldots.Eq.\ (4.2.3)$$

Table 3: Description of Variables

CO_2E	CO_2 emission (metric ton per capita)	EP	Energy production (kilo tons of oil)
TCDC	Temperature change (degree Celsius)	FFEC	Fossil fuel energy consumption
RFMM	Rain fall (millimetre)	OGGHE	Other greenhouse gas emission (metric tons)
LTGHGE	Total greenhouse gas emission	EU	Energy use (kilo gram of oil)
ARAL	Arable land (% total land)	FATL	Forest area (% total land)
LURB	Urbanization (% total population)		

4.2.4 Model Four: Estimate the Effect of Determinants of Urbanization on Environment

The Fourth model estimate the effect of determinants of urbanization on environment status in Pakistan. In this model, It includes urbanization determinants along with all the potential determinants of environment status. The econometric equation for urbanization model is following (Equation 4.2.4):

$$CO_2E_t = \alpha_0 + \beta_1\,TCDC_t + \beta_2\,RFMM_t + \beta_3\,LTGHGE_t + \beta_4\,ARAL_t + \beta_5\,EP_t +$$

$$\beta_6 FFEC_t + \beta_6\,OGGHE_t + \beta_7\,EU_t + \beta_8\,FATL_t + \beta_1\,ALPTL_t + \beta_3\,GDPG_t + \beta_4 HB_t +$$

$$\beta_5 LATEU_t + \beta_6\,LSES_t + \beta_7\,UPG_t + \beta_8\,IG_t + \beta_9\,PG_t + \varepsilon_t \quad ....Eq.\ (4.2.4)$$

Table 4: Description of Variables

CO_2E	Carbon dioxide emission (metric ton per capita)	EP	Energy production (kilo tons of oil)
TCDC	Temperature change (degree Celsius)	FFEC	Fossil fuel energy consumption
RFMM	Rain fall (millimetre)	OGGHE	Other greenhouse gas emission (metric tons)
LTGHGE	Total greenhouse gas emission	EU	Energy use (kilo gram of oil)
ARAL	Arable land (% total land)	FATL	Forest area (% total land)
ALPTL	Agriculture land (% total land)	LATEU	Access to electricity (% urban population)
GDPG	Gross Domestic Product Growth	LSES	Secondary schooling enrolment
HB	Hospital beds (per 1000 people)	UPG	Urban population growth
PG	Population Growth	IG	Industrial growth

4.3 Data Source

The data has been collected from WDI, United States Environmental Protection Agency (EPA), United Nations Environment Programme, Environmental Data Explorer, OECD Environment Statistics, Pakistan bureau of Statistic (PBS), Pakistan Meteorological Department (PMD) and Centre for economic research in Pakistan (CERP).

4.3.1 Data source of each variable

The information regarding the source(s) of variables is explained in the table below. It shows that each variable has been taken from authentic, meaningful and highly reliable source.

4.3.2 Table containing data source

Variable Name	Source/ Link of Variable
population growth	https://data.worldbank.org/indicator/SP.POP.GROW?locations=PK&view=chart
Urban population (% of total land)	https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS?locations=PK&view=chart
Carbon dioxide emission per capita (CO_2PC)	https://data.worldbank.org/indicator/EN.ATM.CO2E.PC?locations=PK&view=chart
Access to electricity (% of urban population)	https://data.worldbank.org/indicator/EG.ELC.ACCS.UR.ZS?locations=PK&view=chart
GDP Growth (GDPG)	https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=PK&view=chart
Hospitals bed (per 1000 people)	https://data.worldbank.org/indicator/SH.MED.BEDS.ZS?locations=PK&view=chart
Secondary school enrolment (LSES)	https://data.worldbank.org/indicator/SE.SEC.ENRR?locations=PK&view=chart
Industrial growth (IG)	https://data.worldbank.org/indicator/NV.IND.TOTL.KD.ZG?locations=PK&view=chart
Total green-house gas emissions (TGHGE)	https://data.worldbank.org/indicator/EN.ATM.GHGT.KT.CE?locations=PK&view=chart
Arable land (% of land area)	https://data.worldbank.org/indicator/AG.LND.ARBL.ZS?locations=PK&view=chart
Fossil fuel energy production(FFEC)	https://data.worldbank.org/indicator/EG.USE.COMM.FO.ZS?locations=PK&view=chart
Other green-house-gas emissions	https://data.worldbank.org/indicator/EN.ATM.GHGO.KT.CE?locations=PK&view=chart

Energy use (kg of oil)	https://data.worldbank.org/indicator/EG.USE.PCAP.KG.OE?locations=PK&view=chart
Forest Area (% of total land)	https://data.worldbank.org/indicator/AG.LND.FRST.ZS?locations=PK&view=chart
Energy production (Kt)	http://www.bp.com/statisticalreview
Land, geophysical parameters, temperatures, heat etc	1. https://giovanni.gsfc.nasa.gov/giovanni/#service=TmAvMp&starttime=&endtime=&variableFacets=dataFieldMeasurement%3AEnergy%2CVegetation%3B 2. https://giovanni.gsfc.nasa.gov/giovanni/#service=TmAvMp&starttime=&endtime=&variableFacets=dataFieldMeasurement%3AVegetatio %3B 3. https://glovis.usgs.gov/app?fullscreen=1 4. https://earthexplorer.usgs.gov/ 5. https://giovanni.gsfc.nasa.gov/giovanni/#service=TmAvMp&starttime=&endtime=&variableFacets=dataFieldMeasurement%3AVegetation%3B
Temperature Change (Degree Celsius)	**Dr. Shahzada Adnan: Meteorologist Pakistan Meteorological Departmen: Post Box #1214, Sector, H-8/2, Islamabad, Pakistan** **Phone#+92-51-4922168** **Fax# +92-51-9250368** **google.com/+ShahzadaAdnan**
Rainfall (millimetres)	**Dr. Shahzada Adnan: Meteorologist Pakistan Meteorological Department: Post Box #1214, Sector, H-8/2, Islamabad, Pakistan** **Phone#+92-51-4922168** **Fax# +92-51-9250368** **google.com/+ShahzadaAdnan**

CHAPTER IV

Results and Discussion

This chapter discusses the empirical analysis of urbanization, environmental status, and impact of urbanization on environment status in Pakistan. In this chapter we discuss four models; the modelling of urbanization, the modelling of environmental status of Pakistan, the impact of urbanization on environmental status, and the impact of potential determinants of urbanization on the environmental status in Pakistan. The ARDL model has been used for modelling by following Charemza and Deadman (1997) procedure.

5.1. Descriptive Statistics

The initial statistics has been given in table 5.1 which unveil some indications about the behavior of our considered economic series. The mean value of LUPTP (urban population percentage of total population) is 3.44 which shows on average the 3.44 percent urban population increase in total population every year while the maximum value it can go is given as 3.666% and minimum can go as 3.211% respectively. The standard deviation shows that it can go only 0.128 deviated from its mean.

The annual population growth (PG) stats are given as follows. The mean value of 2.59 percent depicts that on average that much increase occurs annually. It can go maximum to 3.36% and minimum of 1.59%, respectively. The standard deviation of it shows that it can be deviate only by 0.48 correspondingly to its average. The urban population growth is discussed as. The mean value of population growth is given by 3.598 percent which means on average of 3.598% increase in growth every year. The maximum value it gets to 4.513% and minimum to 3.0151%, separately. The standard deviation which is 0.497 clearly explains that our data is close to mean value. The LSES (secondary

school education schooling) variable description is given as. The mean values is given by 3.183 percent that shows on average it increase that much every year, while, the maximum and minimum values given as 3.831% and 2.80%.

Table 5: Summary of Statistics

Variables	Mean	Max	Min	Std. Dev.	Skewness	Kurtosis	Jrqu-Br
LUPTP	3.44	3.66	3.21	0.12	-0.05	2.00	1.966 (0.374)
PG	2.59	3.36	1.95	0.48	0.18	1.54	4.432 (0.109)
UPG	3.59	4.51	3.01	0.49	0.41	1.60	5.148 (0.076)
LSES	3.18	3.83	2.80	0.31	0.64	2.21	4.459 (0.108)
ΔLATEU	4.49	4.60	4.34	0.09	-0.61	1.77	5.92 (0.052)
IG1	5.73	16.26	-5.20	3.72	-0.10	4.21	2.993 (0.224)
HB	0.64	1.200	0.52	0.14	2.42	8.78	111.621 (0.000)
GDPG	4.74	10.21	0.46	2.17	0.10	2.65	0.31 (0.856)
CO2E	0.66	0.99	0.30	0.22	-0.15	1.62	3.863 (0.145)
ALPTL	46.98	49.95	45.67	0.90	0.76	3.89	6.201 (0.045)

The standard deviation is recorded as 0.313 shows that it can deviate nearer-by to its mean. The statistics of LATEU is describe as follows. The mean value found as 4.497 portrays that much annual increase respectively. While, it can go maximum to 4.603% and minimum to 4.34%, accordingly. The standard deviation shows that it can go only 0.090 to its mean value and indicate that it is normally distributed. The statistics of IG1 is given specifically as. The outcome of mean is given by 5.738 percent that shows annual increase correspondingly while the maximum and entries minimum recorded are 16.262% and -5.206% separately and the only value that showed figures below zero. Furthermore, the standard deviation calculated shows that it can only deviate to 3.72

from its mean value. Additionally, the statistics of Hospital per bed (HB) is recorded following. It's mean is calculated as 0.64 percent which depicts that much annual increase respectively. On the other hand, the highest and lowest estimates values are noted as 1.2% and 0.52% individually. Whereas, the standard deviation is calculated as 0.14 which is near to average/mean value.

In addition, the stats of gross domestic product growth (GDPG) are as follows. The mean value is given as 4.74% depicts that much increase annually. While, the extreme and least values calculated as 10.21% and 0.468% so far. On the other hand, Standard deviation is found as 2.17 which shows that it's normally distribution and nearby to mean/average.

The carbon dioxide emission (CO2E) dimensions given as follows: The mean is given by 0.65 percent which depicts that much increase per annum in it. The highest and lowest values counted of CO2E are 0.99% and 0.30% exclusively. However, its standard deviation has been calculated and deviate only 0.22 to its mean.

The statistics of agricultural land percentage of total land (ALPTL) is given as follows. Its mean is calculated the highest as 46.98 percent which portrays that much annual increase in it, while, on the other hand, their maximum and minimal values have been found as 49.95% and 45.66%, separately. Beside this, the standard deviation counted 0.90 which proves that its nearby to its mean value accordingly.

The skewness, kurtosis and Jarque-Bera values are given follows. The skewness and kurtosis deals with symmetry and distribution, respectively. The skewness values of our given variables i.e. LUPTP, PG, UPG, LSES, LATEU, IG1, HB, GDPG, CO2E, and ALPTL are stated as follows 0.05, 0.18, 0.41, 0.64, -0.61, -0.10, 2.4, 0.10, -0.14, and 0.76 respectively. While, the kurtosis stats are given as 2.00, 1.54, 1.60, 2.21, 1.77,

4.21, 8.78, 2.65, 1.62, and 3.89 individually. Also, the Jarque-Bera values of variables are as follows i.e. 1.96, 4.43, 5.14, 4.45, 5.92, 2.99, 111.62, 0.31, 3.86, and 6.20, correspondingly.

5.2. Unit root Testing

The unit root testing of all the variables is employed on the entire variable. The results are following in table 5.

The unit root test is used to examine the stationarity of the data. As the data used in our research is based on time series, so, I applied unit root to check whether my data is stationary in nature or not. For model specification, we have to check whether our whole data is stationary in nature. If our data is stationary then we are going to apply ARDL model because ARDL model require stationary data series.

Table 6: The Results of Unit Root Test

Variables	At Level		At First Difference	
	Constant	**constant and Trend**	**Constant**	**constant and Trend**
ALPTL		0.12322		
ATEU	0.0505			
CO2E		0.12249		
GDPG	0.1801			
GDPPC	0.4234			
HB		0.12528		
LGDPPC		0.13470		
LUPTP	0.2033			
PG		0.07822		
SEP		0.12411		
CO2EPC		0.11864		
TCDC		0.08976		
EP		0.11838		
ΔFFEC				0.1372
RFMM	0.055861			
FATL		0.09682		
LTGHGE		0.14363		
ARAL		0.09776		
OGGHE		0.10428		
ΔEU				0.3788

KPSS test Ho: Series is stationary. The asymptotic critical values at 5 percent are 0.463000 and 0.146000 with constant and constant and trend respectively.

We applied unit root test on variables the results are given above in table 6. The results are indicating that all the variables are stationary at level; except two; FFEC and EU they are stationary at first difference. The most of the variables are stationary with linear trend which means there is linear trend in the series. To tackle this problem commonly the linear trend variable is introduced in the regression model but the ARDL model has ability to tackle this problem. After that we employ the ARDL model to explore the determinants of urbanization model.

5.3. Urbanization Modelling with Generalized ARDL model

We employed Generalized ARDL model with 3 lags of each variable by following Charemza and Deadman (1997) procedure. According to them with annual model should start from generalized model with 3 lags of each variable. After that, by following their General to Specific methodology impose joint restriction on each lag and exclude the lag values until we get jointly significant lag value. By following stated procedure we used ARDL model with 3 lags and the results are given in below. The results are following (Table 7):

Table 7: Results of Urbanization Model With Generalized ARDL Model

Variables	Coefficient	Std. Error	t-value	t-prob
LUPTP_1	1.54271	0.2395	6.44	0.003
LUPTP_2	-0.19805	0.5563	-0.356	0.7398
LUPTP_3	-0.33658	0.3441	-0.978	0.3834
Constant	-0.00293	0.01189	-0.247	0.8172
ALPTL	-0.00004	0.00003	-1.57	0.1917
ALPTL_1	-0.00006	0.00004	-1.65	0.1746
ALPTL_2	-0.00008	0.00004	-2.15	0.0985
ALPTL_3	-0.00004	0.0003	-1.38	0.2393
CO2EPC	-0.00069	0.00125	-0.553	0.6096
CO2EPC_1	0.00027	0.00175	0.153	0.8856
CO2EPC_2	-0.0011	0.00105	-1.04	0.3572
CO2EPC_3	-0.00051	0.00078	-0.652	0.55
GDPG	-0.00001	0.00001	-2.8	0.5919
GDPG_1	-0.00005	0.00002	-2.8	0.049
GDPG_2	-0.00005	0.00002	-2.25	0.088
GDPG_3	-0.00003	0.00002	-1.39	0.2374
HB	-0.00009	0.0003	-0.284	0.7903
HB_1	0.00014	0.00022	0.614	0.5724
HB_2	0.00022	0.00029	0.743	0.4987
HB_3	-0.00027	0.00017	-1.53	0.2009
PG	0.00694	0.00268	2.59	0.0605
PG_1	-0.02187	0.00504	-4.34	0.0122
PG_2	0.01425	0.00503	2.83	0.0472
PG_3	0.00056	0.00414	0.134	0.8996
LATEU	0.00086	0.00348	0.248	0.8164
LATEU_1	-0.00166	0.00178	-0.932	0.4042
LATEU_2	-0.00045	0.00235	-0.194	0.8558
LATEU_3	-0.00028	0.002	-0.141	0.8946
LSES	-0.00038	0.00027	-1.39	0.2364
LSES_1	0.00007	0.00031	0.231	0.8286
LSES_2	-0.00029	0.00037	-0.791	0.4734
LSES_3	-0.00095	0.00055	-1.73	0.1588
UPG	-0.00057	0.00041	-1.4	0.2351
UPG_1	0.00993	0.00038	26.4	0.0000
UPG_2	-0.0057	0.00241	-2.37	0.0768
UPG_3	-0.00341	0.0036	-0.946	0.3977
IG1	0.0000	0.0000	-0.26	0.8077
IG1_1	0.00001	0.00001	1.96	0.1216
IG1_2	0.00002	0.00001	2.88	0.0451
IG1_3	0.00002	0.00001	2.92	0.0432

(3,3) Model

Before interpreting the above we used F-test to check the joint significance of all the variable in urbanization model. The results are given in below table. The results are following (Table 8):

Table 8: Results of Joint Significance Test of Urbanization Model

Variables	F-test	df	Prob
LUPTP	16667	F(3,4)	(0.0000)***
Const	0.06094	F(1,4)	(0.8172)
ALPTL	1.3689	F(4,4)	(0.3842)
CO2E	0.4827	F(4,4)	(0.7512)
GDPG	3.2431	F(4,4)	(0.1405)
HB	0.9033	F(4,4)	(0.5383)
PG	12.651	F(4,4)	(0.0153)**
LATEU	0.3537	F(4,4)	(0.8308)
LSES	2.5808	F(4,4)	(0.1904)
UPG	231.41	F(4,4)	(0.0001)***
IG1	3.994	F(4,4)	0.1042

The *, **, and *** show the significance of variables at 10%, 5%, and 1% respectively.

This tables 8 explains the f-test for Joint significance of variables for our first model of urbanization. The variables included are urban population percentage of total population (UPTP), arable land percentage of total land, carbon-dioxide emission gross domestic product growth, hospitals per bed, population growth, access to electricity urban , school enrolment secondary, urban population growth and industrial growth respectively. Among all, only three variables got significant urban population percentage of total population (LUPTP), population growth (PG) and urban population growth (UPG) individually.

Before interpreting the joint significance results we employed restriction on lag values of unrestricted ARDL model. Study has two hypotheses Ho and H1 correspondingly. In that, we impose restrictions to check the joint significance of lag values.

Ho: restrictions are valid (The lag values are jointly insignificant, imposed on each lag value)

H1: restrictions are not valid (The lag values are jointly significant, imposed on each lag value)

Table 9: Results of Joint Significance of Lag Values of Urbanization

	F-test	Df	Prob
Tests on the significance of each lag			
Lag 3	2.272	F(10,4)	-0.2228
Lag 2	8.0982	F(10,4)	(0.0293)**
Lag 1	124.07	F(10,4)	(0.0002)***
Tests on the significance of lags up-to 3			
	F-test	Df	Prob
Lag 3 – 3	2.272	F(10,4)	-0.2228
Lag 2 – 3	15.017	F(20,4)	(0.0088)**
Lag 1 – 3	0.6266	F(30,4)	(0.0000)***
Tests on the significance of lags up-to 2			
Lag 2 -2	8.0982	F(10,4)	(0.0293)**
Lag 1 -2	881.06	F(20,4)	(0.0000)***

The table 9 shows the results of joint restriction that the third lag is jointly insignificant that is why we exclude the third lag of each model. The P-value of joint significance test of third lag is 0.2228 which is far more that 0.05 nominal level of significance, because of this we eliminate the third lag value of each variable. The other two joint significance values of first and second lag are statistically significant that is why we cannot exclude them from model. As the P-value of second lag is 0.0239 which is less than critical value and P-value of first lag value is 0.0002 which is also less than 5%

level of significance. All this shows that we should exclude 3 lag value from model and retain first and second lag values.

Table 10: Results of Urbanization Model With Generalized ARDL Model

	Coefficient	Std. Error	t-value	t-prob
Constant	0.0133	0.0091	1.4600	0.1661
LUPTP_1	1.9450	0.1195	16.3000	0.0000
LUPTP_2	-0.9485	0.1176	-8.0600	0.0000
ALPTL	0.0036	0.0015	1.0300	0.3214
ALPTL_1	-0.0032	0.0015	-0.1270	0.9009
ALPTL_2	0.0030	0.0010	0.0561	0.9560
CO2EPC	0.0015	0.0010	1.4500	0.1705
CO2EPC_1	0.0009	0.0010	0.9410	0.3627
CO2EPC_2	0.0006	0.0009	0.6330	0.5367
GDPG	0.0000	0.0000	-0.2800	0.7833
GDPG_1	0.0000	0.0000	-0.8110	0.4307
GDPG_2	0.0000	0.0000	-1.6700	0.1168
HB	0.0001	0.0002	0.5210	0.6107
HB_1	-0.0001	0.0002	-0.4890	0.6322
HB_2	-0.0003	0.0002	-1.1600	0.2669
PG	-0.0007	0.0014	0.5170	0.6131
PG_1	0.0121	0.0021	-5.7400	0.0001
PG_2	0.0108	0.0017	6.2400	0.0000
LATEU	0.0001	0.0018	0.0298	0.9767
LATEU_1	-0.0006	0.0018	-0.3490	0.7324
LATEU_2	-0.0005	0.0017	-0.2890	0.7766
LSES	-0.0003	0.0003	-1.0400	0.3150
LSES_1	0.0003	0.0003	0.8600	0.4042
LSES_2	-0.0001	0.0004	-0.3430	0.7369
UPG	0.0002	0.0004	1.9480	0.0612
UPG_1	0.0098	0.0004	24.8000	0.0000
UPG_2	-0.0091	0.0013	-6.9000	0.0000
IG1	0.0035	0.0015	1.8990	0.0057
IG1_1	0.0029	0.0012	1.7600	0.0077
IG1_2	-0.0021	0.0011	-1.6820	0.0581

(2, 2) model

Before interpreting the above table 10 results we used F-test to check the joint significance of all the variable in urbanization model. The results are given in below table 11. The results are following (Table 11):

Table 11: Results of Joint Significance Test of Urbanization Model

Variable	F-test	df	Prob
LUPTP	47874	F(2,14)	(0.0000)**
Constant	2.1342	F(1,14)	(0.1661)
ALPTL	58.224	F(3,14)	(0.0052)**
CO2E	1.0523	F(3,14)	(0.4004)
GDPG	0.93623	F(3,14)	(0.4493)
HB	0.64581	F(3,14)	(0.5984)
PG	58.574	F(3,14)	(0.0000)**
LATEU	0.11095	F(3,14)	(0.9523)
LSES	0.60837	F(3,14)	(0.6205)
UPG	429.66	F(3,14)	(0.0000)**
IG1	77.226	F(3,14)	(0.0716)*

Before interpreting the joint significance results we employed restriction on lag values of unrestricted ARDL model. We have two hypothesis Ho **and** H1 correspondingly. In that, we impose restrictions to check the joint significance of lag values.

Ho: restrictions are valid (The lag values are jointly insignificant, imposed on each lag value)

H1: restrictions are not valid (The lag values are jointly significant, imposed on each lag value)

Table 12: Results of Joint Significance of Lag Values of Urbanization

	F-test	Df	Prob
Tests on the significance of each lag			
Lag 2	14.546	F(10,14)	(0.0000)**
Lag 1	132.81	F(10,14)	(0.0000)**
Tests on the significance of lags up-to 2			
Lag 2 -2	14.546	F(10,14)	(0.0000)**
Lag 1 -2	127840	F(20,14)	(0.0000)**

The results of table 12 show that all the lag values are significant jointly and individually that is why we cannot exclude any lag. That is why we explain the results of table 5.6 but there is problem which is that the some variable current and lag values are having different sign of coefficient. So, to tackle with this problem we use static long run solution, which explains us what is the actual sign of variables. The results of the static relation have been given in table 13:

Table 13: The Results of Static Long Run Relationship

	sum of coefficients	static long-run
LUPTP	0.00349	
ALPTL	0.00333	0.95533
PG	0.00054	0.15521
UP	0.00086	0.24557
IG	0.00421	1.20581

Results show that ALPTL has positive relation with urbanization which is not consistent with the existing literature. The reason behind this can be that our arable land is also increasing with time to time which can influence the conventional relationship. PG is also has positive relation with urbanization because as population increases urbanization also increases and this is consistent with the existing literature. Cohen (2011) world's urban population increased four-fold between 1950 and 2003, the world's rural population less than doubled going from 1.8 billion in 1950 to 3.2 billion in 2000. And while the world's urban population is expected to increase by almost 2 billion over the next 30 years, the world's rural population is actually expected to decline slightly falling from 3.3 billion in 2003 to 3.2 billion in 2030. Thus, all future population growth for the foreseeable future is expected to be absorbed in urban areas. Urban population also have positive relation with urbanization as population increases it ultimately lead to urbanization and some previous studies showed this relation. Yi and Vaupel (1989) assumes that rural-urban migration is that proportion of Chinese population currently residing in metropolitan areas, will increase to 80 percent by the year 2050. The last variable IG is also have positive relation with urbanization which is quite logical that as industrialization increases it enhance urbanization. Guo et al (2016) has argued that the urbanization has correlations with industrial pollutant emissions, and their relation should be address cautiously, because it depends on the combined influence of the scale effect, the intensive effect and the structure effect. Cheng (2013) view point, the level of urbanization and the development of service industry are found positive correlated. In other words, they are of the view that urbanization is the power of promoting the growth of business industry.

Table 14: The Results of Residual Analysis

	Df	F-stat	Prob
AR 1-2 test	F(2,11)	2.6058	(0.1185)
ARCH 1-1 test	F(1,42)	3.8787	(0.0855)
Hetro test	F(1,42)	5.4290	(0.0954)
RESET test	F(2,11)	1.456	(0.2748)

The residual analysis validates the results of regression. The AR is about the autocorrelation between the residuals. The statistics explains that the test results is insignificant it means there is no autocorrelation in the residuals. The ARCH test explains the that there is no more ARCH effect in residuals. The heteroscedasticity test explains that there is no more hetroscedasticity in the model. Reset test is used to find out the specification of the model which explains that the speciation is true. It over all show that the results of table 14 are reliable.

5.4. Environmental Status Modelling with Generalized ARDL Model

This section discusses the modelling of environmental status of Pakistan. it follows same process line urbanization modelling but for connivance we just explain the final models.

In the table 15. we employed Generalized ARDL model with 3 lags of each variable by following Charemza and deadman (1997) procedure. We used annual data and put structure of generalized model with 3 lags of each variable. After that by following their general to specific procedure, we impose joint restriction on each lag and exclude the lag values until we get jointly significant lag value.

Table 15: Results of Environmental Status Model With Generalized

Variable	Coefficient	Std. Error	t-Statistic	Prob
C	-11.2761	8.8521	-1.2738	0.2498
CO2EPC(-1)	0.5098	0.1806	2.8228	0.0302
CO2EPC(-2)	-0.5360	0.2332	-2.2984	0.0612
TCDC	0.0149	0.0071	2.0953	0.0810
TCDC(-1)	0.0165	0.0089	1.8661	0.1113
TCDC(-2)	0.0452	0.0107	4.2311	0.0055
RFMM	-0.0001	0.0000	-2.6002	0.0407
RFMM(-1)	-0.0001	0.0000	-1.6902	0.1419
RFMM(-2)	-0.0002	0.0000	-4.0585	0.0067
LTGHGE	0.0107	0.2031	0.0525	0.9598
LTGHGE(-1)	1.5701	0.3088	-5.0855	0.0023
LTGHGE(-2)	-0.1329	0.2332	-0.5697	0.5896
LTGHGE(-3)	-1.0405	0.1662	-6.2591	0.0008
ARAL	-0.0601	0.0110	-5.4758	0.0015
ARAL(-1)	0.0073	0.0087	0.8418	0.4322
ARAL(-2)	-0.0417	0.0095	-4.3708	0.0047
ARAL(-3)	0.0331	0.0074	4.4486	0.0043
EP	0.0000	0.0000	-4.4860	0.0042
EP(-1)	0.0000	0.0000	2.9051	0.0272
EP(-2)	0.0000	0.0000	-1.9779	0.0953
EP(-3)	0.0000	0.0000	5.9277	0.0010
D(FFEC)	0.0136	0.0056	2.4368	0.0928
D(FFEC(-1))	0.0067	0.0131	0.5094	0.6456
D(FFEC(-2))	0.0003	0.0107	0.0247	0.9818
D(FFEC(-3))	0.0205	0.0098	2.0777	0.1293
OGGHE	0.0000	0.0000	3.9034	0.0080
OGGHE(-1)	0.0000	0.0000	-3.4111	0.0143
OGGHE(-2)	0.0000	0.0000	5.3002	0.0018
OGGHE(-3)	0.0000	0.0000	-3.9946	0.0072
D(EU)	0.0021	0.0012	1.7280	0.1824
D(EU(-1))	-0.0021	0.0024	-0.8941	0.4372
D(EU(-2))	-0.0002	0.0018	-0.1220	0.9106
D(EU(-3))	-0.0033	0.0019	-1.7566	0.1772
FATL	-0.1946	0.3715	-0.5238	0.6192
FATL(-1)	-0.0871	0.4164	-0.2092	0.8412
FATL(-2)	-0.7467	0.3439	-2.1713	0.0729
FATL(-3)	0.2729	1.8809	5.4616	0.0016

Before interpreting the above we used F-test to check the joint significance of the entire variable in urbanization model. The results are given in below table 16. The results are following:

TABLE 16: The Results off-Stats of Environmental Status Model

Variables	F-stat	df	P-value
CO2EPC	5.33701	(2, 6)	(0.0466)
TCDC	6.59714	(3, 6)	(0.0259)
RFMM	7.49535	(3, 6)	(0.0188)
LTGHGE	13.7253	(4, 6)	(0.0035)
ARAL	11.1964	(4, 6)	(0.0061)
EP	18.4255	(4, 6)	(0.0016)
DFFEC	4.56975	(4, 3)	(0.1211)
OGGHE	8.3635	(4, 6)	(0.0125)
DEU	3.71165	(4, 3)	(0.1549)
FATL	8.66275	(4, 6)	(0.0114)

In the table 16 the calculation of F-stats and P-Values are given. The variables of the environmental models are included in it are stated as carbon-dioxide emission (CO2EPC), Temperature change in degree Celsius (TCDC), Rainfall in millimetre (RFMM), total greenhouse emission gas emission (TGHGE), arable land area (ARAL), EP, fossil fuel energy consumption (FFEC), Other gas green-house emissions (OGGHE), energy use (EU), forest area percentage of total land (FATL) respectively. Among the above mentioned variables, we applied F-test to measure joint significance. There are two justifications which are as follows.

1. Ho= restriction is valid

2. H1= restriction is not valid

According, to our f-test, only two variables who proved insignificant i.e. energy use (EU), and fossil fuel energy consumption (FFEC) while other approved as Ho.

There is a problem which is that the some variable current and lag values are having different sign of coefficient. So, to tackle with this problem we use static long run solution, which explains us what is the actual sign of variables. The results of the static relation have been given in table 17:

Table 17: The Results of Static Long Run Relationship

	Static Relationship	
	Sum of Coefficients	**Statistics**
CO2EPC	-0.0458330	
TCDC	0.0766180	-1.6716776
RFMM	0.0003298	-0.0071957
LTGHGE	-0.4074490	8.8898610
ARAL	-0.0613420	1.3383806
EP	0.0004897	-0.0106844
OGGHE	-0.0000174	0.0003796
FATL	0.7555620	-16.4851090

Results show that variable temperature change in degree Celsius is negatively correlated with CO_2 emission per capita. The reason may be that the temperature is ultimately raised because of increase in the use of fuel (either fossil fuel or some kind of fuel used to generate energy), which leads to increase in CO_2 emission. Rain fall in millimetres has positive relation with per capita CO_2 emission. As rain fall increases it clears the atmosphere and the quantity of the CO_2 in the atmosphere decreases. Novara *et al.,* (2012) revealed that soil respiration is strongly linked with rain exposure and their interaction. CO_2 emission is greater in soil exposed to rainfall than soil which was not exposed. According to Malla (2008) increase in temperature and CO_2 levels is also a threat that could bring catastrophic problems for humanity. It is concluded that overall impact of climatic change will have negative implications in the long run. Clark *et al.,*

(2003) revealed sensitivity of the net carbon balance of tropical rain forests that lead to increase in temperature, and thus indicate the potential for these forests to produce a large positive feedback to on-going atmospheric CO_2 accumulation. Such a feedback in future years would accelerate global warming.

LTGHGE has positive relation with per capita CO_2 emission as total quantity of total green-house -gases increases then as CO_2 is also a green-house gas so it is evident that CO_2 is also a part of green-house gasses. ARAL and has positive relation with CO_2 emission, it looks quite illogical because as arable land increases CO_2 emission should be decreased but logic behind this increase in $C0_2$ is that arable land is increasing slower than CO_2 emission that's why it is showing positive relation. EP and OGGHE has negative relation with per capita CO_2 emission as energy is produced from fuel and as fuel consumption increases it adds up more CO_2 to the environment. According to Alam *et al*., (2007) carbon dioxide (CO_2) emissions have turned into the largest source of greenhouse gases. Their study empirically investigated the relationship among economic development, energy intensity, CO_2 emission, population growth and urbanization in case of Pakistan. They pointed out that economic development in Pakistan is energy driven, which contributes substantially amount to CO_2 emissions. They indicated extremely inefficient energy use, which could become the biggest economic problem for Pakistan.

FATL has negative relation with per capita CO2 emission as forests emits oxygen and consumes carbon dioxide. According to Baccini *et al*., (2012) deforestation in tropical America is widely reported to have occurred in lands with lower than average carbon density. Flux models capable of more fully using information on the spatial distribution of deforestation and carbon density will allow further refinement of carbon emission estimates from tropical nations.

The residual analysis validate the results of regression. The AR is about the autocorrelation between the residuals. The statistics explains that the test results is insignificant it means there is no autocorrelation in the residuals. The ARCH test explains that there is no more ARCH effect in residuals. The heteroscedasticity test explains that there is no more hetroscedasticity in the model.

Table 18: The Results of Residual Analysis

	Df	F-stat	Prob
AR 1-2 test	F(2,11)	4.9897	(0.9327)
ARCH 1-1 test	F(1,42)	0.4653	(0.5782)
Hetro test	F(1,42)	3.0980	(0.1435)
RESET test	F(2,11)	2.8464	(0.4863)

Reset test is used to find out the specification of the model which explain that the speciation is true. It over all shows that the results of table 18 are reliable.

5.5 The Urbanization Impact of Environmental Status Modelling with Generalized

In this section we discuss the empirical impact of urbanization on environmental status in Pakistan through ARDL model. The results of model are given below in table 19.

Table 19: The Results of Urbanization Impact of Environment

	Coefficient	Std. Error	t-value	Prob
Constant	-13.1021	3.0590	-4.2800	0.0001
LUPTP	0.6340	0.3415	1.8600	0.0713

LTGHGE	0.4156	0.1556	2.6700	0.0112
FATL	0.6674	0.1520	4.3900	0.0001
FFEC	0.0086	0.0011	7.6700	0.0000
EP	0.0011	0.0015	7.5400	0.0000
LTGHGE_1	0.2919	0.1683	1.7300	0.0912

Regression results shows that as urbanization and total green-house gas emission are simultaneously significant at 10%, 5% level of significance while forest area percentage of total land, fossil fuel energy consumption and energy production are all highly significant at 1% level of significance.

Urban population and total greenhouse gas emissions. The study of Glaeser *and* Kahn., (2010) also explained that by keeping people and their earnings as constant, the geographical spread is one of the main factor contributing towards generation of greenhouse gases. The researches done by (Holtz-Eakin & Selden, 1995; Auffhammer & Carson, 2008) found that if we analyses on the scale of domestic and regional area, the greenhouse emissions shows strong relation with people and their income pattern. While Dodman (a) (2009) discovered no association between urbanization and generation of greenhouse gases.

FATL and UPTP According to Tilman *et al*., (1994), usually the ecological system and human interaction led to form flora scheme in urban areas. They are of the view that, cover of shrubs and bushes can be sustained in metropolitan areas. Throughout the municipal areas, pattern of forestation always rank on top while sustaining the geography of metropolitan areas.

Meyer and Turner (1992) found that, during this particular century, we have seen unexampled and enormous man-made ecological changes including those related to

land utilization patterns. On the broad scale, they discovered a strong kin between annually land utilization (woodland, crop lands and grazing areas) procedures and expansion in population.

FFEC and UPTP Pataki *et al.,* (2009) discovered a positive trio among the generation of gaseous radiations, enlargement in built-up region and construction of civic highways. They are of the view, that, to reduce the worldwide phenomena of facing the consequences generated from secretion of fossil fuel, we need an array of studies from both developed, developing and under develop nations in order to dispose the matches and alterations, for this we have to go corner to corner geographically and administratively.

The results of the residual Analysis are given as follows. The following table is about the autocorrelation between the residuals.

Table 20: The Results of Residual Analysis

	Df	F-stat	Prob
AR 1-2 test	F(2,32)	0.01723	(0.4658)
ARCH 1-1 test	F(1,42)	0.12329	(0.9845)
Hetro test	F(18,25)	0.91488	(0.3491)
RESET test	F(2,11)	0.3895	(0.0657)

The residual analysis validates the results of regression. The AR is about the autocorrelation between the residuals. The statistics explains that the test results is insignificant it means there is no autocorrelation in the residuals. The ARCH test explains that there is no more ARCH effect in residuals. The heteroscedasticity test explains that there is no more hetroscedasticity in the model. Reset test is used to find

out the specification of the model which explain that the speciation is true. It over all show that the results of table 20 are reliable.

5.6. The Impact Determinants of Urbanization on Environmental Status Modelling with Generalized ARDL Model

In this section we explain the relationship between the determinants of Urbanization and environmental status in Pakistan. Study only adopted variable in this model which are significant in urbanization model and environmental status model. Regression results reveals that population growth and industrial growth which are also taken as independent variable for urbanization, are significant at 5% and 10%, respectively. While urban population growth is insignificant Table 21).

Table 21: Impact of The Determinants of Urbanization on Environment

	Coefficient	Std. Error	t-value	tprob
Constant	-7.6103	1.6800	-4.5300	0.0001
LTGHGE	0.5061	0.1225	4.1300	0.0002
FATL	0.3955	0.0768	5.1500	0.0000
FFEC	0.0087	0.0011	7.7000	0.0000
EP	0.0000	0.0000	6.8600	0.0000
ALPTL	-0.0021	0.0029	-0.7220	0.4748
PG	0.0313	0.0143	2.1800	0.0354
IG	0.0090	0.0046	0.1040	0.0818
UPG	0.0143	0.0506	0.2830	0.7788
LTGHGE_1	0.3424	0.1772	1.9300	0.0617

Modelling with ARDL Model

LTGHGE and FATL Kasischke *et al*., (1995) has showed deep concerns regarding storage of carbon in country side. They also found strong kinship among carbon emissions, forest areas and biomass processes. Their study laid stress on research on wide range of forest types found in boreal territory and biomass intake.

LTGHGE and FFEC Judkins *et al*., (1993) have discovered the strong affiliation between increasing fossil fuel energy utilization, growing climatic disputes and human health. They are of the view that with the help of technological advancement, administrative and modernization we can overcome the issues like entering of emissions in our aerosphere and acidic patters. By the use of non-fossil resources we can control a lot of disturbances regarding ecology.

LTGHGE and EP Halicioglu (2009) have studied empirically the bonding between emissions patterns, energy generation for profitable purposes, income and overseas trade in turkey. They have noticed that in both short and long run periods, these all factors are link with each other quite noticeably. They are of the opinion that turkey should work more on policies related to ecological system in order to control environmental deprivation. The high growth generates more pollution in environment. Tunc *et al*., (2007) and Telli *et al*., (2008) are of the view that turkey should address the problems related to its ecology, energy disputes, polluting substances in control radioactive substance. The government should make viable efforts towards stable and sustainability long term macroeconomic matters.

LTGHGE and ALPTL Kindermann *et al*., (2008) are of the view that greenhouse gases generations, forestation, natural ecosystem and financial system are link together with each other. They are of the view that, if we could decrease the rate of deforestation by 10% it would be feasible from financial point of view. A reduction to 50% in deforestation could help in reduce the emission generation by 1.5 to 2.7 gig tons of CO2/year between the years 2005 and 2030.

LTGHGE and PG Dietz *et al*., (1997) have analyzed that population, affluence, and technological advancement shared strong association, significant implications on

carbon and other radioactive secretions. Their study showed results that the overall impact of population is approximately correlated to its sizes and arrays throughout and its after-effects will be sensed in upcoming decades in majority of the economies.

LTGHGE and IG Ren *et al*., (2014) discovered that increasing trade, carbon generation, FDI and economic growth have strong association with one another. They are of the view that China should develop such mechanism that boosts foreign investment and which is also parallel with industrial set up. They also directed that Chinese merchandise should promote industrial, technical, effective use of resources, efficient energy use-age in order to curb down emissions, promote trade reforms, increase consumption patterns, and generates processes for eco-friendly products.

LTGHGE and UPG Liao *et al*., (2013) have discovered the bonding between land utilization and secretions due to greenhouse effects. All sectors of economy along with urbanization are responsible in generating greenhouse gas radiations except agribusiness and waste management areas. Their research also proves that chlorofluorocarbon discharge from residential and conveyance system are interrelated with urban expansion. If at early stage, both population and density are not addressed in a proper way, they become the chief cause of increase in radioactive generation and land maximization.

Table 22: The Results of Residual Analysis

	Df	F-stat	Prob
AR 1-2 test	F(2,35)	0.6414	(0.5326)
ARCH 1-1 test	F(1,42)	0.91143	(0.3452)
Hetro test	F(12,31)	1.6391	(0.1315)
RESET test	F(2,12)	0.5731	(0.0984)

The residual analysis validate the results of regression. The AR is about the autocorrelation between the residuals. The statistics explains that the test results is insignificant it means there is no autocorrelation in the residuals. The ARCH test explains that there is no more ARCH effect in residuals. The heteroscedasticity test explains that there is no more hetroscedasticity in the model. Reset test is used to find out the specification of the model which explain that the speciation is true. It over all shows that the results of table 22 are reliable.

CHAPTER VI

Summary and Policy Recommendation

Urban development has link its strings with economy and ecology on a large scale and in numerous multi-dimensional ways throughout the world. To examine the true determinants of urban progression and environment which leads to climatic alterations via industrial improvement is strategically crucial.

6.1 Summary:

This paper is an attempt to investigate the relationship between urbanization impacts on Pakistan. Secondary data for 48 years from 1970 to 2018 was used for this purpose. The study shows that factors like urban development and industrial waste have huge implications on ecology of the country. They both add their share equally according to their strength in polluting the environment. Our result showed that agribusiness and industrial revolution has expand yet destroyed the atmosphere in a severe pattern. The first step involves testing the characteristics of the data using ARDL test. Simple linear regression is also applied to estimate the relationship. All the variables used in the study are stationary in their first difference.

Expansion in urbanization is one of the main causes of ecological destruction. There are numerous factors that triggering the various socioeconomic impacts. But the determinants of urbanization are not only affecting physical outlook but also destructing the pattern of ecology. This emissions causing us not only a monetary cost in the form of direct cost (health cost) as well as indirect (unobservable) cost by reducing productivity in future. From both lenses, the direct and indirect costs have a outcome in the future that will be drastic. Therefore, more research is needed to highlight this issue as well. At first, we have noticed potential factors of urban upsurge that affecting

it. This includes urban population (UP), arable land percentage of total land (ALPTL), population growth (PG), industrial growth (IG), access to electricity in urban areas (LATEU) shares positive relation with over-all urbanization. As population increases it lead urbanity process by linking with industrial factor which lead to production factors but at the same time due to this, arable land gets demolished. So, these all are linked together in a string.

At second stage, after analyzing the environmental determinants on carbon dioxide emission per capita, it is concluded that rainfall in millimeter(RFMM), Total greenhouse gas emissions (LTGHGE), arable land percentage of total land (ARAL), are positively correlated to carbon dioxide emission per capita (CO_2PC). While the temperature change in degree Celsius (TCDC), energy production (EP), other gases greenhouse emissions (OGGHE) and forest area percentage of total land (FATL) have shown negative impact which clearly indicates that economic development, forest area and in Pakistan are connected to energy driven which lead to upsurge in the amount of carbon dioxide emission (CO_2) as well as other secretions and also lowered the forest areas. Besides that, it also raises the over-all temperature.

So, we can conclude that, urban growth is linked with industrially expansion and ecological disturbance steadily. They contributed in different ways, patterns and directions. Their determinants showed potential positivity towards urban and ecological disturbances.

6.2 Policy Recommendation

Few recommendations from futuristic point of view are presented as follow:

- ▪ The government should initiate more projects like billion trees, increasing forestation and land area which will lead to increase job creation, seeds

enhancement, weather upgradation and save from soil erosion, land sliding, global warming, floods and severe environmental alterations.

- The policies should be formulated towards creation and upgradation of maximum number of small and medium size cities along with their businesses centers. The need of more collaboration is required between educational institutions and industrial, business corporations. The business communities should play their effective role in this regard.

- The concept of organic farming, vegetation and plantation must be launch to nullify the problem of vegetation in cities. The young entrepreneurs should be utilized and make other small scale industries to go parallel with it for example cattle farming, dairy farming, fruit farming, duck farming, fish farming etc. In this way we could generate employment, small and medium scale industries, spread of industries, utilization of youth potential into economy can be made possible. Small scale industry has a large potential and room in case of Pakistan economy.

- Make at-least 3 to 5 trees per home policy compulsory and tax incentive for those who grow or take part in plantation. Social and educational campaigns must be launch. Awareness program and health related discussions/seminars conducting.

- Concept of money in terms of cash to citizens who take part in generating of less solid waste.

- Increase forest area leading to tourists spots could possibly lead to tourism which will eventually lead to increase its share in GDP. This will have a healthy, large scale and positive impact towards tourism. Similarly, this will give a soft image of the country to global world.

- It will also help in growing of small businesses in such distant areas and other related business activities. Control on upcoming polluted substance/atmospheric toxic into our air system from neighboring countries which is a threat to our livelihood. Control and make mechanism to reduce pollution from industrialization. Condition of automobiles, emission producing cars inspection and maintenance should be called must.

- Adoption of green economy concept with the help of latest equipment and technological advancement to reduce every kind of polluted material. Make industries to use latest techniques to reduce contamination and dumb process within their premises.

- Maximize and utilize the area around the cities to fulfill its vegetation and allow students and young entrepreneurs towards this concept. In this way healthy system and a new way to eliminate burden over village will be control.

- Small Scale industries concept should be brought in order to stabilize economy, besides that, processing and quality management must be injected into practice in order to make our exports grow.

- Utilization of technological automobile industry, solar roads processes should indulge into national economy as per ruling in other countries. The monopoly of few companies should be ended. Encourage public-private partnership and FDI to invest and grow automation industry, which will make products affordable.

- Use of qualitative seeds should be introduced and those seeds must be utilized which can give maximum yield, boost production at low cost and in minimum area.

- Illegal encroachments should be removed from cities, and maintenance/extension plans should be reformulated. Proper mapping of metropolitan areas with its own economic hubs should be brought into practice, also, small and medium enterprises should be promoted.

- Concept of cities near village should be used in order to relive cities from bearing burden of socioeconomic and political interference.

- Concept of small scale turbines in order to generate electricity should be promoted. Utilization of Domestic economic indicators as much to develop SME's and in order to promote export and trade benefits.

- Plantation with vegetations must be made compulsory part of education and curriculum to get young minds to know the importance of it and they develop new ideas to realize the power of agribusiness. Educating masses via formal and informal ways should be explored through educational ways i.e. seminars, symposium, electronic, print and social media etc. Stop entering heavy traffic into cities to safeguard the environment of cities. Concept of making roads from polluted substance should be used by using techniques i.e. utilization of plastic in making roads.

- Necessary steps should be taken to make barren field into arable land and maximum utilize for agricultural purposes which will increase green areas to green lands and also agricultural productivity. As Pakistani land is very fertile and its productivity can be utilized and turned into use. Political agents should take positive steps in stopping the flood of pollutant gases entering into country by having serious dialogues with their neighboring counterparts.

6.3 Relationship between Industrial Growth and Business

In nominal terms, economic condition of Pakistan stands 47th in the entire world and 25th with respect to purchasing power parity (PPP). The relationship between industrial growth and business is just like blood and the body. In the current global scenario, this relationship defines a country's strategic position and its large influence in worldly affairs. Though, Pakistan has its strategic representation and importance which project it as a prominent nation yet a bit behind in the most competitive world. Industrial expansion plays a backbone role in any country's development, its growth, emergence and significance. Without it, no country could imagine to progress or stabilise itself in the long run. Growth leads to success because of industrial expansion which and other parallel commercial activities. It is industrialization which helps other areas and sectors of economy to run parallel with it whether its small or medium scale. It helps others to stand on own and give resourceful fruits in the long run.

In case of Pakistan, Industrial revolution has done miracles not only as socially but also on politically side as well. The expansion and development in industry helped country to stand on its feet and give fruitful benefits in both short and long run era. It's because of Industrial mechanization that led Pakistan to boost its other sectors of economy, creating skill full labor, effective, efficient and resourceful workforce that played its role in economic development. It has produced jobs for micro and macro level and get recognition attention globally. Due to domestic industrial revolution, that we sent our brilliant minds and help other economies to get stable and stand out. Today, our labor recognised as one of the finest in the global affairs from small range to highest level. Businesses and Manufacturing sectors play vibrant character in generating employment opportunities, help domestic industries, scaling and levelling other areas to become part of main-stream industry, economic boost and overall growth. Pakistan has gigantic

potential to grow its commercial activities and convert it moneymaking environment. By far, the country is blessed with every sort of expertise, resources, raw material and other equipment which if utilise accordingly can produce wonders for the generations and play dynamic role in the global village. By breaking stereotypes and control on monopolies and precautionary measures, country has enormous talent to make progress by leaps and bounds. We can also come across our main economic issues like oil deficit, Trade deficit, Balance of payment, energy crises as well. This industrial revolution is a thought-provoking gift to us i.e. on one hand it'll solve our economic matters while on the other hand it benefits us in socioeconomically i.e. increase saving, investment, generate government revenue and make us strong over all.

Pakistan's industrial sector has five main pillars which are mining and quarrying, Fuel extraction, manufacturing, construction and electricity , gas and water supply. If we analyse, we get to know that we are highly enriched in mining industry and possesses vital deposits naturally for example gold, copper, copper, chromite, mineral salt, bauxite along with various types of rocks i.e. igneous rocks, the sedimentary rocks, the metamorphic rocks, schist, slate, phyllites with some quartzite and marble. There is a broad scope of metallic industry with respect to growth as it will not only beneficial for chemicalise industry but also for other minerals. The crushing, polishing, refining and shaping not only create multiple domestic jobs but also a big comparative export base market cum industry for traders. This will open cross border and huge potential market. Our Punjab, KPK, and Gilgit Baltistan area are very famous and enrich with such deposits.

On the second position comes fuel extraction. Mining is the process by which we separation unprocessed material from earth's inner layer which are usually in the form of ores, coal, or any other. The process of extraction produces either in metallic,

industrial minerals and fuel forms that provide foundation to any state or economy to become sustainable and upgrade its life style. According to the World Energy Information Administration (EIA), Pakistan may have over 9 billion barrels of petroleum oil and 105 trillion cubic feet in shale oil and natural gas reserves. Pakistan, being a major producer of different ores i.e. bituminous coal' sub- bituminous, coal and lignite. The sulphur and coal were recently explored near Baluchistan province. Pakistan also produced uranium of approximately 45 tons and utilize it in nuclear power generation and artilleries. The departments asked governments to invest in these mega projects which will not help country's economic growth, deficit issues, and long term sustainability. The government should promote domestic firms, foreign investment , public private partnership to invest and do as much joint venture to make country on the road to progress. In this way, large scale businesses will be set up youth employment will be encourage, small and medium scale industries will come and join them. In this way, multiple corporations will help country to get out of economic, financial and unemployment problems.

At the third position, manufacturing sector comes. The manufacturing is the second sector after services which is contributing by 21% according to latest data taken by Bureau of statistics, Pakistan. In Pakistan, the manufacturing sector is dominated by oil and gas, automobile, heavy engineering, machinery, textile and cement industries in terms of market captivity, size, financial strength and managing all of the resources. There are two kinds of manufacturing setups in Pakistan. One contains automobile, textile, leather, Pharmaceutical and chemical industries while on the other hand, lies small and medium industries which contain metal working, furniture, agrobased, sports goods, fisheries, poultries, Gems and jewellery, and Food and crafting. Cotton and fibre manufacturing are the largest businesses accounted 64% of total exports. The large

,medium and small scale manufacturing setups, through their businesses can give help to economy and help in getting raised from its current situation. Millions of people are employed under big giants of large scale manufacturing businesses which providing skills, innovations, technological advancement, via configuration and upgradation, they are reaching high goals. These businesses with their investment, government encouragement, and stake holders co-operations can not only raise their worth but also provide assistance to other businesses to come in making profit, market setup, and join them in order to play their effective role. The small and medium scale businesses also capturing their share and accounted approximately 40%. These companies provide employment, creating small ventures, standing up of small partnerships in order to raise money flow, employment, daily transactions, indoor and outdoor creativity linked to self-employment. These firms help countries to stand it on its own. In Pakistan's context, due to poor law and order situation, energy crises, political instabilities, macroeconomic indicators depreciation etc , such industries helped the country to stand once again and make it possible to walk on its own even in the time of misery. Though our industries need reforms, yet these SME(small medium enterprises) considered as backbone for our economy. From Punjab and Sindh areas, we are enrich with metal working, sports and crafting, agrobased, poultries . KPK(Khyber Pakhtunkhwa) division is famous for gems and Jewellery cutting and working. Baluchistan is famous for handicrafts, handmade cutlery which provides employment and self-sustainable projects for women to become self-sufficient.

On the fourth place construction industry is placed. The construction industry is strongly correlated with multiple industries and always play vital role even during inflation. This industry also has two parts i.e. large scale and small scale. The large scale consists of hospital, schools and infrastructure related while small scale consisted

on water supply, sewerage lines, drainage etc. The large scale is related to mega construction which involves urban infrastructure projects, construction of highways and roads, airports, dry ports, power stations, irrigation and agrarian system. This demands large scale business activities from high level to lowest level. This industry take everybody's presence and involved every industry to contribute into it to some extent. This allow the employment ranges from high level to lowest of all and in this way everyone gets benefit. The producer, consumer and other stake holders. This also helps in running parallel business activities side-by-side. In this way, industrial revolution comes in a country's economic situation but also boost macro and micro indicators as a whole. Pakistan's huge number of labor is linked with this area and in every era, they contribute in healthy way and win-win situation remain throughout. Since 2005 disastrous earthquake, the rise of 30% to 50% has been observed in construction cost due to implementation and maintaining of safe codes throughout the country. On the other hand, small scale industry consists of water supply matters and making of such items like pipes, fitting material etc. The putting sewerage lines, drainage system and their passage is an important and integral part of construction. Wherever construction happened, such industries worked parallel with large scale. This allows small industries to learn, grow, upgrade and adopt latest trends in order to achieve success.

At the last, comes electricity, gas, and water supply industry. This industry is linked to every industry through out and make other feel its presence. In context of Pakistan, this industry is relatable to energy resources, fair size assets of natural gas, oil reserves, coal (Pakistan stands as 4th largest in the world), gigantic hydropower possibilities. Pakistan is one of those countries which have tremendous amount of compressed natural gas (CNG) deposits. This compressed natural gas (CNG) deposit are enough to fulfil our industrial and automobile needs. This involves intense business opportunities, supply

and demand of jobs, small and medium businesses, other commercial activities, large scale engineering and construction, machinery involved. This industry not only fulfil country's domestic needs but can also relives us from import bill problems, trade deficit and various other macroeconomic disputes.

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